Turn-Off Procedure.

A. Place the STAB switch in the OUT position.

B. Place the scan switch in the STOP position.

C. Rotate the INTENSITY (on both scopes) full counterclockwise.

D. Turn GAIN control full counterclockwise.

E. Move the function switch to OFF position.

Note

If spoking is noticed on the scopes during weather operation or long-range search operation, pulse transformer T-404 is probably burning out. Use set on low-range search operation only.

Terms and Abbreviations.

AFC – Automatic Frequency Control.

A-J – Anti-Jamming Operation.

FTC – Fast Time Constant.

HTR – Antenna Heater.

IAGC – Instantaneous Automatic Gain Control.

MAN – Manual Frequency Control.

MAP – Equal Energy Return Beam.

OBS – Pencil Beam.

STAB – Antenna Stabilizer.

STC – Sensitive Time Control.

TD – Target Discriminator.

RADAR PRESSURIZING KIT MK-59 AP.

The components of the radar pressurizing kit are pump, switch, and control, and are located on the aft side of the bulkhead immediately behind the copilot's seat.

The system is controlled from the RADAR PRESS panel by means of the following controls:

A. Blower switch – Two-position with guard (NORMAL ON position).

MOMENTARY ON – USED for test purposes. Pump operates continuously in this position.

NORMAL ON – Used for normal operation.

Pump controlled automatically by pressure switch.

B. PRESSURE INDICATOR (push-to-test light)– Lights when pump is operating.

C. PUSH-TO-BLEED – Releases pressure from system.

D. Pressure meter (marked in increments of one, 15 through 45) – Registers pressure in the system.

ANTENNAS.

Antenna locations are shown in figure 4-22.

LIGHTING EQUIPMENT.

All lights are wired to the 28-volt d-c supply through their respective circuit breakers and switches.

EXTERIOR LIGHTING.

Taxi Light.

A sealed beam taxi light is installed on the nose gear shock strut and is controlled by an ON-OFF switch mounted on the forward overhead panel *(figures 1-13 and 1-14)*.

Wing Leading Edge Lights.

Two lights are installed, one on each side of the fuselage, to illuminate the leading edges of the wing so that ice formation can be detected. The lights are controlled by an ON-OFF switch which is mounted on the forward overhead panel *(figures 1-13 and 1-14)*.

Landing Lights.

A sealed beam, electrically actuated landing light is installed on the underside of each middle wing panel. Each light is controlled by a 3-position switch marked EXTEND, OFF, and RETRACT, and an ON-OFF switch located on the upper instrument panel *(figure 1-11)*. The EXTEND-OFF-RETRACT switch actuates the landing light mechanism and provides for intermediate positioning. The ON-OFF switch controls illumination of the landing lights.

Navigation Position Lights.

The navigation position lights consist of a green light on the right wing tip, a red light on the left wing tip, red and white lights on the tail cone tip and a white light on the top and bottom of the fuselage. The

wing tip and tail cone lights are controlled by a 3-position switch placarded STEADY, OFF and FLASH. A separate ON-OFF switch controls the upper and lower white fuselage lights. These switches are located on the forward overhead panel *(figure 1-14)*. Placing the 3-position switch in the STEADY position will illuminate the wing tip lights and the white tail cone light. When the switch is placed in the FLASH position, the wing tip lights and the white tail cone light will flash alternately to the red tail cone light. When the fuselage light switch is placed in the ON position, the upper and lower, white fuselage lights will flash with the red tail cone light.

Note

Should the flasher fail, place the switch in the STEADY position.

Anticollision Light.

A red streamlined rotating anticollision light is installed on the top of the vertical stabilizer and is normally controlled by the navigation position lights switch on the forward overhead panel. (On some aircraft, a separate ON-OFF switch controls the anticollision light.) On some aircraft, the circuit is interlocked through a ground control relay to prevent burning the light lens when there is no cooling airstream.

Note

The rotating anticollision light should be turned off during flight through conditions of reduced visibility where the pilot could experience vertigo as a result of the rotating reflections of the light against the clouds. In addition, the light would be ineffective as an anticollision light during these conditions since it could not be observed by pilots of other aircraft.

Wheel Well Lights.

A light is provided in each landing gear wheel well and is controlled by either a switch located on the forward overhead panel *(figures 1-13 and 1-14)* or by a switch located in the nosewheel well. The wheel well lights should be focused on the wheel-down locks.

Lower Baggage Compartment Lights.

Dome lights are installed in the lower baggage compartments, hydraulic accessories compartment, heater compartment, and in the spar area. The lower baggage compartment lights are controlled by a switch located on the bulkhead of the crew's lavatory, aft of the navigator's station. The dome lights in the four lower compartments are individually controlled by a switch installed beside the compartment's respective access door. In addition, a switch and an amber indicator light, located in the flight compartment immediately aft of the crew's entrance door, are provided to illuminate the compartments from within the aircraft. This switch controls all underfloor compartment and tail beater compartment dome lights. Illumination of the amber indicator light indicates that the dome lights are illuminated when the switch is on.

Aldis Lamp (If Installed).

An Aldis lamp is provided in a holder located on the bulkhead aft of the copilot's seat. The lamp cord may be plugged into a receptacle located on the aft overhead panel *(figure 1-12)* when the lamp is required.

INTERIOR LIGHTING.

Cockpit Overhead Lights (Floodlights).

Two adjustable overhead lights *(figure 1-7)*, one white and one red, are installed in the cockpit. The lights provide floodlighting for the cockpit area and are individually controlled by dimming rheostats located on the lower section of the forward overhead panel *(figure 1-13)*. On AF51-3818 through AF51-3835 and AF53-3223 through AF53-3305, both overhead lights are white and the intensity of the lights is controlled by a single dimming rheostat located adjacent to the ammeter-voltmeter panel *(figure 1-22)*; however, the lights may also be turned on to full intensity by an override switch located above the pilot on the forward overhead panel *(figure 1-14)*. The switch is placarded OVERHEAD WHITE LIGHT with the positions ON and OFF and may be used by the pilot to floodlight the cockpit for general illumination or during flight through thunderstorm areas, as required.

Instrument Lighting.

The red lights for the flight instrument panels are controlled by rheostats on the cold air orifice panels *(13, figure 1-6)*.

The red lights for the engine instrument panel, the forward top face of the control pedestal, the fuel dump valve control handles, and the overhead panels are controlled by rheostats on the forward overhead panel *(figures 1-13 and 1-14)*. Twelve white lights on the

main instrument panel also are controlled by rheostats on the forward overhead panel.

Radio Operator's Table Lights and Instrument Lights—C-118A.

Three adjustable table lights are installed at the radio operator's station *(figure 4-18)*. The lights are controlled by three dimming rheostats located on the aft bulkhead at the radio operator's station. The instrument rim red lighting and the radio equipment red and white lights are controlled by two rheostats located on the aft bulkhead at the radio operator's station. An adjustable red instrument panel light, located above the flight compartment dome light provides illumination for the navigator's instrument panel and is controlled by a dimming rheostat on the light.

Radio Operator's Station Lighting—VC-118A.

The radio operator's station is equipped with a flexible work table light with a rheostat control mounted on the radio panel. General illumination for the area is furnished by a dome light in the upper aft corner of the compartment. The dome light switch is located on the dome light support bracket. The main junction box exterior panel is illuminated by a floodlight mounted above the radio operator's seat. The control switch for the junction box floodlight is located on the forward overhead panel *(figure 1-14)*. The integral radio panel lights are controlled by a rheostat located on the radio control panel.

Navigator's Table Lights and Instrument Lights.

Two adjustable table lights are installed at the navigator's station *(figure 4-20)*. The two lights are controlled by separate dimming rheostats, one located on the wall adjacent to the base of the outboard light and the other located on the forward bulkhead beside the radio control panels. On AF53-3223 through AF53-3305, the navigator's white console lights are concealed. Red rim lighting is provided for the instrument panel. Red and white work table lights contained in a single, adjustable fixture are installed on the wall forward of the flight compartment entrance door. The lights are controlled by dimming rheostats located on the navigator's light control panel, overhead.

Dome Lights—C-118A.

Flight Compartment Dome Light. A flight compartment dome light, located above the flight compartment entrance door, can be turned on or off from either the ENTRANCE LIGHT switch on the forward overhead panel *(figures 1-13 and 1-14)* or from the DOME LIGHT switch on the aft side of the entrance door.

Cabin Dome Lights. Seven dome lights, installed down the center of the cabin ceiling, are controlled by an ON-OFF switch located on the forward side of each cargo door *(figure 4-23)*. The main cabin switch panel *(figure 4-23)* also has a BRT-DIM switch for the dome lights.

Emergency Cabin Dome Lights. Five of the dome lights in the cabin ceiling have additional 6-volt bulbs. These bulbs are controlled by an impact switch on the aft right side of the flight compartment partition. A dry-cell battery to supply the 6 volts is located in the right main junction box annex, and a test switch is located on the main cabin switch panel *(figure 4-23)*.

Lavatory Dome Light. A light is installed in the lavatory and is controlled by an ON-OFF switch on the lavatory partition.

Map Reading Lights. Three white map reading lights are installed in the cockpit, and are controlled by individual rheostats. The pilot's map reading light is located on the heater fire control panel *(figure 4-10)*, the copilot's on the ammeter-voltmeter panel, and the crew engineer's on the aft overhead panel *(figure 1-12)*.

On AF53-3223 through AF53-3305, the pilot's map reading light is located immediately above the heater fire control panel and the copilot's is located above the ammeter-voltmeter panel.

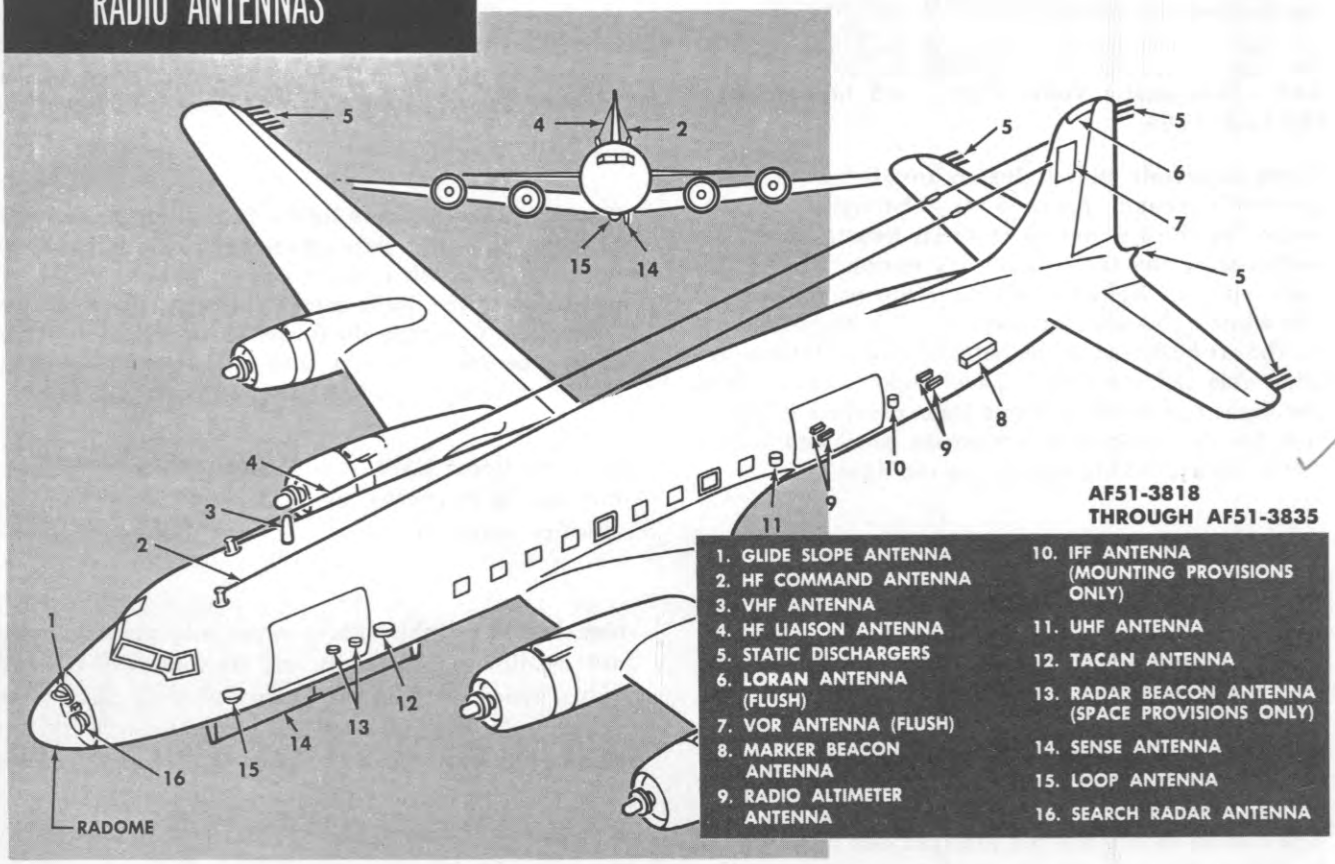
Upper Instrument and Forward Overhead Panel Lighting. A white and red light assembly is located on the bulkhead above each pilot *(figure 1-7)*. Individual dimming rheostats to control light intensity are located on the forward overhead panel *(figures 1-13 and 1-14)*.

On some aircraft, the lights are controlled by a single rheostat located on the right side of the forward overhead panel.

Main Cabin Lights—VC-118A.

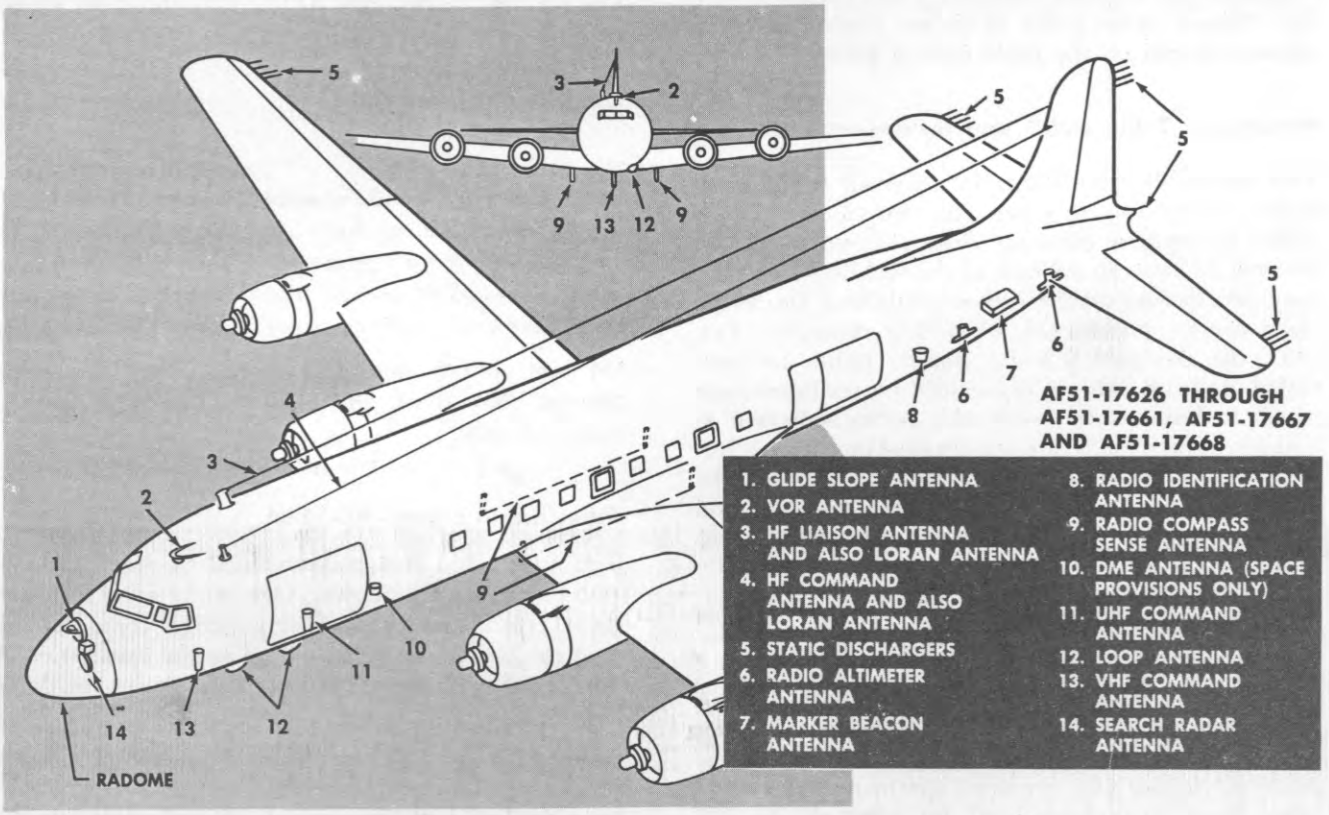
The main cabin area is illuminated by nine combination dome and aisle lights. One in the crew compartment, 2 in the galley, 1 in the passenger compartment, 2 in the conference room, and 3 in the stateroom. A double ON-OFF switch, with one toggle for the dome light and the other toggle for the aisle light, is located beside each compartment door to control the lights for the particular compartment. Seats and divans have individual reading lights which are controlled by ON-OFF switches located on the individual fixtures.

RADIO ANTENNAS



AF51-3818 THROUGH AF51-3835

1. GLIDE SLOPE ANTENNA
2. HF COMMAND ANTENNA
3. VHF ANTENNA
4. HF LIAISON ANTENNA
5. STATIC DISCHARGERS
6. LORAN ANTENNA (FLUSH)
7. VOR ANTENNA (FLUSH)
8. MARKER BEACON ANTENNA
9. RADIO ALTIMETER ANTENNA
10. IFF ANTENNA (MOUNTING PROVISIONS ONLY)
11. UHF ANTENNA
12. TACAN ANTENNA
13. RADAR BEACON ANTENNA (SPACE PROVISIONS ONLY)
14. SENSE ANTENNA
15. LOOP ANTENNA
16. SEARCH RADAR ANTENNA



AF51-17626 THROUGH AF51-17661, AF51-17667 AND AF51-17668

1. GLIDE SLOPE ANTENNA
2. VOR ANTENNA
3. HF LIAISON ANTENNA AND ALSO LORAN ANTENNA
4. HF COMMAND ANTENNA AND ALSO LORAN ANTENNA
5. STATIC DISCHARGERS
6. RADIO ALTIMETER ANTENNA
7. MARKER BEACON ANTENNA
8. RADIO IDENTIFICATION ANTENNA
9. RADIO COMPASS SENSE ANTENNA
10. DME ANTENNA (SPACE PROVISIONS ONLY)
11. UHF COMMAND ANTENNA
12. LOOP ANTENNA
13. VHF COMMAND ANTENNA
14. SEARCH RADAR ANTENNA

Figure 4-22 (Sheet 1 of 2)

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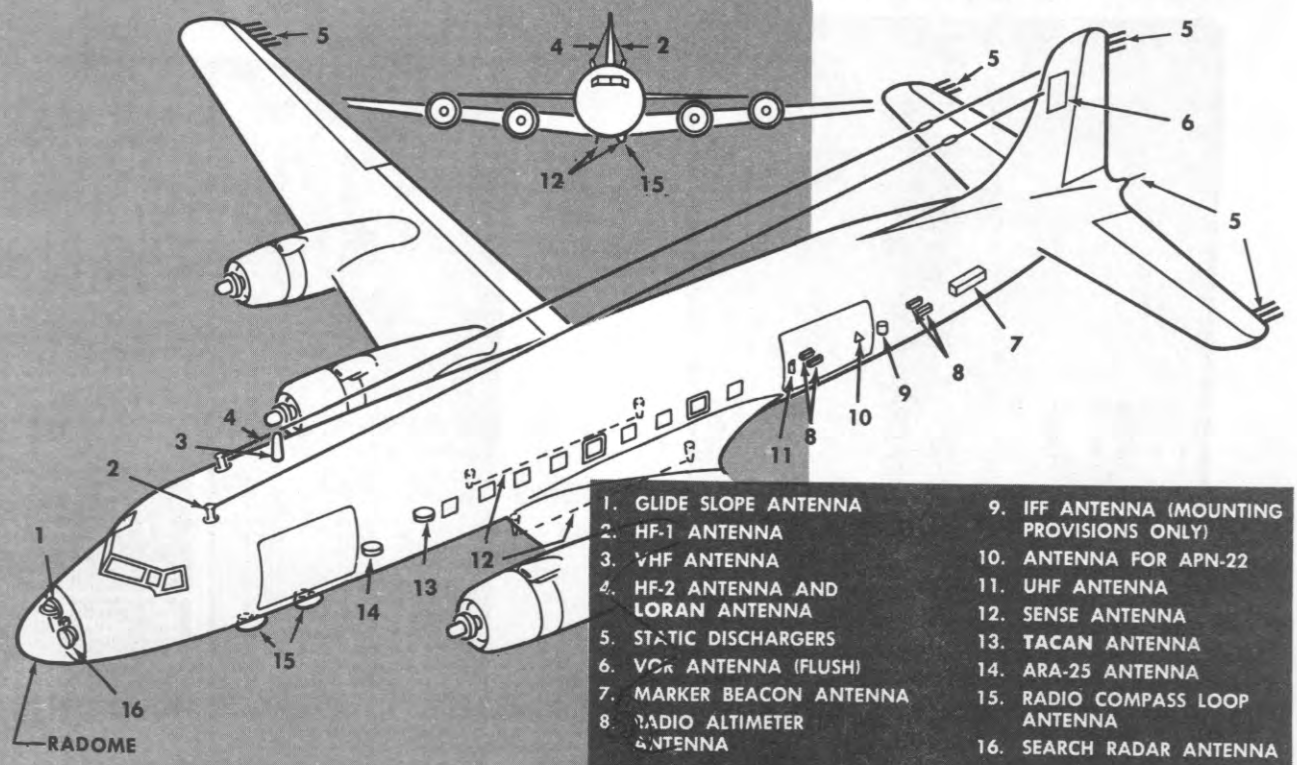
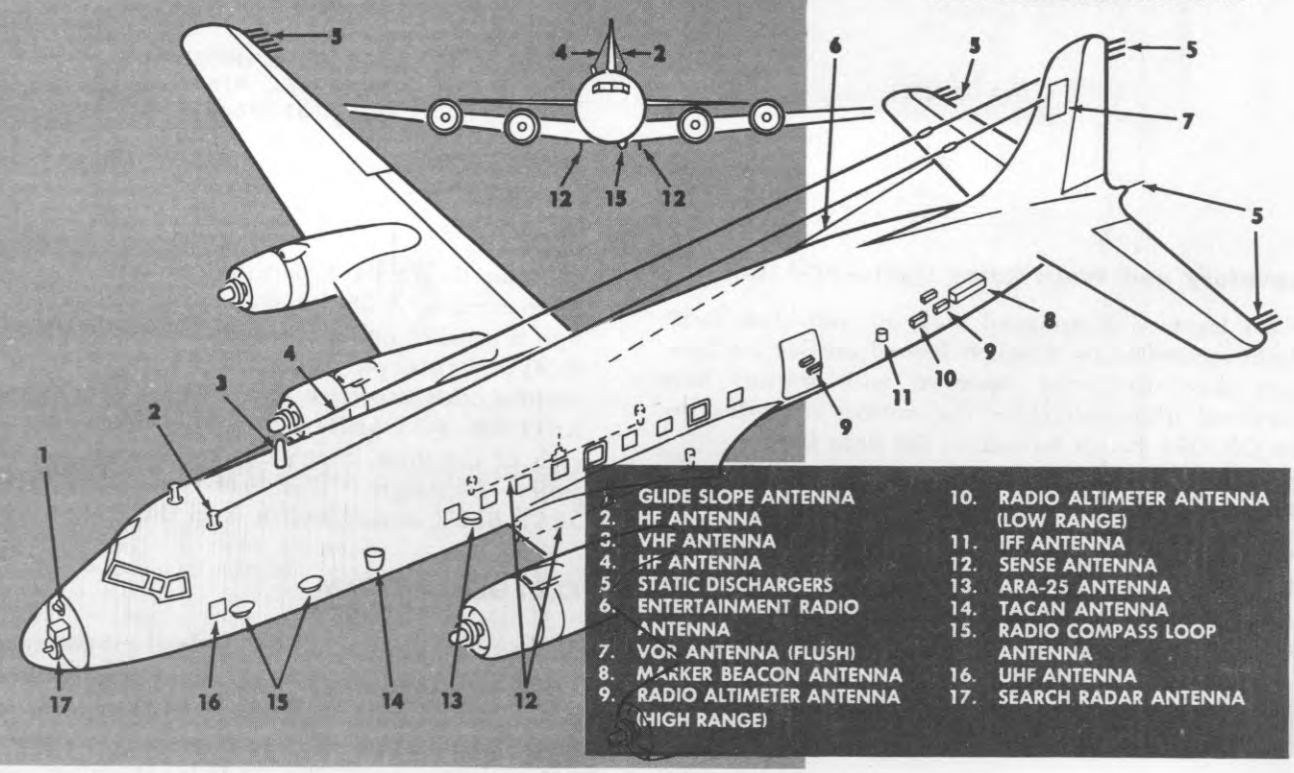
RADIO ANTENNAS

AF53-3223 THROUGH AF53-3228
AF53-3230 THROUGH AF53-3239
AF53-3241 THROUGH AF53-3305



1. GLIDE SLOPE ANTENNA
2. HF-1 ANTENNA
3. VHF ANTENNA
4. HF-2 ANTENNA AND LORAN ANTENNA
5. STATIC DISCHARGERS
6. VOR ANTENNA (FLUSH)
7. MARKER BEACON ANTENNA
8. RADIO ALTIMETER ANTENNA
9. IFF ANTENNA (MOUNTING PROVISIONS ONLY)
10. ANTENNA FOR APN-22
11. UHF ANTENNA
12. SENSE ANTENNA
13. TACAN ANTENNA
14. ARA-25 ANTENNA
15. RADIO COMPASS LOOP ANTENNA
16. SEARCH RADAR ANTENNA

AF53-3229 AND AF53-3240

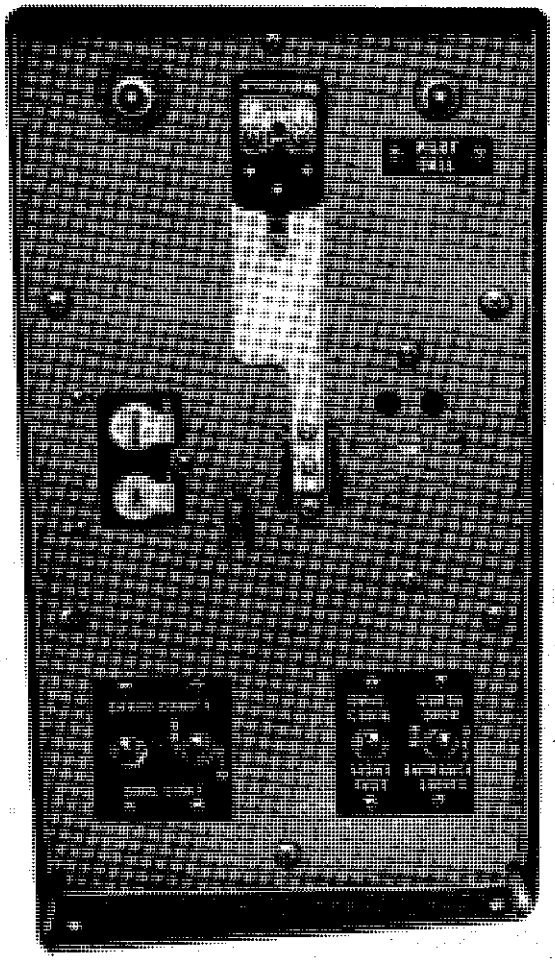


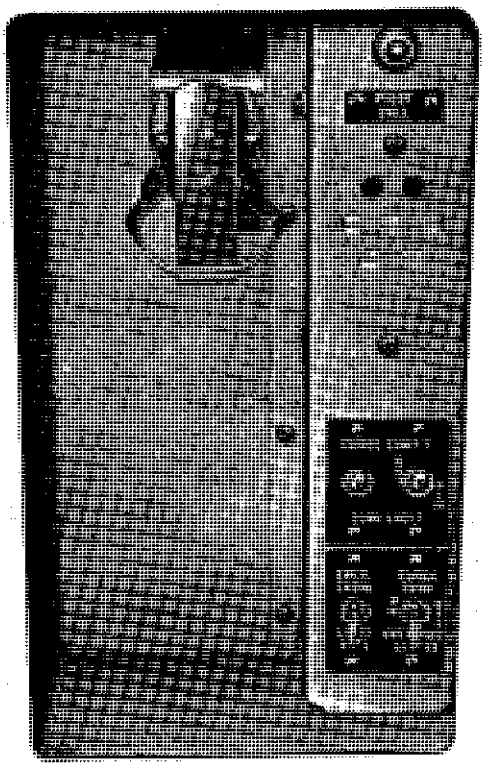
1. GLIDE SLOPE ANTENNA
2. HF ANTENNA
3. VHF ANTENNA
4. HF ANTENNA
5. STATIC DISCHARGERS
6. ENTERTAINMENT RADIO ANTENNA
7. VOR ANTENNA (FLUSH)
8. MARKER BEACON ANTENNA
9. RADIO ALTIMETER ANTENNA (HIGH RANGE)
10. RADIO ALTIMETER ANTENNA (LOW RANGE)
11. IFF ANTENNA
12. SENSE ANTENNA
13. ARA-25 ANTENNA
14. TACAN ANTENNA
15. RADIO COMPASS LOOP ANTENNA
16. UHF ANTENNA
17. SEARCH RADAR ANTENNA

Figure 4-22 (Sheet 2 of 2)

AF51-3818 THROUGH
AF51-3835

MAIN CABIN SWITCH PANEL





AF51-17626 THROUGH
AF51-17661, AF51-17667
AND AF51-17668

AA1-151

Figure 4-23

Lavatory and Wash Room Lights—VC-118A.

Each lavatory is equipped with an individual dome light controlled by a switch located outside the lavatory door. Lavatories equipped with mirrors have localized illumination for the mirrors controlled by an ON-OFF switch located on the light fixture.

Passenger Entrance Lights—VC-118A.

The passenger entrance is illuminated by one dome light for general lighting and two spotlights focused on the threshold. These lights are controlled by two ON-OFF switches located beside the passenger door.

Fasten Seat Belt, No Smoking, and Return to Cabin Signs—VC-118A.

An electrically illuminated FASTEN SEAT BELT sign and a NO SMOKING sign are located above the door on the forward partition of each main cabin compartment. A 28-volt d-c control switch for each sign is installed on the forward overhead panel *(figure 1-14)* in the cockpit. When either switch is in the ON position, the respective sign will be illuminated. A RETURN TO CABIN sign is located on the wall of each of the three lavatories, the aft lounge, and the galley. Each sign is illuminated when the FASTEN SEAT BELT control switch is in the ON position.

OXYGEN SYSTEM.

A fixed low-pressure, diluter-demand oxygen system is installed on the aircraft for the flight crew to use either in the event of cabin supercharger failure or in case of smoke or fire. The standard fixed oxygen system provides an oxygen cylinder (D-2) for the pilot, and one (G-1) for use of the copilot and other flight crew mem-

bers. In addition to the fixed system, three low-pressure portable oxygen cylinders are installed to supplement the fixed system and to provide oxygen at locations other than at the established crew positions. Four recharger fittings are installed in the flight compartment to replenish the portable cylinders. When the aircraft is used to transport litter patients, a rack containing six portable high-pressure oxygen cylinders is installed in the main cabin.

OXYGEN SYSTEM CONTROLS.

Diluter-Demand Regulators.

Five diluter-demand regulators (four on AF53-3223 through AF53-3305) are installed, one at each crew station. On some aircraft, two regulators are also installed in the aft cabin compartment.

Oxygen System Indicators.

Flow Indicators. Oxygen flow indicators (blinker-type) are installed on each regulator.

Pressure Gages.

Two pressure gages, one for each system, are provided. The pilot's system pressure gage is installed on the left side of the cockpit *(figure 1-7)*; the copilot's and crew's pressure gage is installed on the hydraulic and oxygen instrument panel *(figure 1-29)*.

OXYGEN SYSTEM — NORMAL OPERATION.

Normal operation of the oxygen system is as follows:

A. Diluter-demand regulator control — NORMAL OXYGEN.

B. If pure oxygen is required — Diluter-demand regulator control — 100% OXYGEN.

OXYGEN SYSTEM — EMERGENCY OPERATION.

In an emergency, the diluter-demand system is controlled by the safetywired red knob on the diluter-demand regulator. To operate the system, break the safetywire and turn the red knob to the open position. This will supply a continuous flow of 100 percent oxygen.

OXYGEN SYSTEM DURATION.

The oxygen duration table *(figure 4-24)* shows a greater oxygen duration at higher altitudes using 100% oxygen. This is due to the oxygen expansion to a greater volume at altitude than at sea level.

AUTOPILOT.

The A-12 autopilot is designed to enable the pilot to operate the equipment with an absolute minimum of effort and attention. The electrical and mechanical releases and interlocks simplify operation and prevent an improper operating procedure. The following data pertains to the flight operation of the autopilot:

WHEN TO ENGAGE.

The autopilot can be engaged with complete safety when the aircraft is in any of the following attitudes.

A. Normal straight and level flight.

B. Any normal climb or descent, including just after takeoff.

Note

If the autopilot is turned on and engaged in a climb or descent, the aircraft will continue to fly in that attitude until the pitch control knob switch is operated or the altitude control switch is turned on.

AIRCRAFT TRIM PRIOR TO AND DURING AUTOPILOT OPERATION.

A. Trim the aircraft manually by adjusting the aircraft's trim tabs for "hands off" flight.

B. The autopilot automatically synchronizes itself to the aircraft's attitude at all times when disengaged and may be engaged while the aircraft is in an out-of-trim condition. In this case, however, an untrimmed condition is immediately reflected on one of the three trim meters on the autopilot controller *(figure 4-25)* by a constant signal indication.

C. Trim in the elevator channel is automatic within limits which are set on installation. Aileron and rudder trim can only be obtained by manually applying trim tab.

D. In order not to impose an unnecessary load on the autopilot, it is recommended that the aircraft be manually trimmed before engaging.

ENGAGING AUTOPILOT.

A. Automatic approach selector switch — AUTOPILOT.

B. Turn knob — DETENT (centered).

C. Aileron knob — CENTERED.

D. Autopilot engaging levers *(figure 4-24)* — DISENGAGE (down).

E. Pilot switch — ON (allow 2 minutes for warm-up).

OXYGEN DURATION CHART

OXYGEN DURATION, HOURS (UNPRESSURIZED)

CREW MEMBER (PILOT)

ONE TYPE D-2 CYLINDER

ALTITUDE (FEET)	GAGE PRESSURE (PSI)							
	400	350	300	250	200	150	100	Below 100
25,000	1.0 .7	.8 .6	.7 .5	.5 .4	.3 .3	.28 .2	.14 .1	EMERGENCY Descend to Altitude not requiring Oxygen
20,000	1.1 .6	.9 .5	.8 .4	.6 .34	.47 .25	.3 .17	.15 .08	
15,000	1.4 .5	1.2 .4	1.0 .35	.8 .28	.6 .21	.4 .14	.2 .07	
10,000	1.8 .4	1.5 .3	1.3 .3	1.0 .22	.77 .17	.5 .11	.25 .05	

BLACK FIGURES—INDICATE DILUTER DEMAND USAGE
RED FIGURES —INDICATE 100% OXYGEN USAGE

OXYGEN DURATION, HOURS (UNPRESSURIZED)

CREW MEMBER (OTHER THAN PILOT)

BASED ON FOUR CREW MEMBERS, ONE TYPE G-I

ALTITUDE (FEET)	GAGE PRESSURE (PSI)							
	400	350	300	250	200	150	100	Below 100
25,000	1.0 .8	.8 .68	.7 .57	.5 .45	.4 .34	.28 .22	.14 .11	EMERGENCY Descend to Altitude not requiring Oxygen
20,000	1.1 .6	.93 .5	.79 .43	.62 .34	.47 .25	.31 .17	.15 .08	
15,000	1.4 .5	1.2 .4	1.0 .35	.8 .28	.6 .21	.4 .14	.2 .07	
10,000	1.9 .4	1.6 .34	1.3 .28	1.1 .22	.8 .17	.54 .11	.27 .05	

BLACK FIGURES—INDICATE DILUTER DEMAND USAGE
RED FIGURES —INDICATE 100% OXYGEN USAGE

AA1-149

Figure 4-24

F. Aircraft wings – LEVEL WITH HORIZON.

G. Manually trim aircraft.

H. Autopilot trim indicators – CHECK TRIM INDICATORS ON AUTOPILOT CONTROLLER FOR SYNCHRONIZATION.

I. Autopilot engaging levers – ENGAGE (up).

J. Aircraft trim – RECHECK THAT TRIM INDICATORS ON AUTOPILOT CONTROLLER ARE CENTERED.

USE OF ALTITUDE CONTROL.

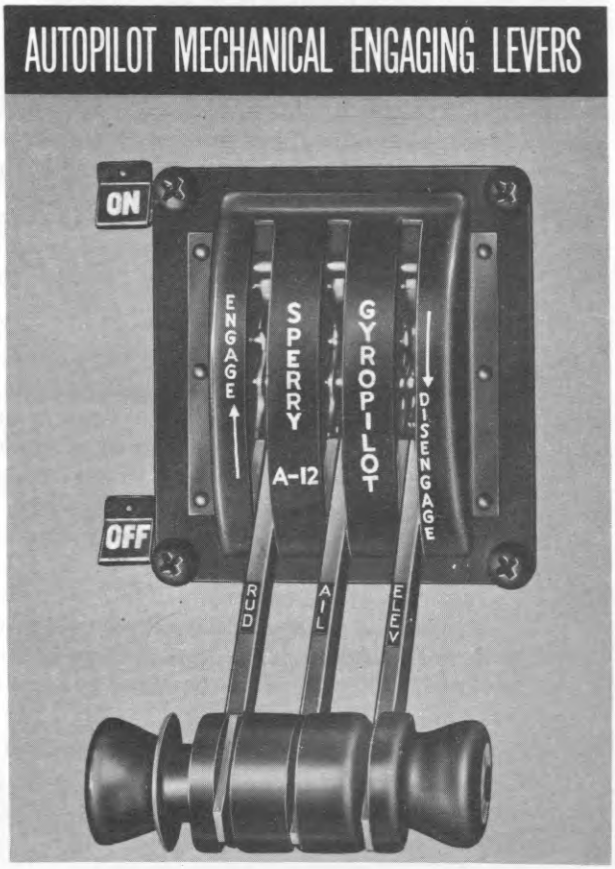
To maintain specific pressure altitude while operating on autopilot, move the altitude control switch to the ON position. The following will occur:

A. If in level flight, the aircraft will continue to fly at the pressure altitude at which the aircraft was flying when the altitude control was turned ON.

B. If climbing or descending when the switch is turned ON, the aircraft will level off and hold a constant altitude. Later, however, when the altitude control switch is turned OFF, the aircraft will return to the climbing or descending attitude effective at the time the switch was turned ON.

AA1-150

Figure 4-25



AA1-146

Figure 4-26

C. Pitch attitude change through the use of the altitude control is limited to plus or minus 6 degrees of level flight attitude. If the altitude control is engaged while the aircraft is climbing or descending at greater than this limit, the altitude control will compensate for 6 degrees, and the aircraft will continue to climb or desecend at a pitch attitude 6 degrees less than the original attitude. In this case, if the aircraft continues to climb or descend, the altitude control may become damaged.

D. It is recommended that the aircraft be leveled off at the cruising altitude before engaging the altitude control.

E. During the time the altitude control switch is ON, the pitch knob will be inoperative.

CAUTION

The altitude control switch must be turned OFF prior to changing the static source selector valve switch to the alternate position. Failure to do so will result in an abrupt change of attitude up to the limit of 6 degrees.

TO CHANGE ATTITUDE OF AIRCRAFT.

The autopilot controller reduces the task of maneuvering the aircraft to the manipulation of two knobs (a pitch knob for climbing and descending and a turn knob for left and right turns).

A. The pitch knob is so placed on the autopilot controller that rotating it forward will produce nosedown control and rotating it aft will produce nose up control.

B. The turn knob is so placed on the autopilot controller that if rotated to the right or left it will produce right or left turns respectively. Operation of the turn knob in either direction, besides establishing a bank, simultaneously applies automatic rudder correction which is simply a means for correcting or preventing any slip or skid of the aircraft. In this way the aircraft will fly a perfectly coordinated turn at any airspeed, without the necessity of making manual adjustments. The smooth turn control permits minute and exact change of course and simplifies aircraft maneuvers.

C. Climbing or descending turns can be made by proper coordination of the pitch knob and the turn knob.

D. Straight and level flight may be resumed after turns by returning the turn knob to the DETENT position and rotating the pitch knob for level flight. When the turn knob is returned to the DETENT position, the aircraft will roll out of the turn and hold the new heading.

AUTOMATIC APPROACH EQUIPMENT.

Automatic approach and range flying equipment is installed and is used with the autopilot. The equipment provides instrument guidance through which the autopilot responds to radio signals and maintains an "on-course" flight path through interpretation of VOR, VAR, and TACAN radio range beam signals, and ILS localizer and glide slope radio beam signals. The automatic approach and range flying equipment consists of an automatic approach control, an automatic approach control selector switch *(figure 1-8)* and a heading selector, installed in the main instrument panel *figure 1-9).*

The heading selector is a part of the automatic range flying system. Automatic range flight requires that the pilot preset the desired course on the heading selector. The angular error between the aircraft heading and the desired course is measured by a synchro in the heading selector which furnishes a proportional signal to the automatic pilot. This signal is mixed with beam error data derived from the course indicator signal. The automatic pilot, therefore, senses a signal which is proportional to the angular heading error as well as the magnitude and rate change of beam error signal. The heading selector contains two synchros. One serves as an A-12 heading repeater, operating a pointer which continuously indicates the magnetic heading of the aircraft. The second synchro is connected to the settable pointer and is used to define the desired heading. The output of the heading selector (a signal proportional to the angular difference between the two pointers) enters the automatic pilot system only when the selector switch is in RANGE position.

AUTOMATIC RANGE AND AUTOMATIC APPROACH FEATURES.

During automatic range flying (omni, VAR), use range position with track heading on the heading selector and course selector. Use BLUE RIGHT for omni-range and BLUE LEFT or BLUE RIGHT for VAR, depending upon direction of flight. The blue left, blue right switch *(figure 4-25)* is in the circuit only in the range position. For best results, do not use the range position for ILS approach due to the 10-degree bank limitation that is imposed.

Holding.

There are times when traffic control conditions will require the pilot to maintain a constant altitude for a period during the descent for landing. For example, a letdown rate of 500 feet per minute may have been set in when traffic control directs the pilot to proceed to 2000 feet and hold that altitude until instructed further. Turning the altitude control switch ON and increasing power to maintain airspeed will automatically level off the aircraft and hold that altitude. When instructions are received to descend, the altitude control switch may be turned OFF and power returned to letdown condition; and the aircraft will return to the original 500-feet-per-minute descent.

Automatic Approach.

Because of the ease in maneuvering and because of the stabilizing effect, the autopilot should be kept engaged and should be used during the letdown and approach when an automatic instrument approach is planned. However, the autopilot should be disengaged before landing (in line with runway and descending). The automatic approach system is more than just another piece of accessory equipment. Its use must be studied and thoroughly understood by the pilot and all others concerned. An automatic approach should be considered as a flight operation technique which must he

AUTOPILOT CONTROLS (VC-118A)

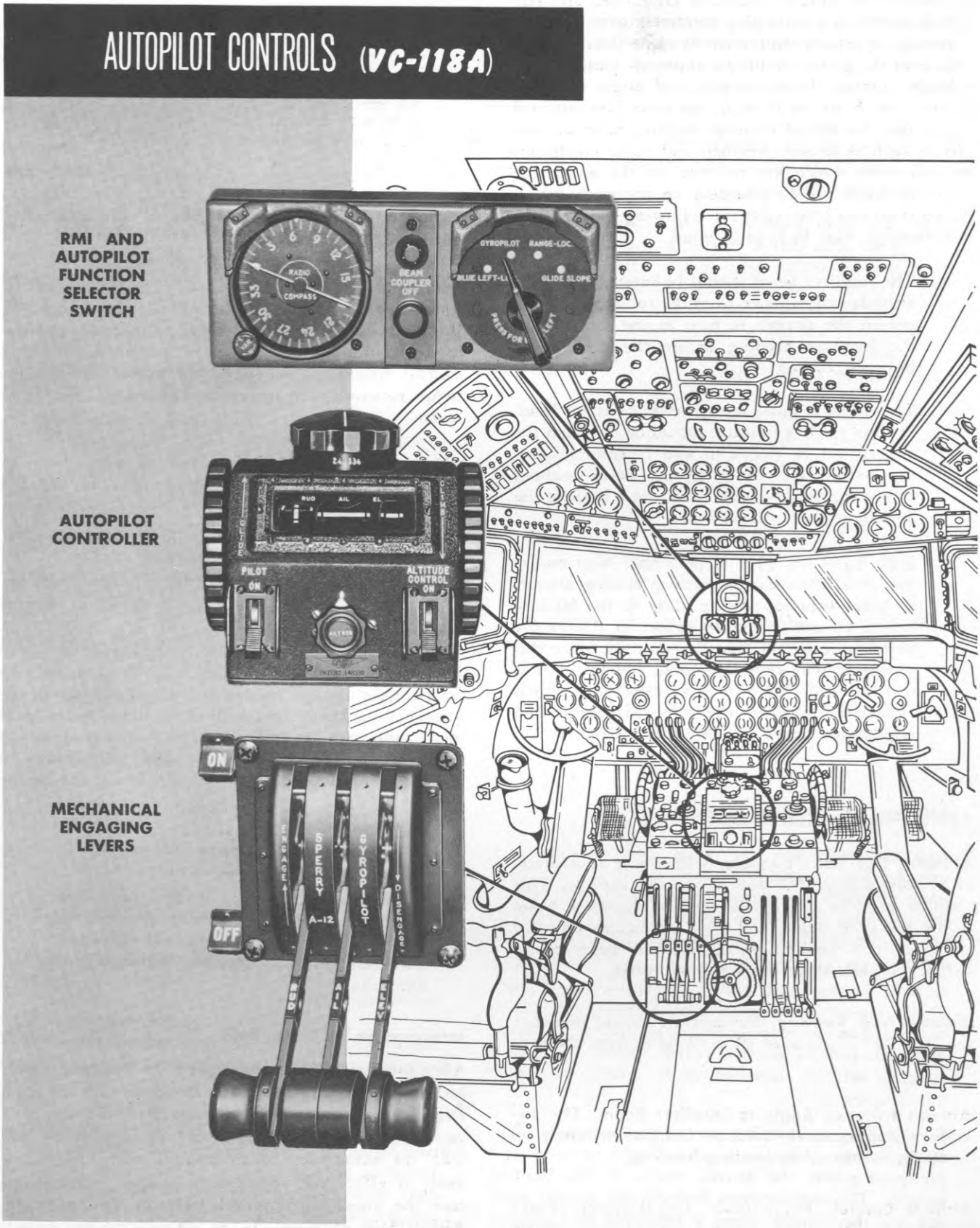


Figure 4-27

carefully planned, developed, and practiced. The cockpit procedures must be definitely established and rigidly followed. It should also be remembered that the automatic approach equipment is quite flexible with regard to the geometry of the approach pattern. The altitude, distance from runway, and angle of interception which are set forth in the procedure outlined below may be varied to meet varying external conditions such as terrain, weather, and traffic conditions or differences which are reflected on the applicable approach plate. When planning an approach which differs from this procedure, the following fundamental relationships must be kept in mind.

A. The localizer beam should be intercepted at an altitude and distance from the runway that will permit the aircraft to turn to and stabilize on the localizer heading before the glide slope beam is reached.

B. The initial angular error between aircraft heading and runway heading should be such that the aircraft will be able to turn to the runway heading within the width of the beam without exceeding the 25-degree bank angle limit of the automatic approach control.

C. Both flight and ground personnel must realize that local disturbances, such as taxiing aircraft or other vehicles passing close to the landing system transmitters, may deflect or distort the beams sent out by these transmitters. Since this distortion may cause a limited amount of control action on the part of an airplane which is attempting to follow the beams, airport ground regulations must be strictly enforced.

Approaching Localizer Beam.

Altitude. The aircraft should be flown at an altitude of approximately 1500 feet above the runway. This altitude permits interception of the localizer beam below the glide slope, and allows sufficient time for the aircraft to stabilize on the localizer beam course before the glide slope beam is intercepted.

Distance from Runway. The aircraft should intercept the beam at a distance of 10 to 12 miles from the runway.

Aircraft Entrance Angle to Localizer Beam. The aircraft may approach the localizer beam at any angle up to 90 degrees from the landing heading.

Altitude Control. The altitude control switch should be turned ON unless particular conditions dictate otherwise.

Note

The use of altitude control in the procedure described represents one recommended method of executing an automatic approach. However, its use is optional and an automatic approach may be made satisfactorily without it. In such a case, the instructions relative to the altitude control may be omitted.

Instrument Landing Receivers. The instrument landing receivers should be turned ON.

Automatic Approach Controller. The selector switch should be in the AUTOPILOT position. The APPROACH READY light must be illuminated to indicate that the autopilot and the automatic approach control equipment are receiving power. Do not attempt to execute an automatic approach if the light is out.

Airspeed. The power settings should be the same as set up for a normal approach pattern.

Course Indicator. When the aircraft intercepts the localizer beam (course), the localizer needle on the course indicator will leave its stop and move towards the center.

Automatic Approach Controller. As soon as the localizer needle on the course indicator leaves its stop, turn the selector switch to the LOCALIZER position (the green light should remain on). As the aircraft approaches the center of the localizer beam under automatic approach control, the needle will continue to move to the center, overshoot, and then return to center. When the aircraft is on the beam, the needle will be centered.

CAUTION

Attempting to put in a manual turn signal by rotating the turn knob on the autopilot controller during the approach procedure will result in electrically disengaging the autopilot.

Interception of Glide Path.

After the aircraft has intercepted the localizer track and is approaching the glide slope, extend the wing flaps and landing gear and establish the approach airspeed. When the glide slope is intercepted turn OFF the automatic altitude control, adjust the pitch knob to effect the approximate rate of descent and turn the automatic approach selector switch to the APPROACH position. If the altitude control switch is not turned OFF manually it will automatically re-

turn to the OFF position when the selector switch is turned to APPROACH.

Airspeed. Power settings should be reduced to maintain constant airspeed as the aircraft flies down the glide slope. Thus, the aircraft is brought over the edge of the field and down the center of the runway on the correct flight slope for a normal landing. The difficulties of manually lining up with the runway under bad visibility conditions and the possibility of over or undershooting are eliminated.

Turning Off Automatic Approach.

The automatic approach system is not an automatic landing system. Under all conditions, the automatic approach equipment must be turned OFF at a safe predetermined minimum altitude. The pilot must assume control of the aircraft from the autopilot and complete the landing.

The recommended way to turn off the automatic approach equipment is to push the electric release switch and disengage the autopilot servo controls. (The elevator trim tab wheels cannot be moved while the servos are engaged.)

Note

During the entire automatic approach procedure, the elevator trim tab servo of the autopilot automatically keeps the aircraft in trim about the pitch axis. This is important to the pilot in that it insures proper pitch trim for the aircraft when the autopilot is turned OFF.

Automatic Range and Automatic Approach Operation Checklist.

Inbound on Front Beam or Outbound on Back Beam of Localizer — Flag Down.

A. Auto approach selector switch.....RANGE.

B. Blue left/right selector switch....BLUE RIGHT.

C. Heading selector.....SET ON INBOUND LOCALIZER HEADING.

Inbound on Back Beam or Outbound on Front Beam of Localizer — Flag Down.

A. Auto approach selector switch.....RANGE.

B. Blue left/right selector switch.....BLUE LEFT.

C. Heading selector.....SET ON OUTBOUND LOCALIZER HEADING.

Localizer Inbound for Landing on Front Beam — 15 to 20 Miles from Transmitter.

A. Auto approach switch.....SWITCH FROM LOCALIZER TO APPROACH WHEN CENTER OF GLIDE SLOPE BEAM IS INTERCEPTED, I.E., WHEN CROSS-POINTER METER IS CENTERED.

B. Blue left/right selector switch.....OUT OF CIRCUIT; HAS NO EFEFCT ON OPERATION OF AUTOPILOT.

C. Heading selector.....OUT OF CIRCUIT; HAS NO EFFECT ON OPERATION OF AUTOPILOT.

Note

If bracketing the localizer beam, do not turn the auto approach switch to the LOCALIZER position until the needle on the cross-pointer meter leaves its stop.

Omni-Range Inbound.

A. Auto approach selector switch.....RANGE.

B. Blue left/right selector switch....BLUE RIGHT.

C. Heading selector.....SET ON HEADING TO OMNI STATION.

D. Course selector.....SET ON HEADING TO OMNI STATION.

Omni-Range Outbound.

A. Auto approach selector switch.....RANGE.

B. Blue left/right selector switch....BLUE RIGHT.

C. Heading selector.....SET ON HEADING FROM OMNI STATION.

D. Course selector.....SET ON HEADING FROM OMNI STATION.

VAR Inbound.

A. Auto approach selector switch.....RANGE.

B. Blue left/right selector switch.....POSITIONED ACCORDING TO WHETHER BLUE IS ON LEFT OR RIGHT ACCORDING TO VAR CHART.

C. Heading selector.....SET ON HEADING TO VAR STATION (BEAM HEADING).

VAR Outbound.

A. Automatic range selector switch.....RANGE

B. Blue left/right selector switch..... POSITIONED ACCORDING TO VAR CHART.

C. Heading selector..... SET ON HEADING FROM VAR STATION.

Note

Under crosswind conditions, the crab angle necessary to maintain flight along the center of the radio beam can result in the autopilot affecting a hunting reaction from side to side of the course to the omni station. This reaction is caused by feedback of correcting signals from the heading selector synchro and the automatic approach control amplifier synchro to the autopilot. To eliminate the hunting reaction, the correct crab angle should be determined and maintained by aligning the heading selector (double needle or settable pointer) with the average heading indicated by the compass repeater pointer.

The operation of the directional switch is such that when the blue area of the VAR station is on the right of the aircraft heading, the direction switch must be positioned at BLUE RIGHT in making the approach to the station. If it is positioned at BLUE LEFT, the automatic approach equipment will turn the aircraft away from the station rather than towards it. When tracking with the blue area on the left, the switch must be positioned on BLUE LEFT. The direction switch does not cause reversed course indicator indication. For omni-range operation, the switch is normally in the BLUE RIGHT position.

During cross-wind condition, the crab angle will show up as the difference between the heading selector and the omni bearing selector settings after stabilization of the autopilot is obtained.

The autopilot information during omni-range operation is dependent upon the aircraft's heading, the setting of the heading selector, and the omni bearing selector settings. The omni bearing selector is not connected in the circuit during VAR operation. It is difficult to obtain intelligent indication from the autopilot when the auto approach selector switch is in RANGE position while the aircraft is on the ground unless the aircraft heading, heading selector, and the omni needle are approximately the same.

Operating Limits.

All specifications given are maximum and are measured from the normal level flight reference position.

On Autopilot.

Bank..... 45 DEGREES.

Climb and descent.....18 DEGREES.

Altitude control..... 6 DEGREES (APPROXIMATELY). CAN BE REDUCED TO MEET ANY AIRCRAFT CHARACTERISTICS.

Aileron trim.....8 DEGREES BANK IN EITHER DIRECTION.

On Manual Control.

GYRO TILT.....85 DEGREES IN EITHER DIRECTION FROM OPERATING LEVEL POSITION BEFORE HITTING STOPS.

Automatic Range.

Bank.....10 DEGREES.

Automatic Approach — Localizer.

Bank.....25 DEGREES.

Automatic Approach — Approach.

Bank.....10 DEGREES.

Climb and descent..... 5 DEGREES.

NAVIGATION EQUIPMENT.

Periscopic sextants are installed on all aircraft. The following procedure includes only the information that is pertinent to this particular aircraft. For more complete information on the alignment of the periscopic sextant mount, see the applicable equipment handbook.

A. Select the point of antenna connection at the top center portion of the leading edge of the vertical stabilizer, and crank the azimuth counter to read 180.4 degrees.

B. When sighting on the object described above, the vertical reticle, target, and 0 degrees (or N) on the azimuth scale should coincide within ¼ degree, and the azimuth counter should have the reading of 180.4 degrees previously set in.

Driftmeters are installed on AF51-3818 through AF51-3835, AF51-17626 through AF51-17661, AF51-17667, and AF51-17668 in the navigator's compartment aft of the copilot's bulkhead. The driftmeter is used by the navigator while the aircraft is in flight, to measure both drift and azimuth. The instrument makes it possible to obtain direct indications of drift or the angle between the actual direction of motion of the aircraft and its heading, the relative bearing angle of a fixed object on the earth, and data for calculating ground speed.

DRIFTMETER ALIGNMENT.

The driftmeter is aligned as follows:

A. With the caging knob in the CAGED position, apply 115 volts a-c to the driftmeter, and place the toggle switch in the ON position.

B. Depress the starting button and hold it in for approximately 1 minute.

C. Allow at least 5 minutes for the gyro to erect.

D. By rotating the tangent screw and sight control handle, sight on the UHF antenna on AF51-3818 through AF51-3835, AF51-17626 through AF51-17661, AF51-17667, and AF51-17668.

E. Uncage the gyro by pulling out the caging knob and moving it as far as it will go toward UNCAGED.

F. With the target centered on the grid lines, tighten the driftmeter to the mount.

G. Again sight the target and note that the driftmeter azimuth scale reads 182 ($\pm\frac{1}{2}$) degrees on AF51-3818 through AF51-3835, and 190 ($\pm\frac{1}{2}$) degrees on AF51-17626 through AF51-17661, AF51-17667, and AF51-17668.

H. When the target and grid lines are aligned as described above, and the driftmeter azimuth scale does not read the correct azimuth, proceed as follows:

I. Make certain that the driftmeter is tightened on the mount and again sight through the driftmeter to assure that the target and grid lines are properly aligned.

J. Loosen the screws securing the index pointer to the rotating tube.

K. Set the lubber line of the index pointer to read the proper azimuth reading as outlined in step G.

L. Retighten the index pointer screws, cage the gyro, and move the toggle switch to the OFF position.

AUXILIARY POWER UNIT (D-2).

On some aircraft, an auxiliary power unit is installed in the lower forward cargo compartment *(28, figure 1-3)* to provide a source of additional electrical power independent of a ground power supply. The auxiliary power unit is provided primarily for ground operation only, and is a 2-cylinder, 4-cycle, V-type gasoline engine with a muffler and a self-contained oil supply system which has a capacity of 3 quarts. Fuel is supplied from the No. 2 main fuel tank. The engine will supply, at constant speed, an electrical output of 0 to 5 kilowatts (0 to 175 amperes at 28.5 volts).

AUXILIARY POWER UNIT CONTROLS (D-2).

Auxiliary Power Unit Throttle Control (D-2).

The auxiliary power unit carburetor is controlled by a mechanical 3-position control located below the auxiliary power unit control panel *(figure 4-28, sheet 1)*. The positions are CHOKE, IDLE, and RUN. The CHOKE position is used as the starting position. The IDLE position is used after the power plant has started to provide a slower warmup rpm. The RUN position is used after the engine has warmed up thoroughly (approximately 5 minutes) to provide maximum power output.

Note

Operation of the CHOKE can best be determined by experience. Little or no choke will be necessary above 10°C.

Auxiliary Power Unit Ignition Switch (D-2).

A 2-position ignition switch is mounted on the auxiliary power unit control panel *(figure 4-28, sheet 1)*. The switch positions are ON and OFF and are conventional in operation.

Auxiliary Power Unit Starter and Generator Switch (D-2).

A 3-position combination starter and generator switch is mounted on the auxiliary power unit control panel *(figure 4-28, sheet 1)*. The generator serves the dual purpose of starter and generator. The spring-loaded START position causes the generator to function as a starter. The ON position produces generator functioning. The center position is the OFF position. The auxiliary power unit may be started by power supplied from the aircraft batteries.

Auxiliary Power Unit Circuit Breaker (D-2).

A generator field circuit breaker is mounted on the auxiliary power unit control panel *(figure 4-28, sheet 1)*, and must be set to ON before starting the auxiliary power unit.

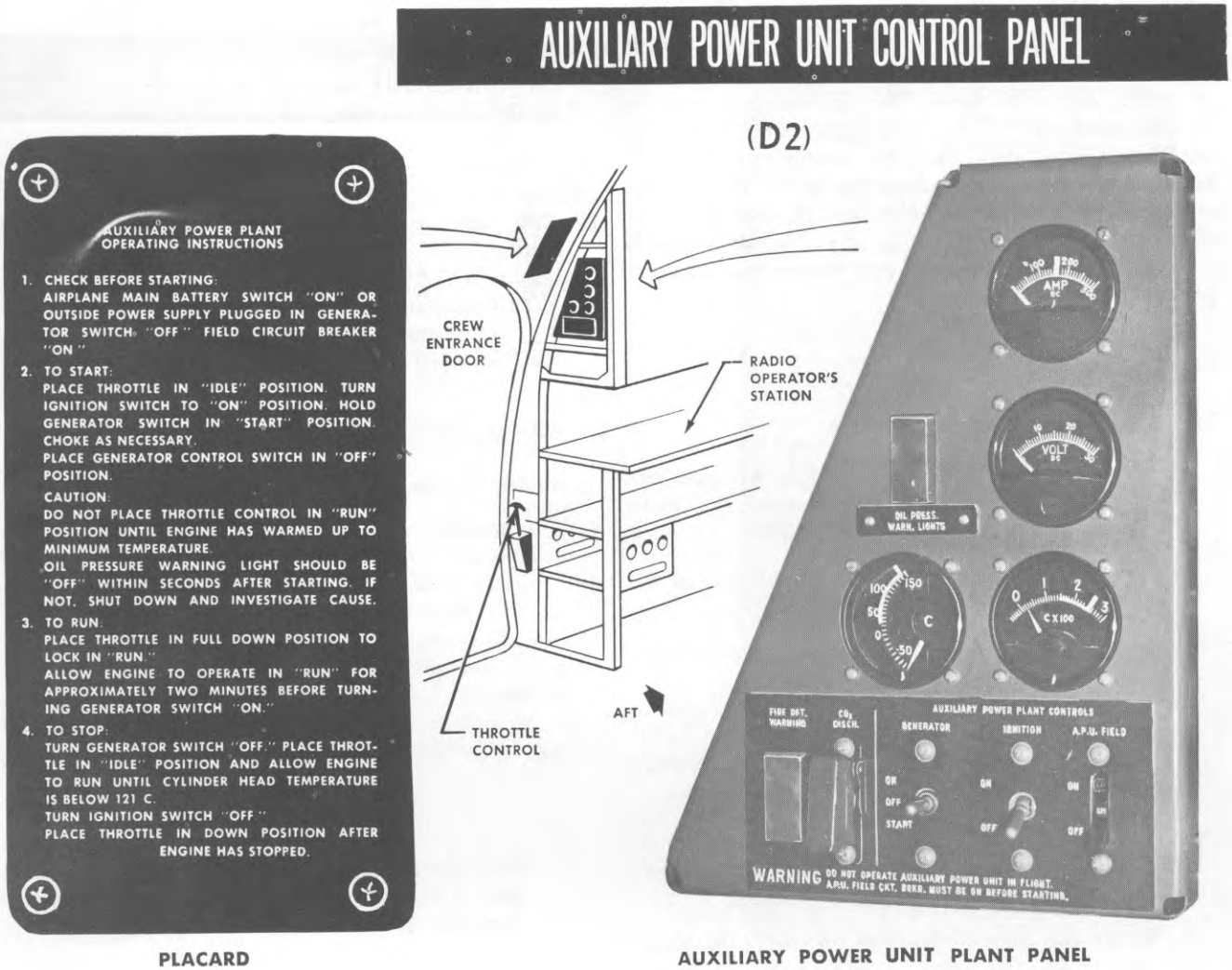


Figure 4-28 (Sheet 1 of 4)

Auxiliary Power Unit Hand Cranking (D-2).

The auxiliary power unit can be hand cranked with a pull cord that fits into a notched and grooved pulley on the engine flywheel. Operation of the auxiliary power unit controls is identical for both electrical and manual starting. The pull cord is stowed on the auxiliary power unit mounting platform *(28, figure 1-3)*.

Auxiliary Power Unit Oil Temperature Gage (D-2).

An oil temperature gage is mounted on the auxiliary power unit control panel *(figure 4-28, sheet 1)*.

Auxiliary Power Unit Cylinder Head Temperature Gage (D-2).

A cylinder head temperature gage is mounted on the auxiliary power unit control panel *(figure 4-28, sheet 1)*.

Auxiliary Power Unit Oil Pressure Warning Light (D-2).

An oil pressure warning light is mounted on the auxiliary power unit control panel *(figure 4-28, sheet 1)*. If the light does not go out a few seconds after the auxiliary power unit has started, shut down and investigate.

Auxiliary Power Unit Ammeter (D-2).

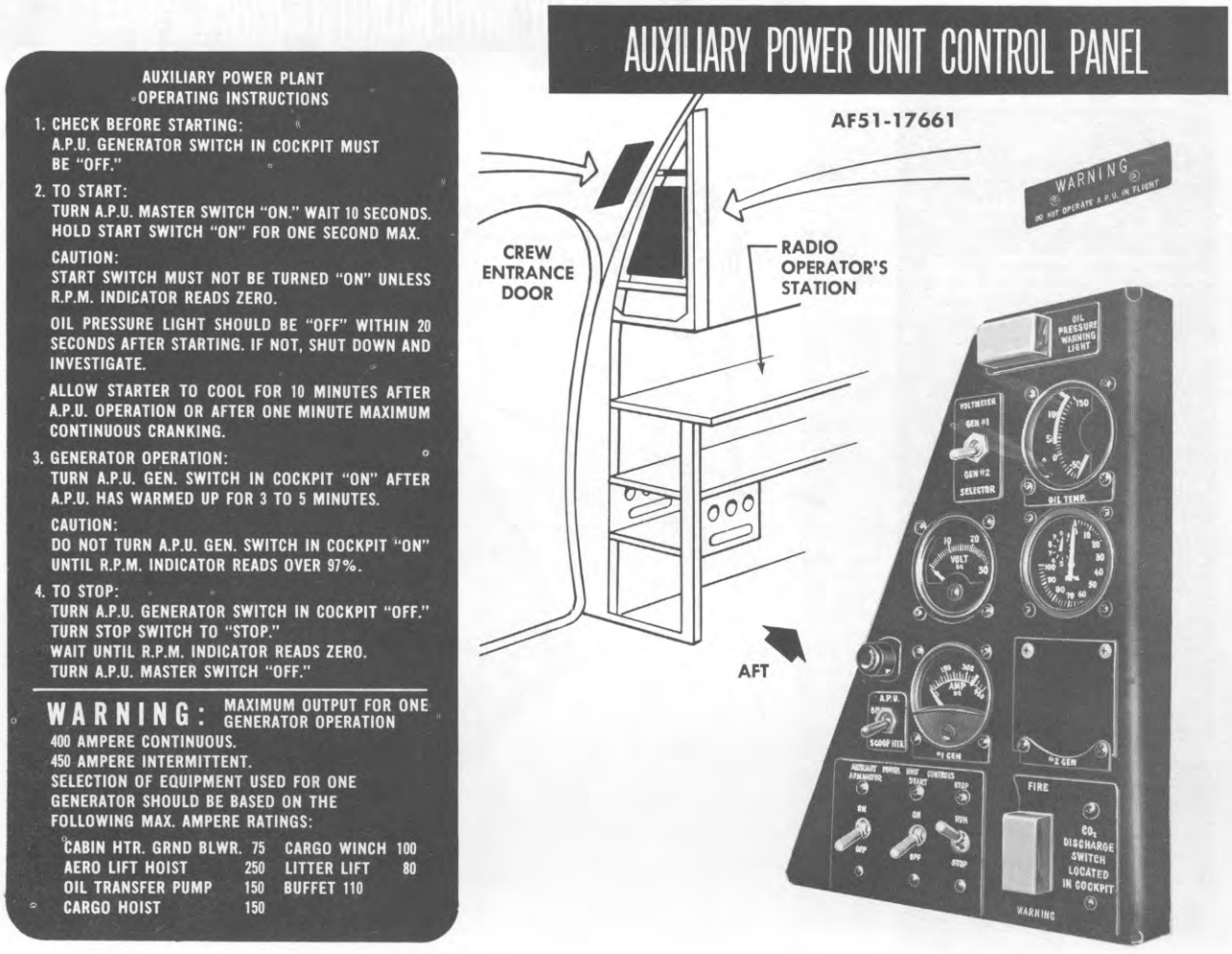
A d-c ammeter is mounted on the auxiliary power unit panel *(figure 4-28, sheet 1)*.

Auxiliary Power Unit Voltmeter (D-2).

A d-c voltmeter is mounted on the auxiliary power unit control panel *(figure 4-28, sheet 1)*.

Starting Auxiliary Power Unit (D-2).

Before starting the auxiliary power unit, make certain that either the main battery switch is ON or external power is plugged in, that the APU generator switch is OFF, and that the APU field circuit breaker is ON.



AA1-160

Figure 4-28 (Sheet 2 of 4)

Use the following procedure to start the APU.

A. APU throttle – CHOKE.

B. APU ignition switch – ON.

C. APU generator switch – HOLD IN START.

D. APU generator control switch – OFF.

Note

Operation of the CHOKE can best be determined by experience. Little or no choke will be necessary above 10°C.

E. APU throttle – IDLE AFTER ENGINE STARTS, EXCEPT FOR STARTS AT ALTITUDE, WHEN THROTTLE SHOULD BE PLACED IN THE RUN POSITION. CONSISTENT STARTS UNDER LOAD CANNOT BE MADE AT ALTITUDES OVER 5500 FEET.

CAUTION

Do not place the throttle in Run position except for altitude starts, until the engine has warmed up to minimum temperature. The oil pressure warning light should be OFF within seconds after starting; if not, shut down and investigate.

TO OPERATE AUXILIARY POWER UNIT (D-2).

Use the following procedure to operate the APU:

A. Place APU throttle in the full down position to lock in the RUN position.

B. Allow APU to operate in RUN position for approximately 2 minutes before turning the generator switch ON.

AUXILIARY POWER UNIT CONTROL-PANEL

(GTP70-60)

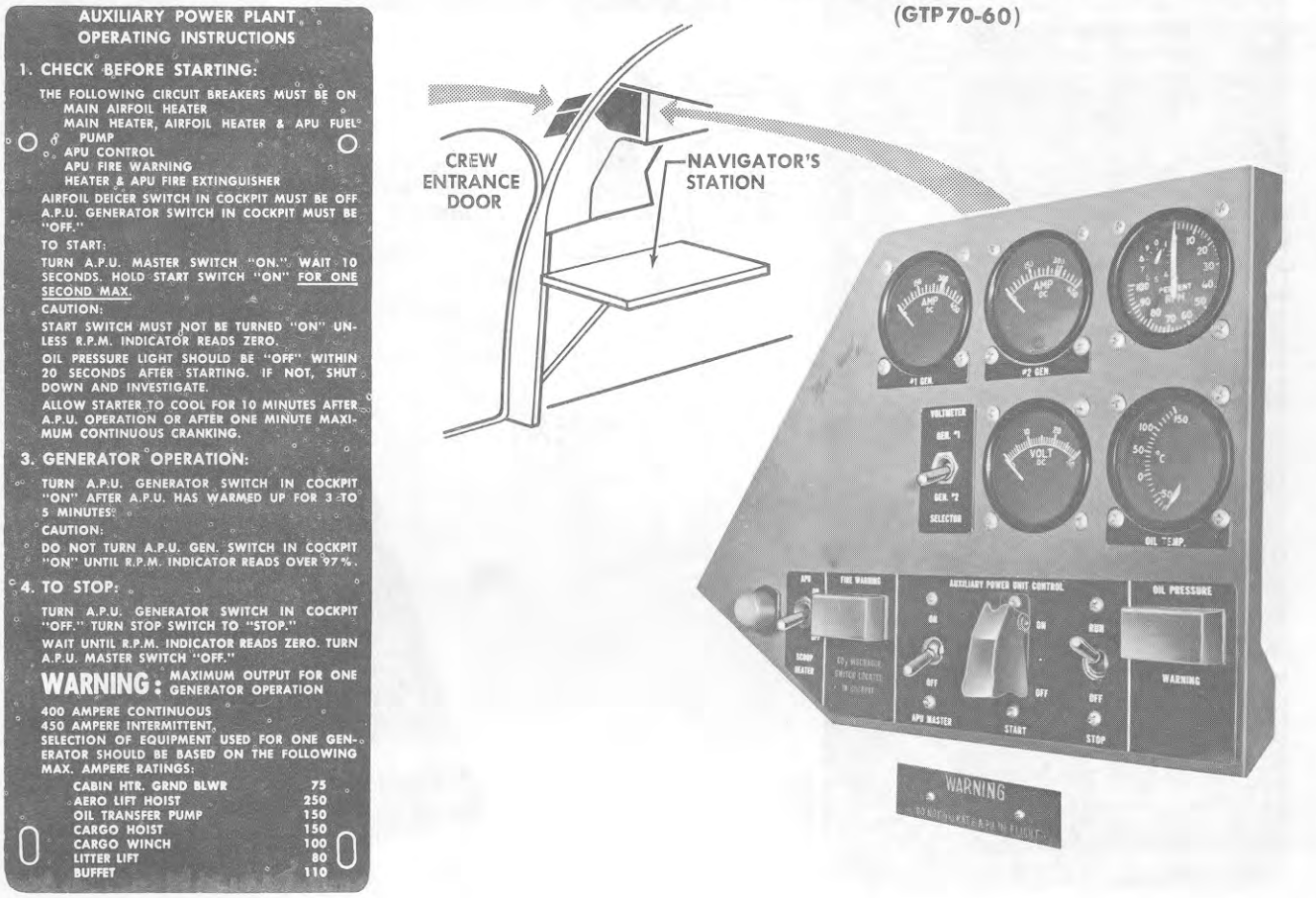


Figure 4-28 (Sheet 3 of 4)

AA1-161

TO STOP AUXILIARY POWER UNIT (D-2).

Use the following procedure to stop the APU:

A. APU generator switch – OFF.

B. Place the throttle in the IDLE position and allow engine to run until the cylinder head temperature is below 121°C.

C. APU ignition switch – OFF.

D. Place the throttle in the DOWN position after the engine has stopped.

MANUAL STARTING OF AUXILIARY POWER UNIT (D-2).

The auxiliary power unit can be started by hand by means of a pull cord if electrical power is not available to make a normal start.

AUXILIARY POWER UNIT (GTP70)

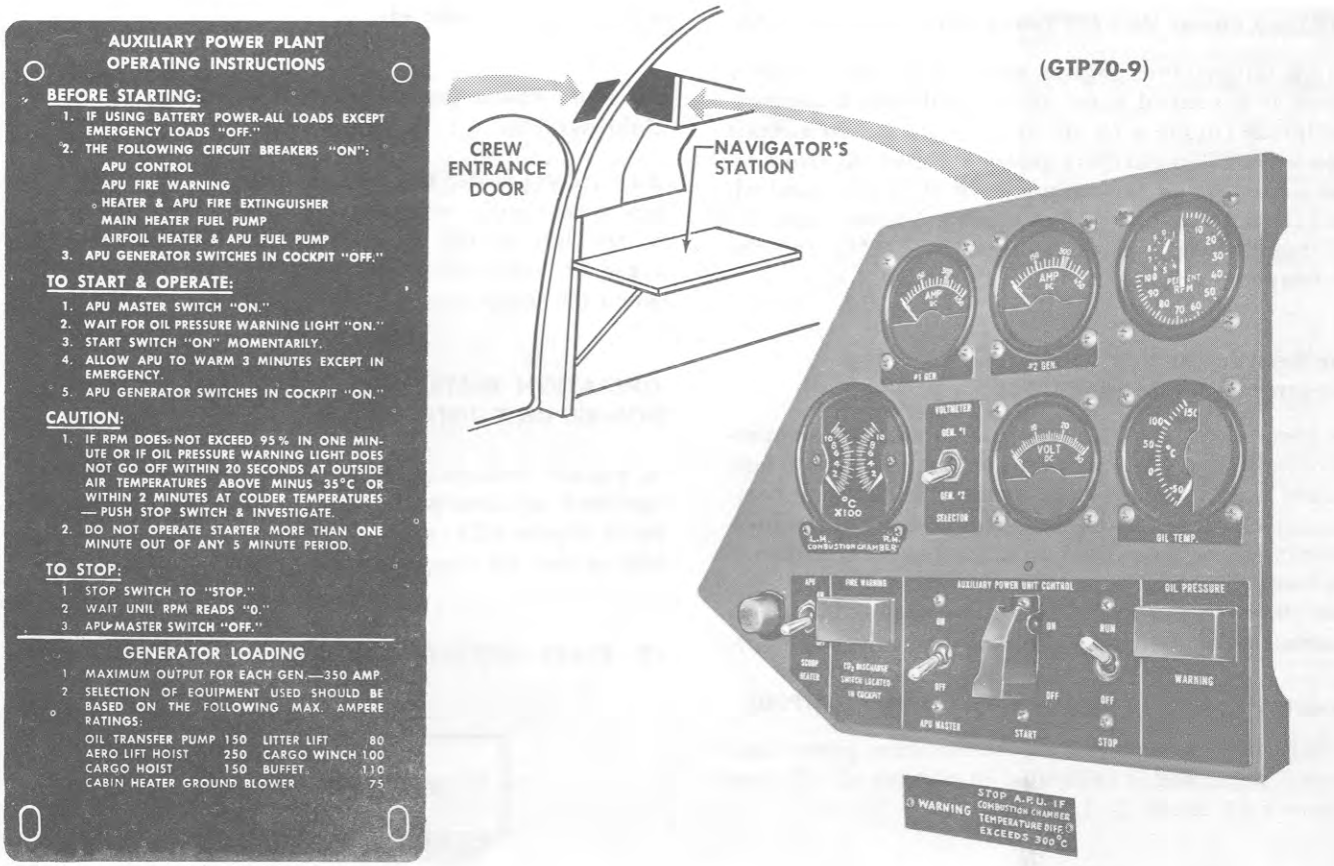
On some aircraft, an auxiliary power unit is installed in the fuselage tail section, aft of the pressure dome *(19, figure 1-3)* to provide a source of electrical power on the ground. The auxiliary power unit is an automatically controlled, gas turbine-powered source of constant speed power, used to drive and cool two aircraft-type generators. Fuel is supplied from the No. 3 main fuel tank; fuel consumption at normal rated power (70 horsepower) is approximately 97.5 pounds per hour. The maximum output for each generator is 350 amperes at 28 volts.

AUXILIARY POWER UNIT CONTROLS (GTP70).

Auxiliary Power Unit Master Switch (GTP70).

An ON-OFF auxiliary power unit master switch is mounted on the auxiliary power unit control panel and is placarded APU MASTER *(figure 4-28, sheets 2, 3, and 4)*.

AUXILIARY POWER UNIT CONTROL PANEL



AA1-162

Figure 4-28 (Sheet 4 of 4)

Auxiliary Power Unit Start Switch (GTP70).

A guarded ON-OFF auxiliary power unit START switch is mounted on the auxiliary power unit control panel. It is spring loaded to the OFF position *(figure 4-28, sheets 2, 3, and 4)*.

Auxiliary Power Unit Stop Switch (GTP70).

An auxiliary power unit STOP switch is mounted on the auxiliary power unit control panel. It is spring loaded to the RUN position *(figure 4-28, sheets 2, 3, and 4)*.

Auxiliary Power Unit Scoop Heater Switch (GTP70).

An ON-OFF auxiliary power unit scoop heater switch is mounted on the auxiliary power unit control panel, and is placarded APU SCOOP HTR *(figure 4-28, sheets 2, 3, and 4)*.

Auxiliary Power Unit Voltmeter Selector Switch (GTP70).

A 2-position VOLTMETER SELECTOR switch is mounted on the auxiliary power unit control panel, and has the positions GEN #1 and GEN #2. On some aircraft, provisions for only the GEN #2 position are installed.

Auxiliary Power Unit Generator Switch (GTP70).

On some aircraft, an ON-OFF auxiliary power unit generator switch is mounted on the aft right corner of the forward overhead panel, and is placarded GEN #1. Provisions are made for a GEN #2 switch, and an APU GENERATOR CUTOFF bar is installed so the two switches may be cut off simultaneously.

On some aircraft, two generator ON-OFF switches for the auxiliary power unit are mounted on the forward overhead panel adjacent to the four generator control switches. A gang bar is installed to cut off the four

generator control switches, the two auxiliary power unit generator switches, and the battery master switch, simultaneously.

Auxiliary Power Unit Oil Temperature Gage (GTP70).

An oil temperature gage is mounted on the auxiliary power unit control panel and is calibrated in degrees centigrade *(figure 4-28, sheets 2, 3, and 4)*. On aircraft with a GTP70-6 auxiliary power unit, an oil temperature limit card for various grades of oil is also installed. On aircraft with a GTP70-9 auxiliary power unit, the oil temperature gage is red-lined at 124°C, and the oil temperature limit card is not installed.

Auxiliary Power Unit Combustion Chamber Temperature Indicator (GTP70).

On some aircraft, a dual combustion chamber temperature indicator is mounted on the auxiliary power unit control panel and gives the temperature of each combustion chamber in degrees centigrade. The temperature indicator provides indication that both chambers are firing. If at any time after start there is a temperature difference of over 300°C between combustion chambers, the APU must be shut down immediately.

Auxiliary Power Unit Tachometer Indicator (GTP70).

A tachometer is mounted on the auxiliary power unit control panel and is calibrated in percent of full rpm *(figure 4-28, sheets 2, 3, and 4)*.

Auxiliary Power Unit Voltmeter (GTP70).

On some aircraft, a d-c voltmeter is mounted on the auxiliary power unit control panel to indicate the voltage output when the voltmeter selector switch is in the GEN #1 position only. On some aircraft, the d-c voltmeter indicates the voltage output of either generator when the voltmeter selector switch is positioned to the respective generator.

Auxiliary Power Unit Ammeter (GTP70).

On some aircraft, a d-c ammeter is mounted on the auxiliary power unit control panel to indicate the amperage output of the generator. On some aircraft, two d-c ammeters are mounted on the control panel to indicate the amperage output of the two generators *(figure 4-28, sheets 3 and 4)*.

Auxiliary Power Unit Oil Pressure Warning Light (GTP70).

An oil pressure warning light is mounted on the auxiliary power unit control panel *(figure 4-28, sheets 2, 3, and 4)*. The light should go out within 20 seconds after the START switch is energized.

Auxiliary Power Unit Fire Warning Light (GTP70).

A fire warning light is mounted on the auxiliary power unit control panel and is wired in parallel, with a warning light on the heater fire control panel *(figure 4-28, sheets 2, 3, and 4)*.

Auxiliary Power Unit Airscoop Heater on Light (GTP70).

An airscoop heater ON light is mounted on the auxiliary power unit control panel immediately above or to the left of the APU SCOOP HTR switch *(figure 4-28, sheets 2, 3, and 4)*. This light illuminates when the scoop heater is ON.

OPERATION INSTRUCTIONS FOR AUXILIARY POWER UNIT (GTP70).

A placard containing brief operation instructions is mounted adjacent to the auxiliary power unit control panel *(figure 4-28, sheets 2, 3, and 4)*. The following instructions are supplementary to those on the placard.

TO START AUXILIARY POWER UNIT (GTP70-6).

WARNING

If aircraft APU is equipped with GE2CM82D4 generators, emergency operation only of the GTP70-6 APU is authorized provided an observer is stationed near the APU. If vibration is observed to the extent that visible vibration is being transmitted to the APU support structure and aircraft structure, the unit must be turned OFF immediately.

A. Check that the APU generator switches (located on the forward overhead panel) and the airfoil de-icer switch (located on the heater control panel) are OFF. Position the battery switch to PLANE BATTERY, or to GROUND POWER if the external power source is plugged in.

B. Check that the following circuit heaters are ON:
Main airfoil heater.
Main heater, airfoil heater, and APU fuel pump.

APU control.

APU fire warning.

Heater and APU fire extinguisher.

C. Test the fire warning lights on the heater fire control panel and the auxiliary power unit control panel by pressing the auxiliary power unit test button on the heater fire control panel.

D. APU scoop heater – ON, IF REQUIRED (BELOW FREEZING).

E. Turn ON the APU MASTER switch. Allow 10 seconds for the intake duct door to open.

F. Push the START switch momentarily (not over 1 second) to the ON position. The unit should start and show a constant increase in rpm. Do not turn the START switch ON unless the percent rpm indicator reads zero. Do not hold the START switch ON longer than 1 second. The duty cycle of the starter is 35 seconds ON, 10 minutes OFF. In case of malfunction, or an aborted start, do not exceed these requirements because the starting motor will be damaged. If the duration of the starter operation exceeds 35 seconds, the stop switch should be actuated and the unit allowed to stop; however, if the unit has not been in operation previously for at least 1 hour, three consecutive starts may be made. If additional starts are made, the starter duty cycle must be observed.

G. Note that the oil pressure warning light on the auxiliary power unit control panel goes out within 20 seconds after the START switch is energized.

CAUTION

If the light does not go out within 20 seconds, shut down the unit and investigate.

If the APU does not come up to full speed or slows down when a load is applied, the cause may be that a single combustion chamber is inoperative. The APU should be shut down immediately and the cause investigated.

H. After 3 to 5 minutes of warmup time, turn ON the APU generator switches on the forward overhead panel. In an emergency, it is not necessary to warmup the unit, but do not turn the APU generator switch ON unless the percent rpm indicator shows 97 percent rpm, or more.

TO STOP AUXILIARY POWER UNIT (GTP70-6).

A. Turn the APU generator switches OFF.

B. Momentarily place the STOP switch in the STOP position.

C. Wait until the percent rpm indicator indicates 0.

D. Place the APU MASTER switch in the OFF position.

Note

To facilitate cooling after shutdown, the intake duct door should be kept open for a short period of time. This can be accomplished by waiting for approximately 5 minutes after the speed of the unit reaches zero before turning the APU master switch OFF. This should not be interpreted to mean that such a procedure is necessary in case of a fire. When the auxiliary power unit is selected for fire extinguishing on the heater fire control panel, the intake door is closed simultaneously with shutting down of the unit.

E. If the auxiliary power unit circuit breakers are to be opened, wait approximately 10 seconds in order to insure that the air intake duct door has had time to close.

TO START AUXILIARY POWER UNIT (GTP70-9).

Use the following procedure to start the APU:

A. Check that the APU generator switches (located on the forward overhead panel) and the airfoil deicer switch (located on the heater control panel) are OFF. Position the battery switch to PLANE BATTERY, or to GROUND POWER if external power source is plugged in.

Note

If using PLANE BATTERY, all loads except emergency loads shall be OFF.

B. Check that the following circuit breakers are ON:
APU control.
APU fire warning.
Heater and APU fire extinguisher.
Main heater fuel pump.
Airfoil heater and APU fuel pump.

C. Test the fire warning lights on the heater fire control panel and the auxiliary power unit control panel by pressing in the auxiliary power unit test button located on the heater fire control panel.

D. APU scoop heater – ON, IF REQUIRED (BELOW FREEZING).

E. Turn ON the APU Master switch.

F. Wait until the oil pressure warning light illuminates. This indicates that the air intake door is open.

G. Press the START switch momentarily to the ON position. The unit should start and show a constant increase in rpm. The duty cycle of the generator acting as a starter is 1 minute out of any 5-minute period.

NOTE

Aircraft that have been modified by T.O. 1C-118A-626, the oil pressure warning light will not illuminate until start switch is pressed, and air intake door is open. The start switch must be held on until oil pressure warning light goes off. Do not exceed starter operating limitations.

CAUTION

If rpm does not exceed 95 percent in 1 minute, or if oil pressure warning light does not go off within 20 seconds at outside air temperatures above −35°C (−31°F) or within 2 minutes at colder temperatures, push stop switch and investigate. Do not operate starter more than 1 minute out of any 5-minute period.

WARNING

Stop APU if combustion chamber temperature difference exceeds 300°C.

H. After 3 to 5 minutes of warmup time, turn the generator switches on the forward overhead switch panel to ON.

TO STOP AUXILIARY POWER UNIT (GTP70-9).

Use the following procedure to stop the APU:

A. Generator — OFF.

B. Momentarily place the STOP switch in the STOP position.

C. Wait until the percent rpm indicator reads zero.

D. Place the APU MASTER switch in the OFF position.

Note

To facilitate cooling after shutdown, wait until the speed of the unit reaches zero as indicated on the percent rpm indicator, and, if practical, wait 5 minutes before turning the APU MASTER switch OFF (which closes the air intake door). This should not be interpreted to mean that such a procedure is necessary in case of a fire. When the auxiliary power unit is selected for fire extinguishing on the heater control panel, the intake door is closed simultaneously with shut down of the unit.

E. If the auxiliary power unit circuit breakers are to be opened, wait approximately 10 seconds in order to insure that the air intake door has had time to close.

ENGINE ANALYZER.

On some aircraft, a fixed engine analyzer is installed, while certain other aircraft contain provisions for the use of a portable engine analyzer. The engine analyzer, which permits continuous visual analysis of the power plant during either flight or ground operation, isolates and identifies malfunctions and imminent failures by projecting a series of patterns *(figure 4-29)* on the phosphorescent screen of a cathode ray tube.

ENGINE ANALYZER CONTROLS.

Engine Analyzer Power Switch.

The engine analyzer is controlled by an ON-OFF toggle-type power switch located on the engine analyzer panel when a fixed engine analyzer is provided. When a portable engine analyzer is employed, the power switch is located on the face of the analyzer.

Condition Selector Switch.

The condition selector switch, mounted on the engine analyzer panel (fixed analyzer), and on the face of the analyzer (portable analyzer), chooses an engine and magneto and the kind of pattern (ignition, synchronization, or vibration) to be analyzed.

Cycle Selector Switch.

The cycle selector switch, mounted on the engine analyzer panel (fixed analyzer), and on the face of the analyzer (portable analyzer) chooses the individual spark plug and portion of the complete engine cycle. The push-button at the center of the cycle selector switch, when pulled out, simultaneously displays patterns of all spark plugs in a row on the indicator, starting with any single cylinder selected by the rotary position of the switch. Numbers on the switch dial

identify the particular spark plug and positively show the location of any detected trouble in the engine. For vibration analysis, the cycle switch can select only the No. 5 cylinder (all engines) since a vibration pick-up has been installed only on the No. 5 cylinder for all engines.

Engine Analyzer Indicator.

The engine analyzer indicator, mounted on the engine analyzer panel (fixed analyzer), and on the face of the engine analyzer (portable analyzer), shows the exact characteristic patterns of engine operation on a phosphorescent screen, as selected by the condition selector switch.

ENGINE ANALYZER OPERATION.

See figure *4-29.*

IGNITION ANALYSIS.

For ignition analysis, the engine analyzer is operated as follows:

Note

Allow approximately 1 minute for the power supply amplifier and the indicator tube to warm up.

A. Engine analyzer power switch – ON.

B. Condition selector switch – PLACE INDEX LINE ON L, R, OR B WITHIN THE IGNITION SECTOR ON THE ENGINE TO BE CHECKED. INDEXING THE DIAL DETERMINES WHETHER THE PATTERN WILL BE FOR THE LEFT, RIGHT, OR BOTH DISTRIBUTORS.

C. Cycle selector switch – ALIGN THE IGN INDEX LINE WITH THE NUMBER OF THE CYLINDER TO BE SHOWN FIRST IN THE SERIES OF PATTERNS FOR ONE DISTRIBUTOR.

D. Cycle switch knob – PULL OUT TO OBTAIN A SLOW SWEEP (720 DEGREES OF CRANKSHAFT ROTATION) COVERING THE IGNITION PATTERNS FOR ALL OF THE CYLINDERS. THE CYLINDER SELECTED BY THE CYCLE SWITCH WILL APPEAR TO THE LEFT ON THE INDICATOR, FOLLOWED BY THE OTHER 17 IN THE ORDER OF FIRING OF THAT DISTRIBUTOR.

E. If all 18 patterns are abnormal during the slow sweep, the malfunction is associated with that portion of the magneto circuit that is common to all 18 ignition circuits. This would indicate magneto or distributor difficulty.

F. If part of the series is abnormal, position the cycle selector switch to bring one of the abnormal patterns to the left side of the screen.

G. Cycle switch knob – PUSH IN FOR A MORE THOROUGH EXAMINATION OF THE EXAMINATION OF THE EXPANDED PATTERN OF ANY ABNORMAL CYLINDER.

H. Repeat the above steps for left and right sides of both distributors for all engines. It is suggested that at slack work periods all ignition patterns be investigated on the fast sweep for malfunctions that may not be observed on the slow sweep.

DISTRIBUTOR SYNCHRONIZATION CHECK.

The distributor synchronization check is made to determine that both distributors simultaneously fire the two plugs in a cylinder. The distributor points are timed to the No. 1 cylinder, and therefore should be checked on the No. 1 reference cylinder. For this check, proceed as follows:

A. Engine analyzer power switch – ON.

B. Condition selector switch – INDEX LINE ON B UNDER THE ENGINE NUMBER TO BE CHECKED.

C. Cycle selector switch knob – PUSH IN FOR FAST SWEEP.

D. Cycle switch – ALIGN THE IGN INDEX LINE WITH THE NO. 1 REFERENCE CYLINDER. THIS SUPERIMPOSES THE IGNITION PATTERN OF THE LEFT AND RIGHT DISTRIBUTORS. IF THE DISTRIBUTORS ARE SYNCHRONIZED, THE PATTERNS COINCIDE AND APPEAR AS ONE; OTHERWISE, THEY OVERLAY AND THE ONE APPEARING TO THE LEFT IS ADVANCED IN RELATION TO THE OTHER. BY MEASURING THE DISTANCE ON THE SCOPE BETWEEN THE POINTS OF BREAKER POINT OPENING, AND ALLOWING 1/32 INCH TO EQUAL 1 DEGREE OF CRANKSHAFT TRAVEL, THE AMOUNT OF SYNCHRONIZATION ERROR MAY BE DETERMINED.

E. Repeat the above procedure for both distributors on each engine.

Two methods are available for determining which distributor, right or left is out of synchronization. The first is as follows:

A. Condition selector switch – SET TO R UNDER THE ENGINE NUMBER TO BE CHECKED.

B. Cycle switch knob – IN.

ENGINE ANALYZER

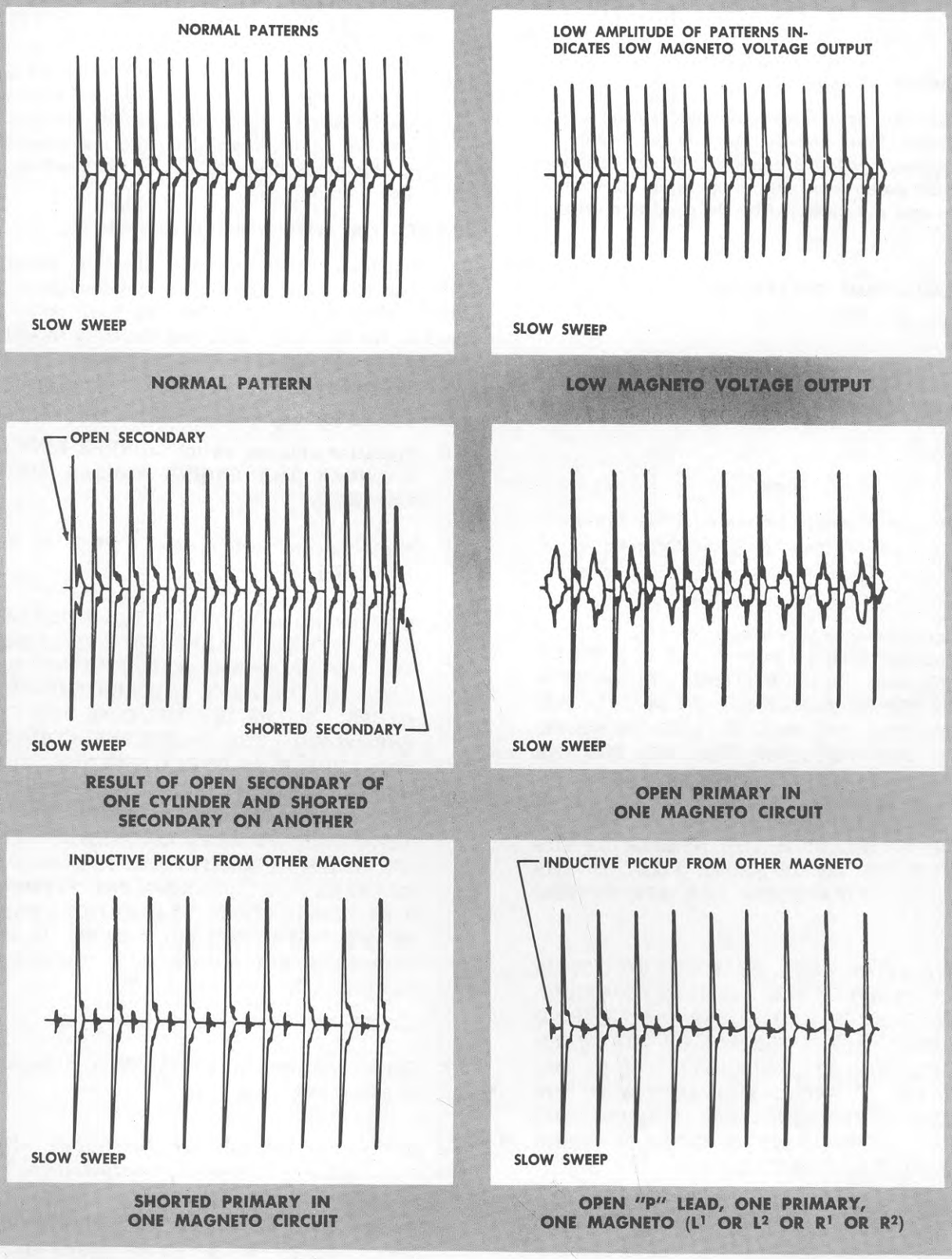
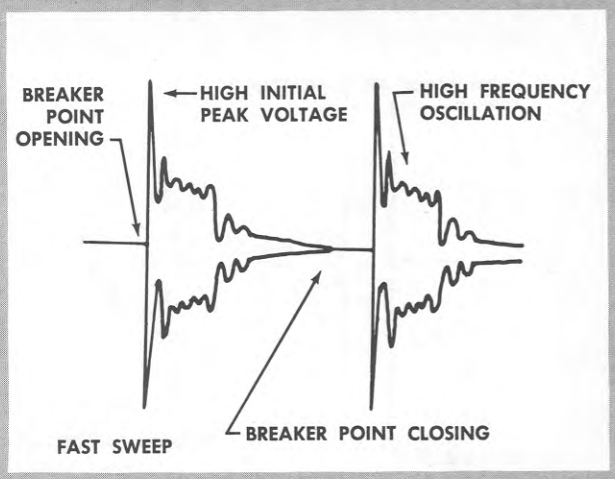


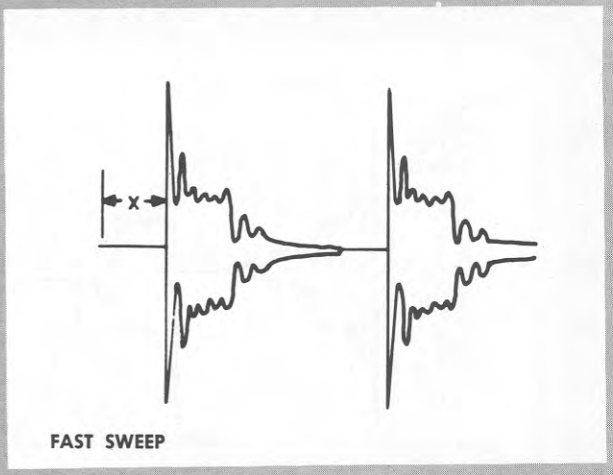
Figure 4-29 (Sheet 1 of 4)

AA1-163

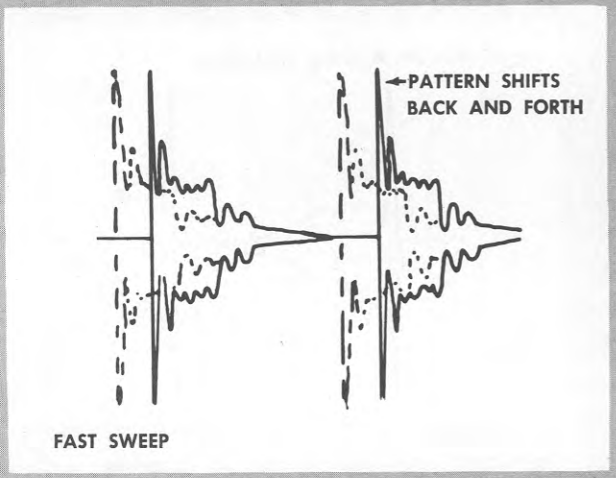
PATTERNS



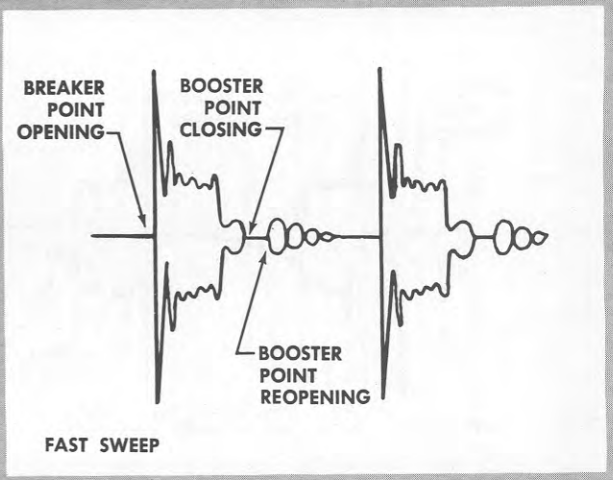
NORMAL PATTERN (SHOWING REFERENCE POINTS ON WAVE)



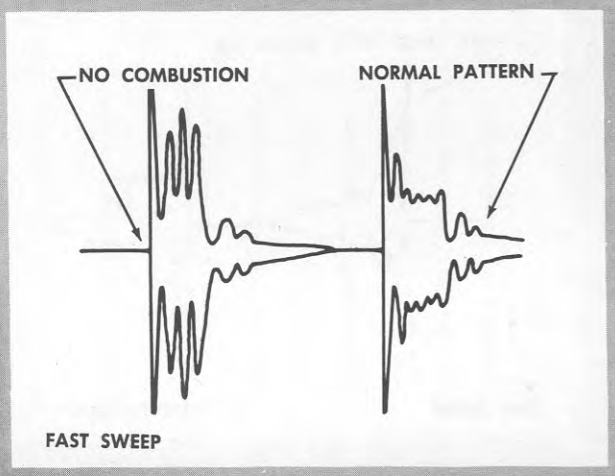
NORMAL PATTERN (SHOWING MAG TIMING X)



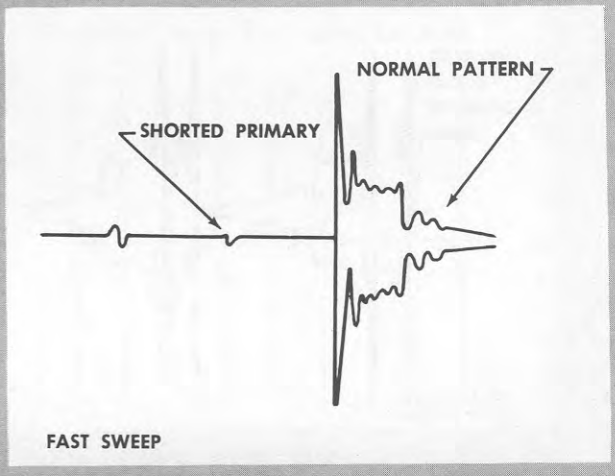
ROUGH ENGINE



NORMAL PATTERN (SHOWING BOOSTER POINT CLOSING)



NO COMBUSTION

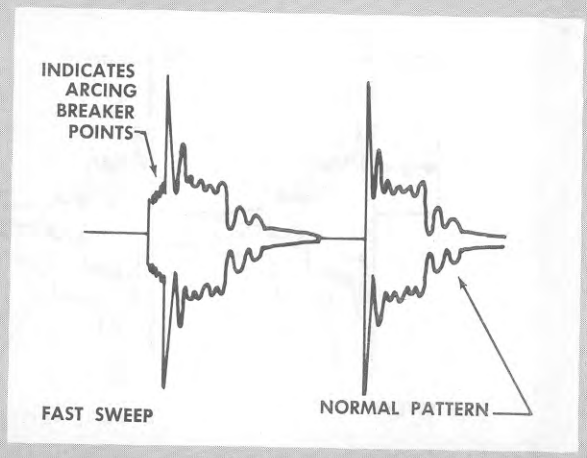


SHORTED PRIMARY ON ONE CYLINDER COIL

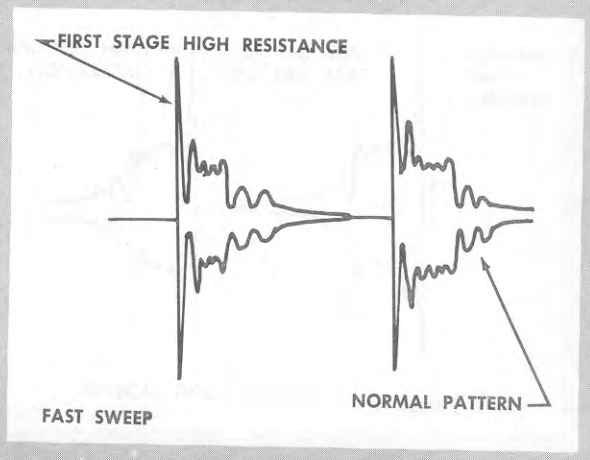
AA1-194

Figure 4-29 (Sheet 2 of 4)

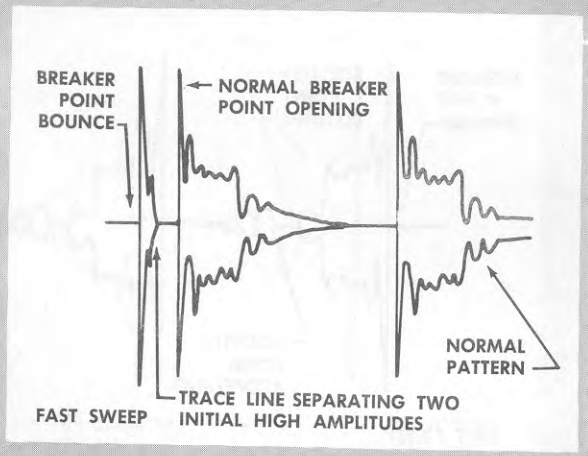
ENGINE ANALYZER



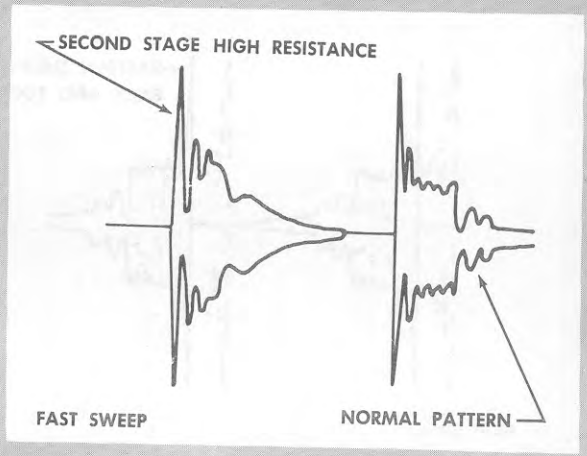
ARCING BREAKER POINTS



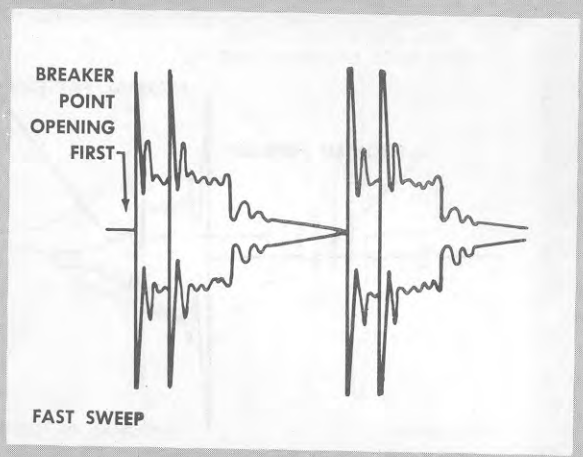
FIRST STAGE HIGH RESISTANCE



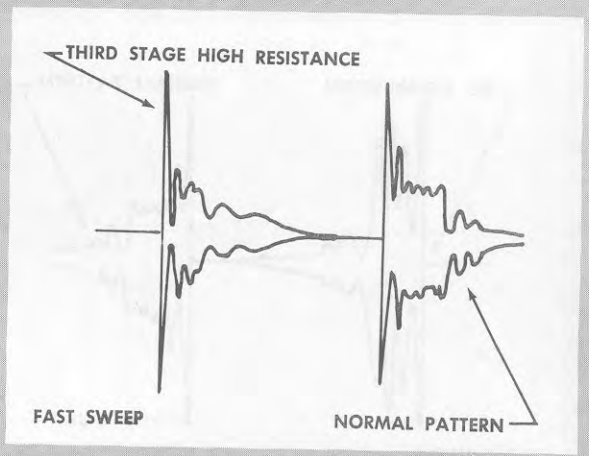
BOUNCING BREAKER POINTS



SECOND STAGE HIGH REISTANCE



INCORRECT BREAKER POINT SYNCHRONIZATION

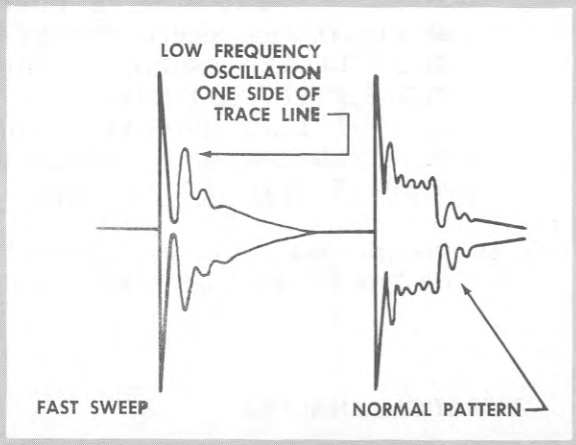


THIRD STAGE HIGH RESISTANCE

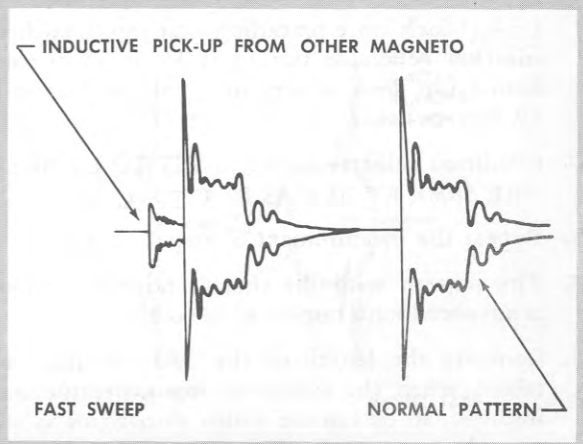
AA1-164

Figure 4-29 (Sheet 3 of 4)

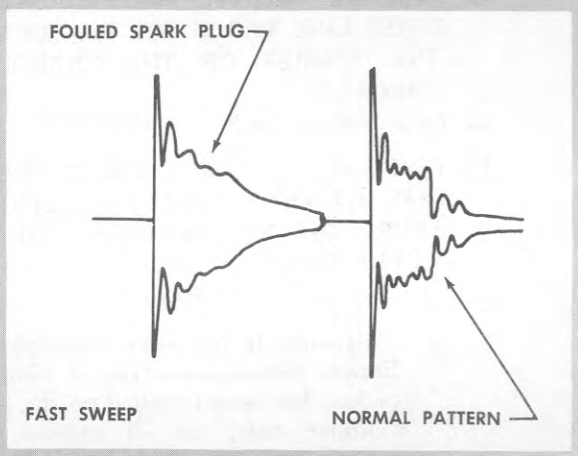
PATTERNS



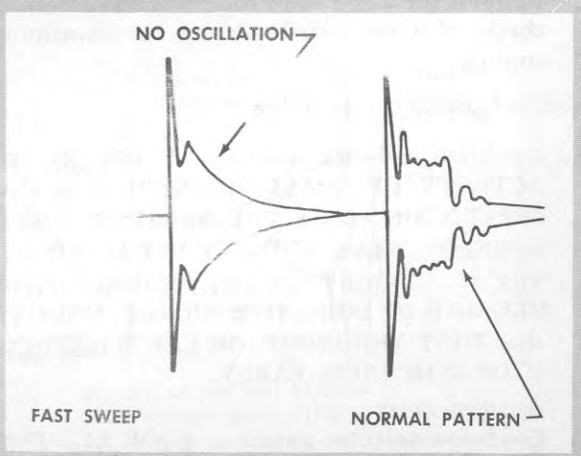
OPEN SECONDARY



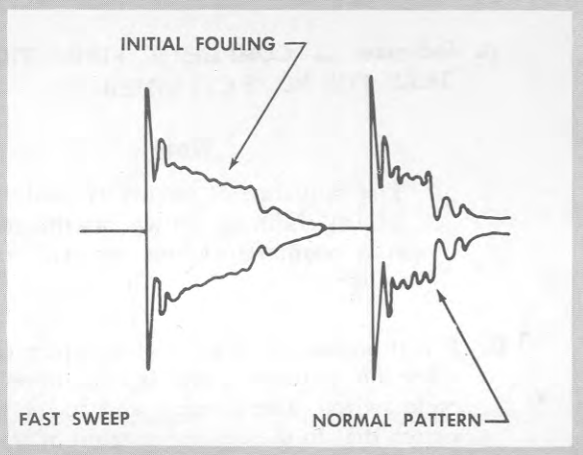
BREAKER POINT SYNC.
(CONDITION ON L OR R)



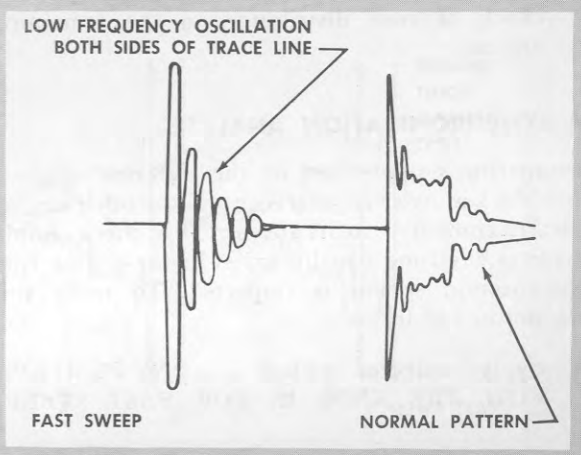
FOULED SPARK PLUG



SHORTED SECONDARY



INITIAL SPARK PLUG FOULING



OPEN PRIMARY ONE CYLINDER COIL

AA1-165

Figure 4-29 (Sheet 4 of 4)

C. Measure the exact distance between the start of the horizontal trace at the left edge of the indicator screen and the point at which the breaker points open. The No. 1 reference cylinder, being uncompensated, should leave $1\frac{5}{32}$ ($\pm\frac{1}{32}$)-inch trace preceding first pip. (Synchronization generator timing is 34 or 35 degrees before top dead center, and ignition timing is 19 degrees before top dead center.)

D. Condition selector switch – SET TO L UNDER THE SAME ENGINE AS IN STEP A.

E. Repeat the measurement of step C.

F. The pattern with the shorter horizontal trace is advanced with respect to the other.

G. Compare the length of the traces to that obtained when the synchronizing generator was installed, to determine which distributor is advanced or retarded with respect to the crankshaft position.

H. Perform the above steps for the synchronization check of each distributor on the remaining engines.

The second method is as follows:

A. Condition selector switch – L (OR R). IF ACTIVITY OF SMALL MAGNITUDE IS OBSERVED AHEAD OF THE BREAKER POINT OPENING, THAT ACTIVITY IS CAUSED BY THE RIGHT (OR LEFT) DISTRIBUTOR BECAUSE OF INDUCTIVE PICKUP, INDICATING THAT THE RIGHT (OR LEFT) DISTRIBUTOR IS OPENING EARLY.

B. Condition selector switch – R (OR L). THIS SHOULD ELIMINATE THE ACTIVITY.

C. Perform the above steps for the synchronization check of each distributor on the remaining engines.

RPM SYNCHRONIZATION ANALYSIS.

In comparing engine rpm of the different engines, engine No. 1 is used as a reference and the other engine speeds are compared to its speeds. This check should be made at any time a malfunction of the engine rpm synchronization system is suspected. To make this check, proceed as follows:

A. Cycle selector switch – ANY POSITION, WITH THE KNOB IN FOR FAST SWEEP.

B. Condition selector switch – ALIGN THE INDEX LINE IN THE SYN SECTOR WITH THE NUMBER OF THE ENGINE TO BE COMPARED WITH ENGINE NO. 1.

C. Indicator – THE IGNITION PATTERN WILL BE STATIONARY ON THE SCREEN IF THE ENGINES ARE SYNCHRONIZED, AND MOVING IF THE ENGINES ARE NOT SYNCHRONIZED. A PROGRESSIVE HORIZONTAL SHIFT TO THE RIGHT INDICATES THAT THE SELECTED ENGINE IS UNDERSPEED WITH RESPECT TO ENGINE NO. 1; A SHIFT TO THE LEFT INDICATES THAT THE SELECTED ENGINE IS OVERSPEED WITH RESPECT TO THE NO. 1 ENGINE.

D. Condition selector switch – INDEX TO EACH OF THE REMAINING SYN POSITIONS.

VIBRATION ANALYSIS.

For engine vibration analysis, the engine analyzer is operated as follows:

A. Condition selector switch – ALIGN THE INDEX LINE WITHIN THE VIB SECTOR WITH THE NUMBER OF THE ENGINE TO BE CHECKED.

B. Cycle switch knob – PULL OUT.

C. Cycle switch – PLACE THE CYCLE SWITCH DIAL SO THAT THE DESIGNATION EC IS APPROXIMATELY ALIGNED WITH THE NO. 5 CYLINDER.

Note

This aircraft has been equipped for limited vibration analysis. A vibration pickup has been installed on the No. 5 cylinder only, for all engines, and therefore a vibration analysis can be made only on the No. 5 cylinder for all engines.

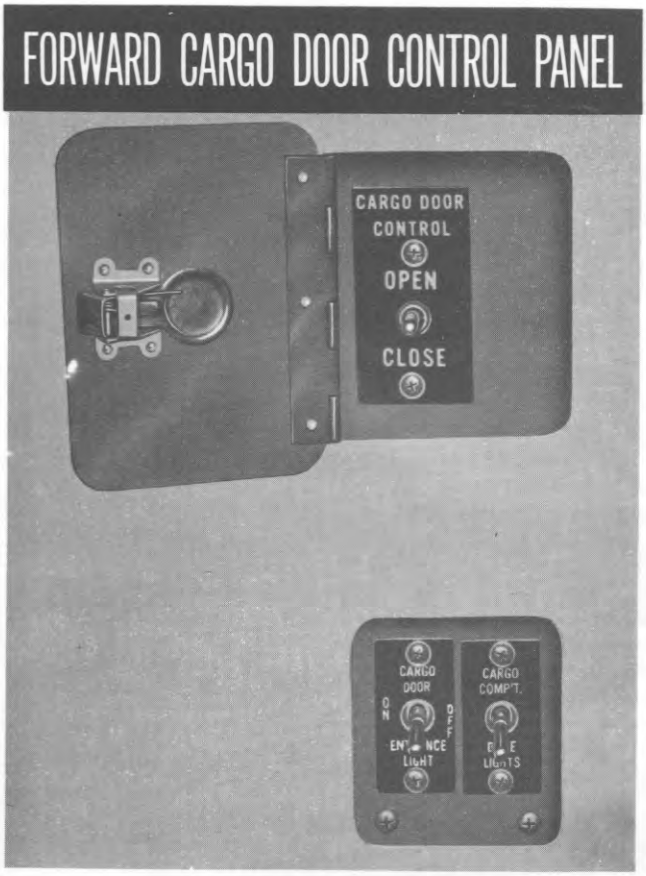
D. Indicator – COMPLETE VIBRATION PATTERN FOR NO. 5 CYLINDER.

Note

The sequence of events is read from left to right, as shown on the scope, and counterclockwise on the cycle switch.

E. For an expanded pattern of any portion of the vibration pattern, push in the knob on the cycle switch (fast sweep), and index the cycle switch dial to the desired portion of the engine cycle to be inspected for the No. 5 cylinder.

F. Condition selector switch – REPEAT STEPS B THROUGH D FOR THE REMAINING VIB POSITIONS.



AA1-148

Figure 4-30

Note

On the assumption that the portable engine analyzer will be used primarily on the ground and for a group of engines having the same number of cylinders, the engine switch and the cylinders-per-engine switch, which require only initial settings, are mounted in a compartment that is shielded by a spring-tensioned door.

SYNCHRONIZATION TIMING CHECK.

Synchronization generator timing should be checked once during each flight. If a spark plug malfunction is discovered on the same engine with a mistimed synchronization generator, it is recommended that this be noted on Form 781. The procedure for checking synchronization generator timing is as follows:

A. Set the condition switch for the desired engine to VIB.

B. Select slow sweep with the cycle switch.

C. Position the EC event opposite cylinder No. 5 with the cycle switch.

D. If the EC event is approximately $\frac{1}{8}$ inch from the start of the trace line, the synchronizing generator is properly timed to the engine crankshaft; thus, when ignition analysis is performed, the correct cylinder will appear on the screen in the proper position.

E. Adjust the gain control for pattern height as necessary.

CARGO LOADING EQUIPMENT.

Most aircraft are equipped with hydraulically actuated, electrically operated forward and aft cargo loading doors. The forward cargo loading door is hinged at the top and opens outward. The aft loading door is divided into two sections. The forward section swings outward and forward, providing normal entry into the aircraft, and may be jettisoned. The aft section of the loading door is hinged at the top and opens outward. A hold-open rod is provided for auxiliary support when the aft section of the door is in the loading position. A downward swinging access door is provided on the right side of the aircraft for each lower cargo compartment, and may be opened or closed by external handles installed flush with the outside of each door. Hatches are installed in the fuselage floor to provide internal access to the underfloor compartments.

(For detailed information on cargo loading procedures for this aircraft, see the applicable handbook of cargo loading instructions.)

AA1-147

Figure 4-31

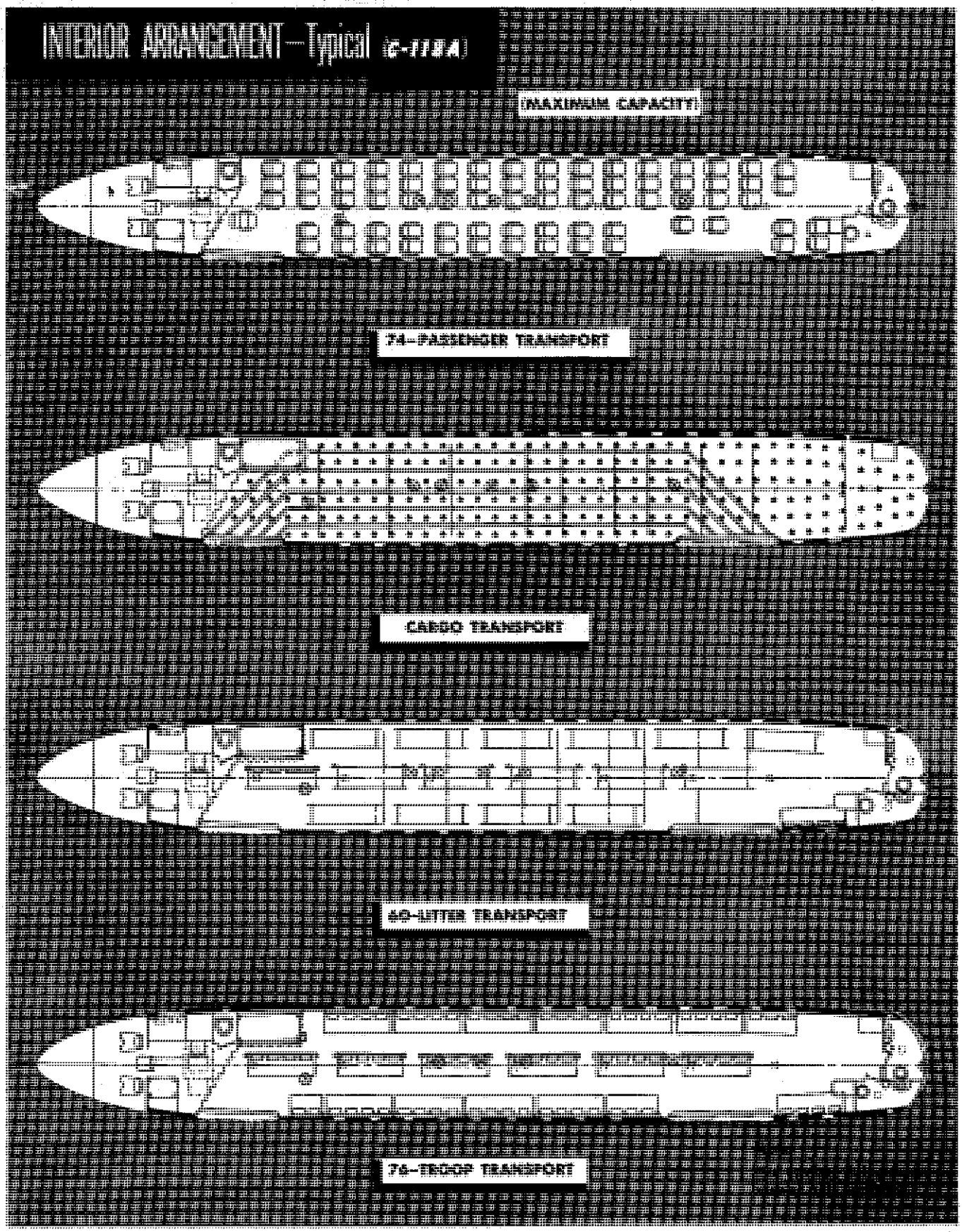

INTERIOR ARRANGEMENT—Typical (C-118A)
MAXIMUM CAPACITY
74—PASSENGER TRANSPORT
CARGO TRANSPORT
60-LITTER TRANSPORT
75—TROOP TRANSPORT

Figure 4-32

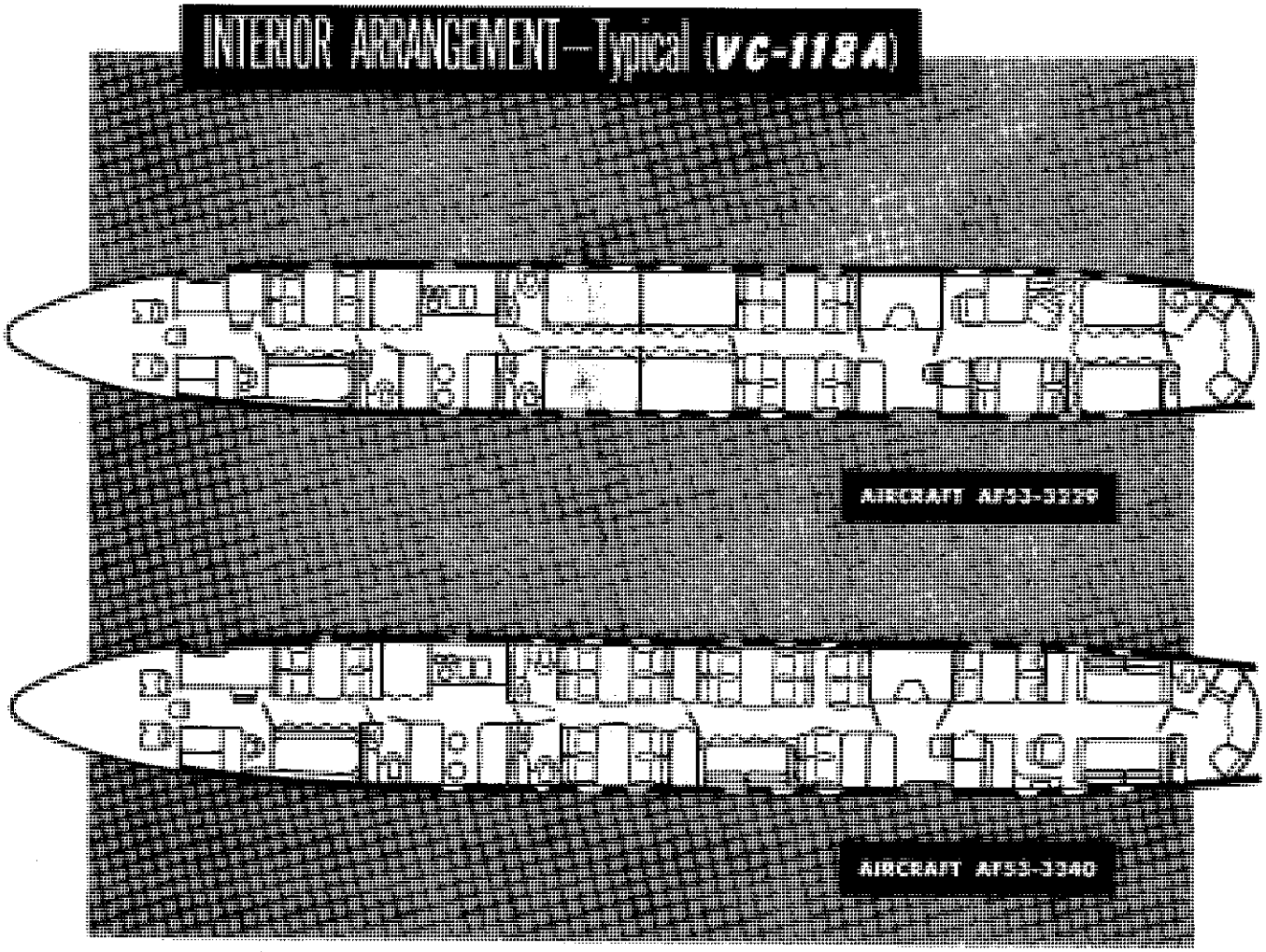


Figure 4-33

CARGO DOOR CONTROLS.

Forward Cargo Door Control.

The hydraulically actuated forward cargo door is controlled by a spring-loaded 2-position switch located on the fuselage wall forward of the door *(figure 4-30)*. The switch positions are OPEN and CLOSE.

Aft Cargo Door Control.

The hydraulically actuated aft loading door (aft section of divided door) is controlled by a spring-loaded 2-position switch located on the fuselage wall forward of the door *(figure 4-31)*. The switch positions are OPEN and CLOSE. The forward section of the door must be in the full OPEN position and latched before the aft section will operate.

TROOP CARRYING EQUIPMENT.

The aircraft may be utilized as a high density personnel transport, and is designed for cargo carrying and troop and ambulance transport *(figure 4-32)*. High-strength floors, and high-strength tiedown fittings in the floor and side walls are installed. Provisions for cargo lifts are installed at both the forward and aft cargo doors. Troop transport and litter fittings are supplied in kit form and stowed in the baggage compartment.

PASSENGER CARRYING EQUIPMENT.

Some aircraft are designed as staff transports and differ from the standard cargo version in the main cabin interior only.

INTERIOR ARRANGEMENT—VC-118A.

Aircraft AF53-3240 is arranged as a staff transport and is provided with a combination day-plane and sleeping compartment, a conference compartment, an aft stateroom, and a galley. Aircraft AF53-3229 is arranged as a staff transport and is equipped with fixed seating for eight passengers, fixed berths for eight passengers, an aft stateroom, and a galley *(figure 4-33)*.

MISCELLANEOUS EQUIPMENT.

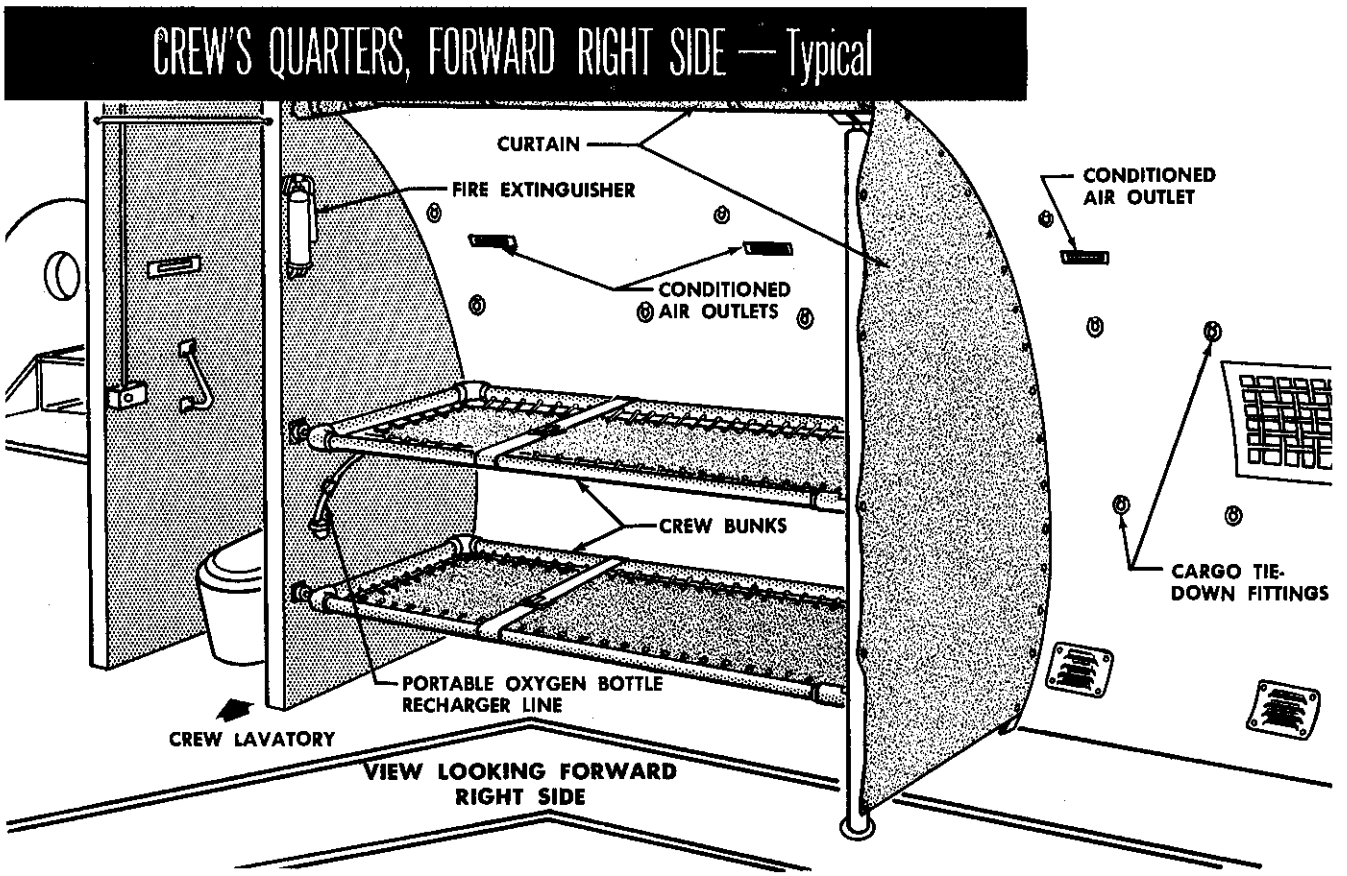


Figure 4-34

CREW'S QUARTERS.

Quarters for the accommodation of the relief crew are provided forward of the main cabin *(figures 4-33, 4-34 and 4-35)*.

Navigator's Seat.

The navigator's seat incorporates a backrest, an upholstered seat cushion, a safety belt, and an adjustable platform for use with the periscopic sextant.

Radio Operator's Seat (If Installed).

The radio operator's seat is the full-swivel type, incorporating a backrest, armrests, a lever to lock the seat and prevent swiveling, and a safety belt.

Briefcase Rack.

Two briefcase racks are installed, one on each outboard side of the pilot's seats.

Pre-Takeoff Warning Systems.

Door-Open Warning Lights. Red warning lights are installed on the cabin pressure control panel *(figure 4-2)* and remain illuminated when any pressurized door is not closed and locked. Each warning light has dual bulbs to provide light in case one bulb goes out.

Ladder.

A folding ladder is provided *(31 figure 1-3)* for entering or leaving the aircraft. This ladder should be used only in case of emergency.

Windshield Wipers.

Two hydraulically actuated windshield wiper units are installed, one on each windshield, and are operated in a synchronized movement. Full or partial stoppage of one windshield wiper blade will not interfere with complete operation of the other. Both blades are controlled by a single-speed control knob mounted to the left of the pilot *(31, figure 1-6)*.

Note

To avoid scratching the windshield, the blades should not be operated when the windshield is dry.

Protective Covers.

Protective covers for the pitot tubes are stowed just inside the rear cargo door *(27, figure 1-3)*.

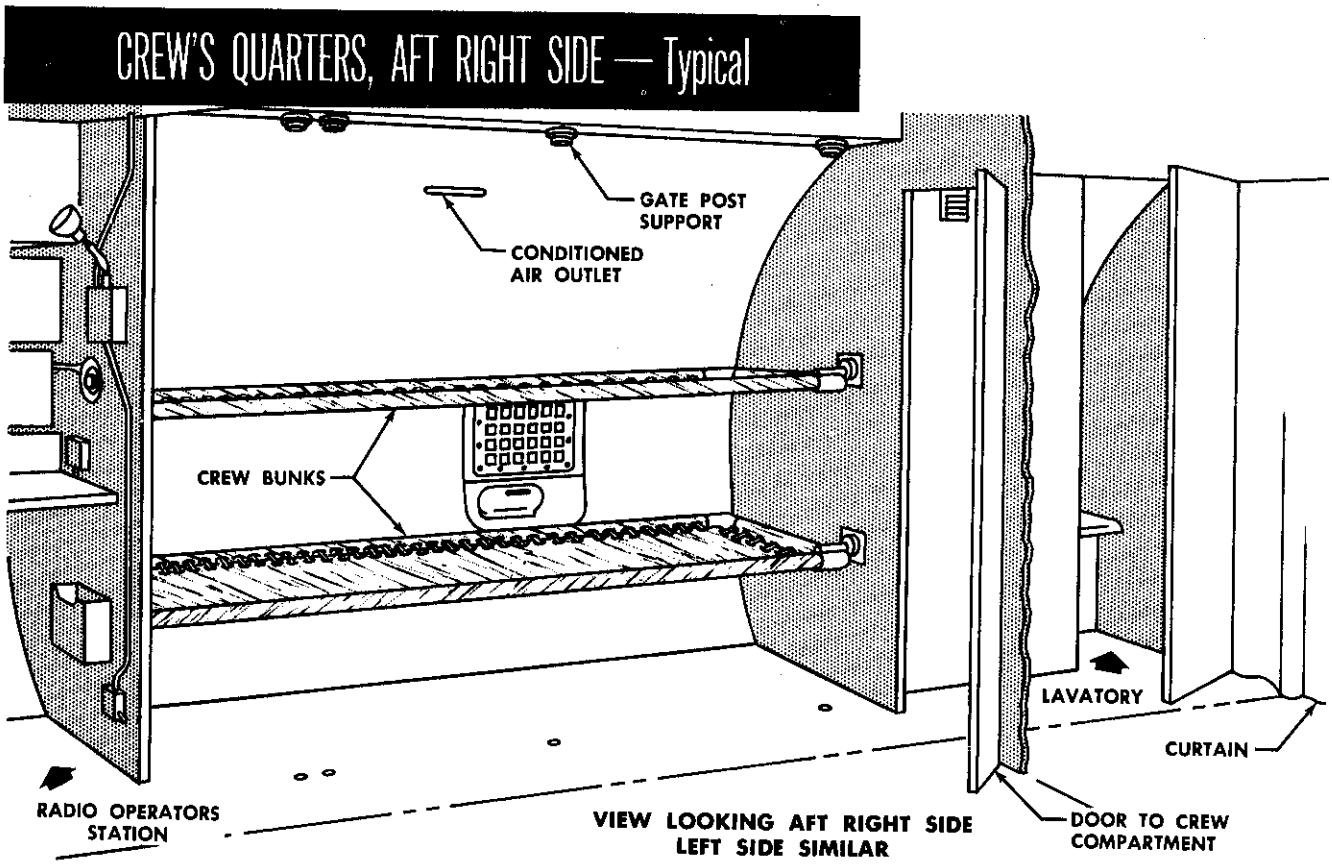


Figure 4-35

WATER SUPPLY.

Main Cabin Water Supply and Disposal System—C-118A.

A 26-gallon water supply tank is installed for washing purposes. *See 15, figure 1-36,* for filler location.

WARNING

Do not dump wash water during flight in below freezing temperatures, as the overflow water could freeze over the auxiliary power unit exhaust.

Wash Water Supply—VC-118A.

Fifty-five gallons of fresh water are supplied for washing and galley sanitary use. The water is heated by thermostatically controlled immersion heaters. Three tanks are furnished; one 15-gallon tank to supply the galley, one 25-gallon tank to supply the lavatories and wash room, and one 15-gallon tank to supply the aft lounge *(8, and 12, figure 1-4).* A single-point pressure-type filler for the wash water supply system is located inside an access door located on the bottom of the aft edge of the left wing fillet.

Drinking Water Supply—VC-118A.

Each lavatory and washroom is equipped with a 2-quart thermos bottle and paper cup dispenser. Drinking water for the aft lounge and stateroom is provided in a 1-gallon thermos located in the aft lounge.

GALLEY—VC-118A.

Both aircraft are equipped with a galley for the storage and preparation of food. The galley is furnished with a 28-volt d-c stove and oven, an electric refrigerator, an electric toaster, and two outlets for electric hot cups. Dishes and utensils are stowed in the galley cabinets. Circuit breakers placarded for the applicable galley power sources are located on a breaker panel above the stove.

Galley Power Switch—VC-118A.

A galley power switch is installed in the cockpit to deenergize all galley power. The switch is located on the cabin temperature control panel *(figure 4-9).*

ATTENDANT'S SEAT—VC-118A.

A cabin attendant's seat and stowable table for secretarial use are installed against the aft bulkhead in the passenger entry area. When not in use, the seat folds against the aft bulkhead and the table is stowed in a slot outboard of the folding seat.

UTILITY OUTLETS—VC-118A.

Sixty-cycle, 115-volt a-c outlets are provided for electric shavers in each lavatory and washroom. In addition, there is an outlet in the stateroom and at the radio operator's station for the use of a tape recorder. All 60-cycle outlets are placarded to indicate restrictions as to voltage and use. Power for the 60-cycle circuits is provided by the 60-cycle inverter located in the radio operator's compartment.

60-CYCLE INVERTER—VC-118A.

A 60-cycle, 115-volt a-c inverter is installed at the radio operator's station. The inverter is supplied with 28-volt d-c power from the main bus. A control panel with a three-position rotary switch placarded PASS. COMP., CONF., and STATERM., and a two-position toggle switch placarded NORMAL AND SELECTIVE, is provided to control the output of the inverter. The inverter is automatically energized when the entertainment radio switch is turned ON.

CABIN INSTRUMENTS—VC-118A.

An altimeter, an airspeed indicator, an OAT indicator, and an eight-day clock are installed on the forward left bulkhead of the aft stateroom.

PASSENGER ENTRANCE LADDER—VC-118A.

A folding ladder, operated by a 28-volt d-c motor, is provided at the passenger entrance door. A switch at the aft edge of the door operates the motor. The ladder is stowed on rails in a slot along the inside of the fuselage aft of the door.