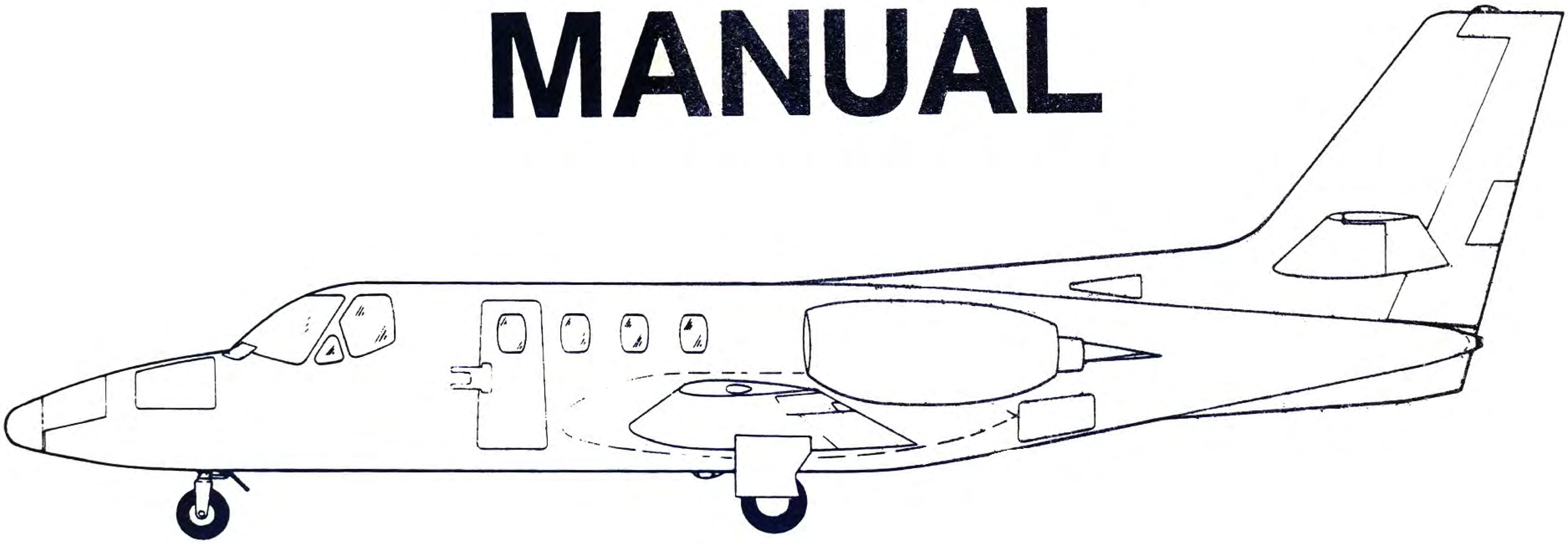
OPERATING MANUAL

cessna/CITATION

OPERATING MANUAL



THIS MANUAL IS APPLICABLE TO AIRPLANES UNIT 500-0001 THRU -0349
OPERATING AT 11,850 POUNDS GROSS WEIGHT WITH JT15D-1 ENGINES

ORIGINAL ISSUE 15 FEBRUARY 1979

REVISION 3

1 MARCH 1990

CESSNA AIRCRAFT COMPANY, AIRCRAFT DIVISION, P.O. BOX 7704, WICHITA, KANSAS 67277

This Manual is intended to provide an information source for familiarization, review, and suggested technique to achieve maximum safety, passenger comfort and utility. It is written by Cessna flight personnel and is based on experience gained in the typical transport category jet operating environment.

While the Operating Manual covers and expands upon Airplane FLight Manual information, the FAA Approved document shall take precedence should a difference be noted.

Immediately below each page number in this manual is a letter code (see example below). This letter code is used to identify a specific manual. The code identification used in this manual is "C". Any page in this manual without this code identification must be discarded.

Example of Page Number With Code: Introduction-1
C

SERVICE BULLETIN CONFIGURATION LIST

The following is a list of Service Bulletins that are applicable to the operation of the airplane and have been incorporated into this manual:

NUMBER	TITLE	AIRPLANE EFFECTIVITY UNIT
SB21-9	Increased Altitude and Range Modification	-0001 thru -0213
SB27-9	Speedbrake Control Switch Replacement	-0001 thru -0572
SB28-7	Motive Flow Fuel Pressure Switch Removal	-0001 thru -0661
SB32-1	Increased Gross Weight Modification	-0001 thru -0070
SB32-23	Increased Gross Weight (11,850 Pound Take-Off)	-0001 thru -0302
SB34-13	Altitude Alerting	-0001 thru -0062
SB34-15	9500 Pound Zero Fuel Weight	-0001 and On
SB34-23	10,500 Pound Zero Fuel Weight	-0001 thru -0349
SB71-2	EPA Fuel Canister	-0001 thru -0213
SB72-3	Installation of JT15D-1A Engines	-0001 thru -0349
SB79-1	Redundant Oil Pressure Indicating System	-0001 thru -0388

Cessna Citation
OPERATING MANUAL
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Revision 1	1 Nov 79
Revision 2	3 Feb 86
Revision 3	1 Mar 90

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SECTION I

DESCRIPTION and SPECIFICATIONS

GENERAL DESCRIPTION

The Cessna CITATION is certified in accordance with FAR Part 25 airworthiness standards and utilizes the fail-safe construction concept. It combines systems simplicity with ease of access to reduce maintenance requirements. Low takeoff and landing speeds permit operation at small and unimproved airports. High-bypass turbofan engines contribute to overall operating efficiency and performance. The CITATION has an optimum range of approximately 1400 statute miles and a maximum cruise speed of 350 knots.

Flight Controls

Primary flight control is accomplished through conventional cable-operated surfaces. Trimming is provided by aileron, elevator, and rudder tabs. Hydraulically operated speedbrakes are installed on the upper and lower surface of both wings. Trailing edge, slotted flaps are powered electrically. Nose wheel steering is mechanically controlled by the rudder pedals.

Engines

Two Pratt and Whitney Canada Inc. JT15D-1/JT15D-1A Turbofans installed on the rear fuselage produce 2200 lbs. of thrust each. Ice protection and fire detection and extinguishing systems are incorporated. Fuel is carried in two integral wing tanks with each engine normally supplied from its respective side. Crossfeeding can be selected. Fueling is done through an overwing port in each tank. Optional target type thrust reversers individually operated by conventional "piggy back" controls mounted on the throttles are available.

Fuselage

Sequentially from front to rear are the avionics bay, nose baggage area, forward pressure bulkhead; flight, passenger and aft compartments; rear pressure bulkhead and aft equipment bay (tailcone compartment).

Seventeen cubic feet of baggage space is available in the nose. The flight deck is equipped with dual controls and both seats can be moved vertically, horizontally, and tilted.

GENERAL DESCRIPTION

The passenger compartment provides an air outlet, light, and oxygen mask for each occupant. The rear four seats may be moved laterally away from the sidewall, tracked fore or aft, and reclined. The aft compartment, which may be closed off with a privacy curtain, has another 43 cubic feet of baggage space and a toilet. The tailcone compartment contains equipment and systems components.

Electrical System

The main DC buses are supplied from two starter/generators. Engine starting and secondary DC power is available from either the battery or an external source. Two static inverters provide AC power.

Hydraulic System

Engine driven pumps supply pressure for operation of the landing gear, speedbrakes and optional thrust reversers through an open center system. The main gear are equipped with wheel brakes actuated hydraulically from a separate, closed system. Pneumatic back-up is available for landing gear extension and braking.

Environmental Control

Cabin pressurization utilizes bleed air from the engines which is conditioned by an air cycle machine. Temperature is controllable over a wide range and the system provides sufficient pressure to maintain an 8,000' cabin at a cruise altitude of 35,000'. The oxygen system supplies the cockpit through quick-donning masks, and the cabin with drop-out type masks which are automatically deployed in the event of excessive cabin altitude; or which may be deployed manually by the pilot.

Avionics

The standard, factory installed avionics package includes weather radar, altitude reporting transponder, autopilot, and integrated flight director system. Communication is provided by two VHF transceivers. Navigation equipment includes digitally-tuned ADF, DME, and two VOR/Localizer/Glideslope/Marker Beacon receivers.

GENERAL DESCRIPTION

The passenger compartment provides an air outlet, light, and oxygen mask for each occupant. The rear four seats may be moved laterally away from the sidewall, tracked fore or aft, and reclined. The aft compartment, which may be closed off with a privacy curtain, has another 43 cubic feet of baggage space and a toilet. The tailcone compartment contains equipment and systems components.

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Environmental Control

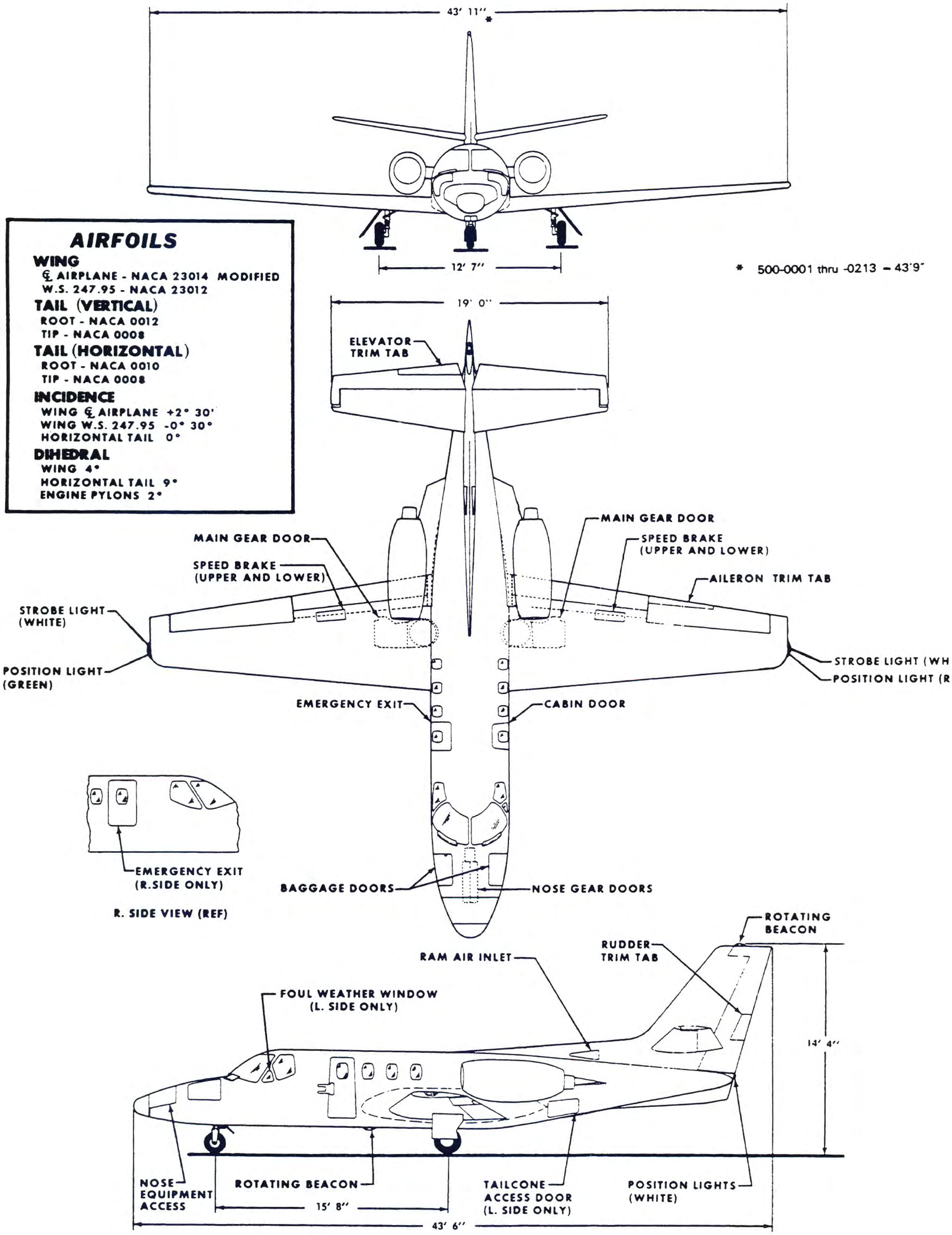
Cabin pressurization utilizes bleed air from the engines which is conditioned by an air cycle machine. Temperature is controllable over a wide range and the system provides sufficient pressure to maintain an 8,000' cabin at a cruise altitude of 41,000'. The oxygen system supplies the cockpit through quick-donning masks, and the cabin with drop-out type masks which are automatically deployed in the event of excessive cabin altitude; or which may be deployed manually by the pilot.

Avionics

The standard, factory installed avionics package includes weather radar, altitude reporting transponder, autopilot, and integrated flight director system. Communication is provided by two VHF transceivers. Navigation equipment includes digitally-tuned ADF, DME, and two VOR/Localizer/Glideslope/Marker Beacon receivers.

SPECIFICATIONS

500-0001 thru -0349



AIRFOILS

WING
℄ AIRPLANE - NACA 23014 MODIFIED
W.S. 247.95 - NACA 23012

TAIL (VERTICAL)
ROOT - NACA 0012
TIP - NACA 0008

TAIL (HORIZONTAL)
ROOT - NACA 0010
TIP - NACA 0008

INCIDENCE
WING ℄ AIRPLANE +2° 30'
WING W.S. 247.95 -0° 30°
HORIZONTAL TAIL 0°

DIHEDRAL
WING 4°
HORIZONTAL TAIL 9°
ENGINE PYLONS 2°

SPECIFICATIONS

Dimensions

Length		43 ft. 6 in.
Height (to top of rotating beacon)		14 ft. 4 in.
Wingspan	500-0001 thru -0213	43 ft. 9 in.
	500-214 thru -0349 and aircraft incorporating SB21-9	43 ft. 11 in.
Horizontal stabilizer span		19 ft.
Wheelbase (main to nose gear)		15 ft. 8 in.
Stance (distance between main gear)		12 ft. 7 in.
Cabin		
Length (pressure vessel)		17 ft. 6 in.
Height		4 ft. 4 in.
Width		4 ft. 11 in.

Capacities

Oil Tank		2.39 gal. per engine
Fuel	500-0001 thru -0040	1809 lbs. per tank (approx. 268 gal.)
	500-0041 thru -0213	1836 lbs. per tank (approx. 272 gal.)
500-0214 thru -0349 and -0001 thru -0213 incorporating SB21-9		1903 lbs per tank (approx. 282 gal.)
Oxygen (full bottle)		500 liters at 70 PSI.
Hydraulic fluid (reservoir)		.65 gal.

Engines

Type	JT15D-1/JT15D-1A Turbofan
Manufacturer	Pratt and Whitney Aircraft Canada Inc.
Dry Weight	506 lbs JT15D-1 ENGINES
	511 lbs JT15D-1A ENGINES
Thrust (Take Off, Standard Day at Sea Level	2200 lbs.
Bypass ratio	3.3 to 1

Avionics (Standard Package)

Unit	Qty.	500-0001 thru -0274	500-0275 thru -0349
Comm	2	RCA AVC 110/110A	Collins VHF-20A
Nav	2	RCA AVN 220/220A	Collins VIR-30A
RMI	2	RCA AVI 200	Collins 332C-10
DME	1	RCA AVC 85	Collins DME-40
Transponder	1	RCA AVQ 95	Collins TDR-90
Weather Radar	1	RCA AVQ 21	Bendix RDR-1200*
ADF	1	King KDF 800	ARC 846A*
Autopilot Flight Director	1	Bendix FGS 70	Sperry SPZ-500
Control Panel	1		Edo-Aire IU-434-0001 or Gables G4606A

*500-0257 thru -0349

OPERATING LIMITATIONS

Weight

	500-0001 thru -0070	*500-0071 thru -0302	*500-0303 thru -0349
Maximum Ramp Weight	11,000 lbs.	11,650 lbs.	12,000 lbs.
Maximum Take Off Weight	10,850 lbs.	11,500 lbs.	11,850 lbs.
Maximum Landing Weight	10,400 lbs.	11,000 lbs.	11,350 lbs.
Maximum Zero Fuel Weight	8,400 lbs.	8,400 lbs.	8,400 lbs.
Maximum Zero Fuel Weight			
(with Service Bulletin 34-15)	9,500 lbs.	9,500 lbs.	9,500 lbs.
(with Service Bulletin 34-23)	10,500 lbs.	10,500 lbs.	10,500 lbs.

Maximum take off and landing weights may be additionally restricted due to altitude, temperature, and field length.

*Earlier aircraft may be modified for operation at these weights by SB32-23 as applicable.

Center of Gravity

Forward limit: At 7,500 lbs or less - 18% MAC (246.4 inches aft of datum)

At 10,850 lbs - 21.5% MAC (249.2 inches aft of datum) 500-0001 thru -0070 (Straight line variation between 18 and 21.5% MAC)

At 11,500 lbs - 22.2% MAC (249.7 inches aft of datum) 500-0071 thru -0302 (Straight line variation between 18 and 22.2% MAC)

** At 11,850 lbs - 22.6% MAC (250.0 inches aft of datum) 500-0303 thru (Straight line variation between 18 and 22.6% MAC)

Aft limit: 30% MAC (255.9 inches aft of datum)

** Limit will apply to earlier aircraft when modified by SB32-23 as applicable.

Airspeed

Maximum Operating Speed (V_{MO}/M_{MO})

Above 26,000 ft . . . . .705 Mach

Between 14,000 ft. & 26,000 ft. . . . . 289 KIAS

(with 9,500 lb. ZFW, 14,000 to 28,000 ft.) 277 KIAS

(with 10,500 lb. ZFW, 14,000 to 30,500 ft.) 262 KIAS

Below 14,000 ft. . . . . 262 KIAS

Maneuvering Speed (V_A) . . . . Refer to Section II of the FAA Approved Flight Manual (At Sea Level, approximately 150 KIAS @ 7,500 lbs. to 187 KIAS @ 11,850 lbs.)

OPERATING LIMITATIONS

Flaps - 15°(T.O. & APPR. position) . . . . 202 KIAS

Flaps - 40°(LAND position) . . . . 176 KIAS

Landing Gear Operating Speed - (V_{LO}) . . . . 176 KIAS

Landing Gear Extended Speed - (V_{LE}) . . . . 176 KIAS

Speedbrake Operation Speed - (V_{SB}) . . . . No Limit

Minimum Control Speed-Airborne (V_{MCA}) . . . . Below stall speed for all weights

Minimum Control Speed-Ground (V_{MCG}) . . . . 55 KIAS

Maximum Tire Ground Speed . . . . 165 knots

Altitude

Maximum Operating Altitude

500-0001 thru -0213 . . . . 35,000 ft.

500-0214 thru -0349 and 500-0001
thru -0213 incorporating SB21-9 . . . . . . 41,000 ft.

Take Off And Landing

Maximum Altitude . . . . 14,000 ft.

Crosswind Component . . . . 25 knots (Demonstrated, Not Limiting)

Maximum Runway Water/Slush Accumulation . . . . 0.75 in.

Maximum Ambient Temperature at Sea Level . . . . 54°C (130°F)

For thrust reverser equipped aircraft engine static ground operation is limited to less than 80% N_1 for ambient temperature at sea level above 45°C (114°F).

Minimum Ambient Temperature at Sea Level . . . . -54°C (-65°F)

Autopilot must be OFF.

Vertical navigation system must be OFF below 500 Ft. AGL. 500-0275 thru -0349

OPERATING LIMITATIONS

Engine

Thrust Setting	Time Limit (Minutes)	% Fan RPM (N_1)	ITT °C	% Turbine RPM (N_2)	Oil Temp. °C *	Oil Pressure P.S.I.
Take Off	5	99	700	95	10 to Indicator Red Line	65 to 80
Maximum Continuous	Continuous	99	680	95	0 to Indicator Red Line	65 to 80
Maximum Cruise	Continuous	99	670	95	0 to Indicator Red Line	65 to 80
Idle	Continuous	--	580	46	Minus 40 To Indicator Red Line	35 Minimum
Starting	--	--	700°for 2 seconds	--	Minus 40 Minimum	--
Acceleration	--	99	700	95	0 to Indicator Red Line	--

* Oil temperature limitation is dictated by the red line on the oil temperature indicator. Some indicators are red lined at 115°C and some are red lined at 121°C. The red line indication must not be exceeded.

OVERSPEED

Duration	% Fan RPM (N_1)	% Turbine RPM (N_2)	Action Required
Transient		91-95	None
Transient	99-110	95-97	Log Book Entry
Transient	Exceeds 110	Exceeds 97	Refer to Maintenance Manual
Steady State	Exceeds 105	Exceeds 95	Refer to Maintenance Manual
Steady State	99-105		Log Book Entry

ITT

Inter-Turbine Temperature indications in excess of 700°, or in excess of 680°for more than 5 minutes require reference to the Maintenance Manual.

OPERATING LIMITATIONS

Battery And Starter Cycle Limitations

Starter Limitation . . . Three engine starts per 30 minutes. Three cycles of operation with a 30-second rest period between cycles is permitted.

NOTE

This limitation is independent of starter power source; i.e. battery, generator assisted cross start, or external power unit.

Battery Limitation . . . Three engine starts per hour. See notes (2) and (3).

NOTE

(1) If battery limitation is exceeded, a deep cycle including a capacity check must be accomplished to detect possible cell damage. Refer to chapter 24 of the Airplane Maintenance Manual for BATTERY ADJUSTMENT/TEST Procedure.
(2) Three generator assisted cross starts are equal to one battery start.
(3) Three external power unit starts are equal to one battery start.
(4) Use of an External Power Source with voltage in excess of 28 volts DC or current in excess of 1000 amps may damage the starter.

Starting ITT of over 500°is not normal. Action should be taken as illustrated in the Starting Envelope if this occurs.

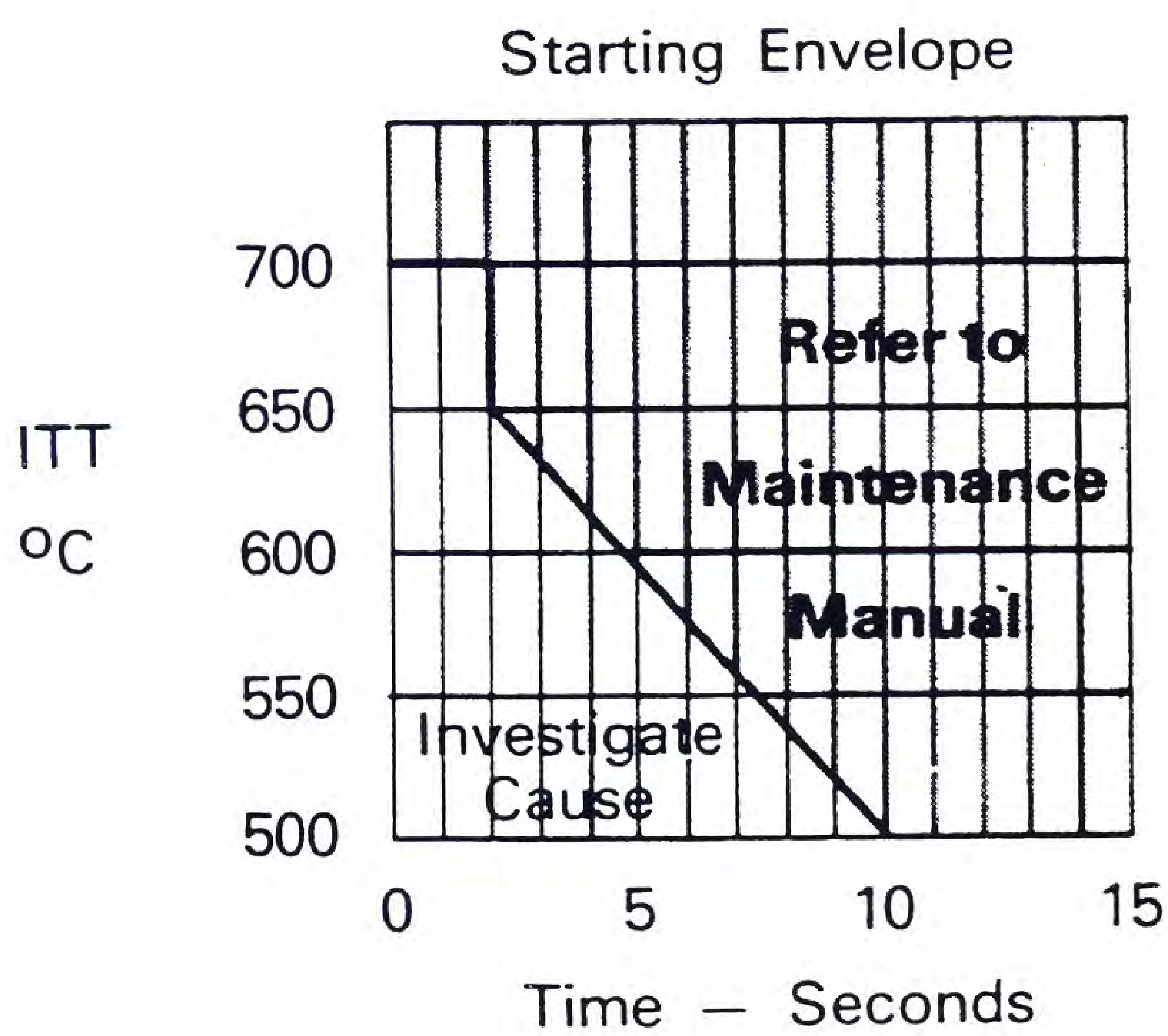
Minimum starting oil temperature is minus 40°C (minus 40°F)

Hydraulic Fluid

Approved fluids:

Skydrol 500A, B, B-4, C or LD-4

Hyjet, Hyjet W, III, or IV



OPERATING LIMITATIONS

Battery And Starter Cycle Limitations

Starter Limitation . . . Three engine starts per 30 minutes. Three cycles of operation with a 30-second rest period between cycles is permitted.

NOTE

This limitation is independent of starter power source; i.e. battery, generator assisted cross start, or external power unit.

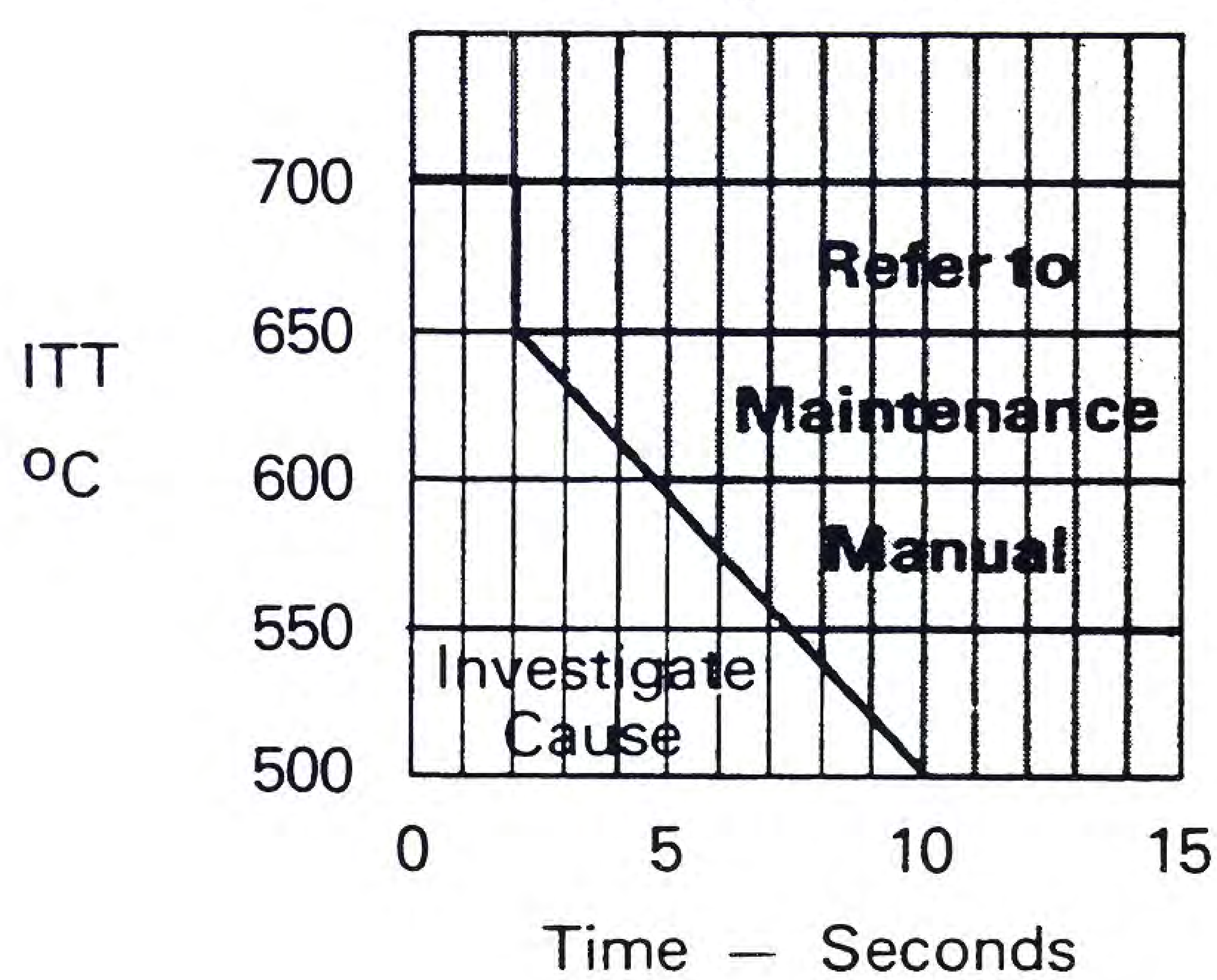
Battery Limitation . . . Three engine starts per hour. See notes (2) and (3).

NOTE

(1) If battery limitation is exceeded, a deep cycle including a capacity check must be accomplished to detect possible cell damage. Refer to chapter 24 of the Airplane Maintenance Manual for BATTERY ADJUSTMENT/TEST Procedure.
(2) Three generator assisted cross starts are equal to one battery start.
(3) If an external power unit is used for start, no battery cycle is counted.
(4) Use of an External Power Source with voltage in excess of 28 volts DC or current in excess of 1000 amps may damage the starter.

Starting ITT of over 500°is not normal. Action should be taken as illustrated in the Starting Envelope if this occurs.

Starting Envelope



Minimum starting oil temperature is minus 40°C (minus 40°F)

Hydraulic Fluid

Approved fluids:

Skydrol 500A, B, B-4, C or LD-4

Hyjet, Hyjet W, III, or IV

OPERATING LIMITATIONS

Oil

The following oils are approved for use:

MOBIL JET OIL II — EXXON TURBO OIL 2380 — AERO SHELL TURBINE OIL 500

MOBIL JET OIL 254 — CASTROL 5000 — ROYCO TURBINE OIL 500

In addition, oils listed for the engine in the latest revision to Pratt and Whitney Canada Inc. Service Bulletin Number 7001 are approved.

Should it be necessary to replenish oil consumption losses when oil of the same brand (as tank contents) is unavailable, then the following requirements apply:

For contingency purposes, oil replenishment using any other approved oil brand listed is acceptable provided:

1. The total quantity of added oil does not exceed two U.S. quarts in any 400-hour period.
2. If it is required to add more than two U.S. quarts of dissimilar oil brands. drain and flush complete oil system and refill with an approved oil in accordance with Engine Maintenance Manual instructions.

Should oils of nonapproved brands or of different viscosities become intermixed, drain and flush complete oil system and refill with an approved oil in accordance with Engine Maintenance Manual Instructions.

Fuel

	Jet A (Commercial Kerosene) Jet A-1, Jet A-2, JP-5 and JP-8	Jet B and JP-4	Aviation Gasoline
Minimum Fuel Temperature (Take Off)	-29°C(-20°F)	-54°C(-65°F)	-54°C(-65°F)
Maximum Fuel Temperature	+48°C(+118°F)	+48°C (+118°F)	+32°C(+90°F)
Maximum Altitude	--	--	25,000 ft.
Fuel Control Density Adjustment for Optimum Engine Acceleration	0.81	0.79	0.73

Maximum allowable quantity differential between tanks is 800 lbs.

Anti-icing additive (MIL-I-27686E) must be used in fuels not already premixed.

Concentration shall be a minimum of .06% and a maximum of .15% by volume.

See SERVICING, SECTION IV for additive procedures.

OPERATING LIMITATIONS

Use of Aviation Gasoline, all grades, is permitted for a maximum of 50 hours between overhauls if the following operating conditions are met:

1. Maximum fuel temperature and ambient air temperature of 32°C (90°F).
2. Boost pumps ON.
3. Maximum operating altitude of 25,000'.
4. Hours used entered in Log Book. Use of AvGas in partial concentrations is covered in SERVICING, SECTION IV.

TIRE PRESSURE

Main Gear	-0001 thru -0051 Not incorporating SB32-1	79+3 PSI or -1 PSI
	-0052 thru -0070 Not incorporating SB32-1	90+3 PSI or -1 PSI
	-0071 and On and -0001 thru -0070 Incorporating SB32-1	100+5 PSI or -5 PSI
Nose Wheel		120+5 PSI or -5 PSI

LOAD FACTOR	G Limit
Flaps Up	-1.52 to +3.8
Flaps Extended	0 to +2.0

PRESSURIZATION DIFFERENTIAL	Normal	Maximum (relief valve setting)
500-0001 thru -0213	0 to 7.6 PSI	8.0 PSI
500-0214 thru -0349 and 500-0001 thru -0213 incorporating SB21-9	0 to 8.5 PSI	8.8 PSI

Cabin Fan

The cabin fan must be operated in either the HI or LOW position when the aft baggage compartment dividers are closed. If the cabin fan is OFF or inoperable, the following placard must be displayed on the fixed portion of the aft divider.
"PRIVACY CURTAIN & DOOR MUST BE OPEN UNLESS TOILET IS OCCUPIED"

Airplane Battery

If the BATT O'HEAT light illuminates during ground operation, do not take off until after the proper maintenance procedures have been accomplished. Refer to Chapter 24 of the Airplane Maintenance Manual.

Autopilot

One pilot must remain in his seat with the seat belt fastened during all autopilot operations.

Dual Flight Director Installation

The copilot's second attitude indicating system must be installed, operational, and remain operating throughout the flight for those airplanes equipped with the Dual Flight Director Installation.

Oxygen Mask

The standard diluter demand oxygen mask must be positioned around the neck to qualify as a quick-donning oxygen mask.

The optional pressure demand sweep-on oxygen mask must be properly stowed to qualify as a quick-donning oxygen mask.

NOTE

Headsets, eyeglasses or hats worn by the crew may interfere with the quick-donning capabilities of the optional oxygen masks.

Cabin Fan

The cabin fan must be operated in either the HI or LOW position when the aft baggage compartment dividers are closed. If the cabin fan is OFF or inoperable, the following placard must be displayed on the fixed portion of the aft divider.
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Airplane Battery

If the BATT O'HEAT light illuminates during ground operation, do not take off until after the proper maintenance procedures have been accomplished. Refer to Chapter 24 of the Airplane Maintenance Manual.

Autopilot

One pilot must remain in his seat with the seat belt fastened during all autopilot operations. The autopilot current monitor system must be functionally tested per the Normal Procedures in Section IV, prior to inflight use of the autopilot.

Dual Flight Director Installation

The copilot's second attitude indicating system must be installed, operational, and remain operating throughout the flight for those airplanes equipped with the Dual Flight Director Installation.

HF/ADF Systems

The ADF bearing information may be erratic when keying the HF transmitter. Should this occur, do not rely on the ADF bearing accuracy.

Oxygen Mask

The standard diluter demand oxygen mask must be positioned around the neck to qualify as a quick-donning oxygen mask.

The optional pressure demand sweep-on oxygen mask must be properly stowed to qualify as a quick-donning oxygen mask.

NOTE

Headsets, eyeglasses or hats worn by the crew may interfere with the quick-donning capabilities of the optional oxygen masks.

OPERATING LIMITATIONS

Cabin

Seats

For takeoff and landing, all seats must be upright and outboard. The seat adjacent to the emergency exit must be fully tracked toward the rear of the aircraft.

Fan

To meet smoke detection criteria, the cabin fan must be operating any time the privacy curtain is closed. If the fan is inoperable, the curtain must remain open unless the toilet is in use.

Authorized Operations

The CITATION is approved for day and night, VFR and IFR operations. Flight into known icing conditions is approved, if the required airframe de-ice equipment is installed.

Aerobatic maneuvers and spins are prohibited.

Minimum Crew

Minimum Flight Crew for all operations:

1 Pilot and 1 Copilot

The pilot in command must have a C-500 Type Rating, and meet the requirements of FAR 61.58.

The copilot shall possess a multiengine rating and meet the requirements of FAR 61.55.

Thrust Reversing

Reverse thrust power must be reduced to the idle reverse detent position at 60 KIAS on landing roll.

Maximum reverse thrust is limited to takeoff thrust.

Maximum allowable thrust reverser deployed time is 15 minutes in any 1 hour period.

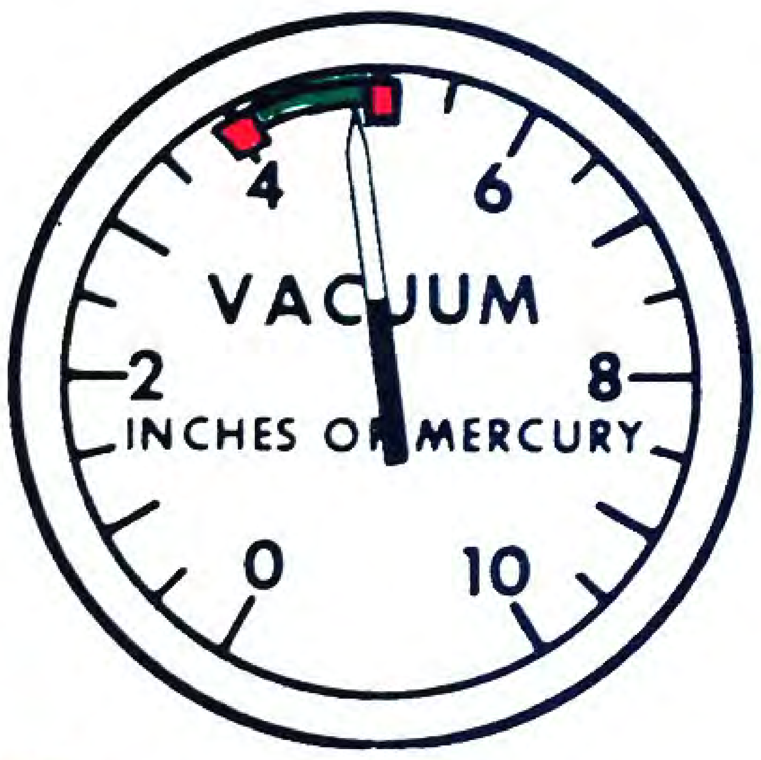
Thrust reversing on sod/dirt, or gravel runways is not allowed.

Simultaneous usage of both the drag chute and the thrust reversers prohibited.

OPERATING LIMITATIONS

VACUUM

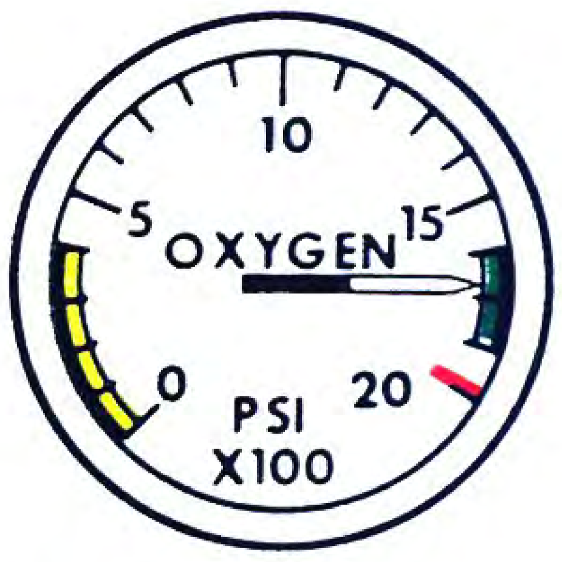
500-0001 thru -0213



4.0 and 5.0 in. Hg

4.0 to 5.0 in. Hg.

OXYGEN PRESSURE



2000 p.s.i

0 to 400 p.s.i.

1600 to 1800 p.s.i.

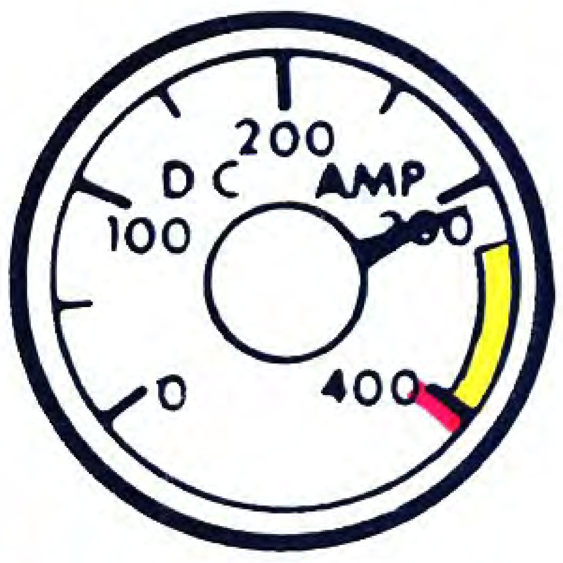
GYRO PRESSURE

500-0214 thru -0349
and 500-0001 thru -0213 incorporating SB21-9

2.0 and 3.0 p.s.i.

2.0 to 3.0 p.s.i.

AMMETER

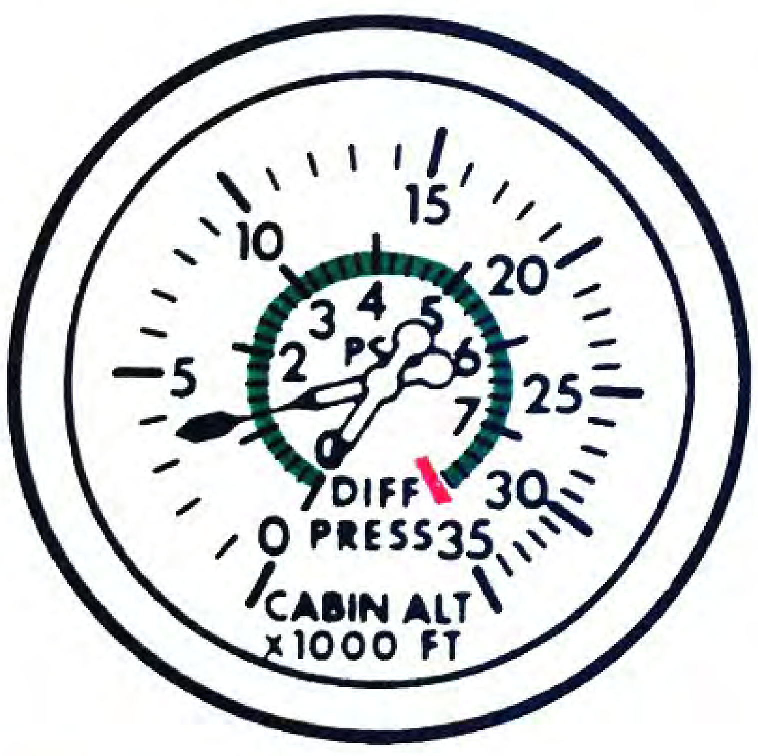


400 Amperes Up To 35,000 ft.

325 Amperes Above 35,000 ft.
(A/C Unit -0214 and On)

DIFFERENTIAL PRESSURE

500-0001 thru -0213

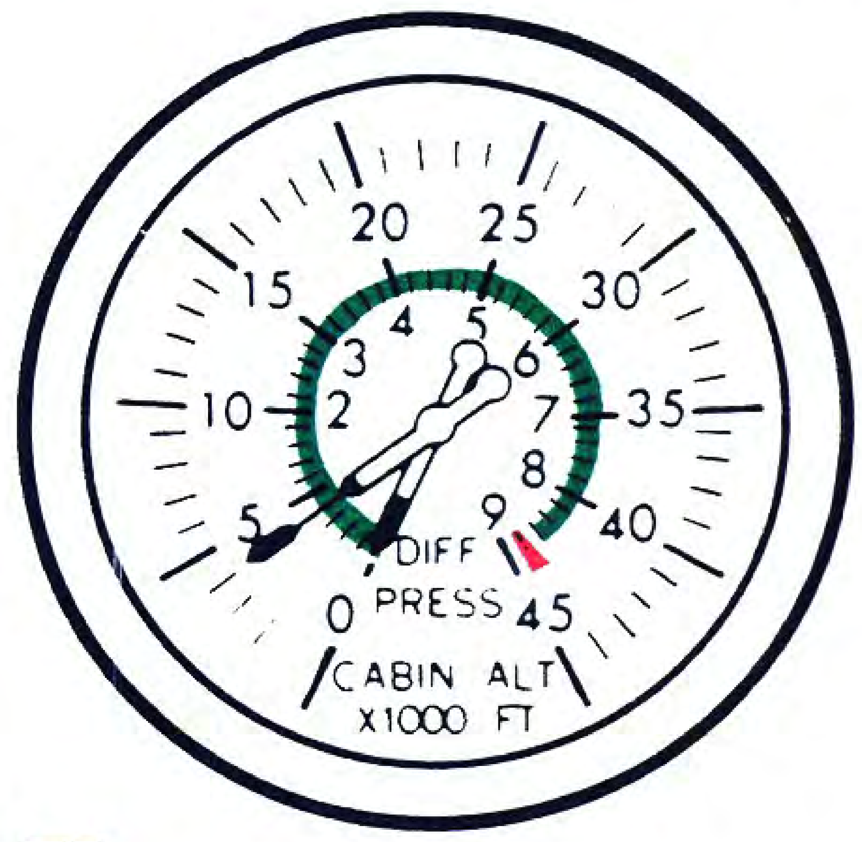


8.0 p.s.i.

0.0 to 8.0 p.s.i.

DIFFERENTIAL PRESSURE

500-0214 thru -0349
and 500-0001 thru -0213 incorporating SB21-9

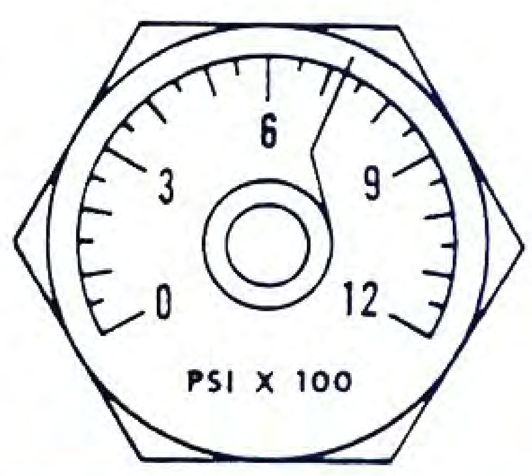


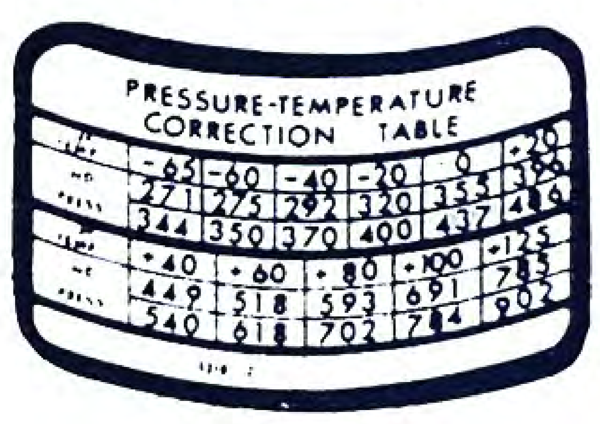
8.8 p.s.i.

0.0 to 8.8 p.s.i.

ENGINE FIRE BOTTLE PRESSURE

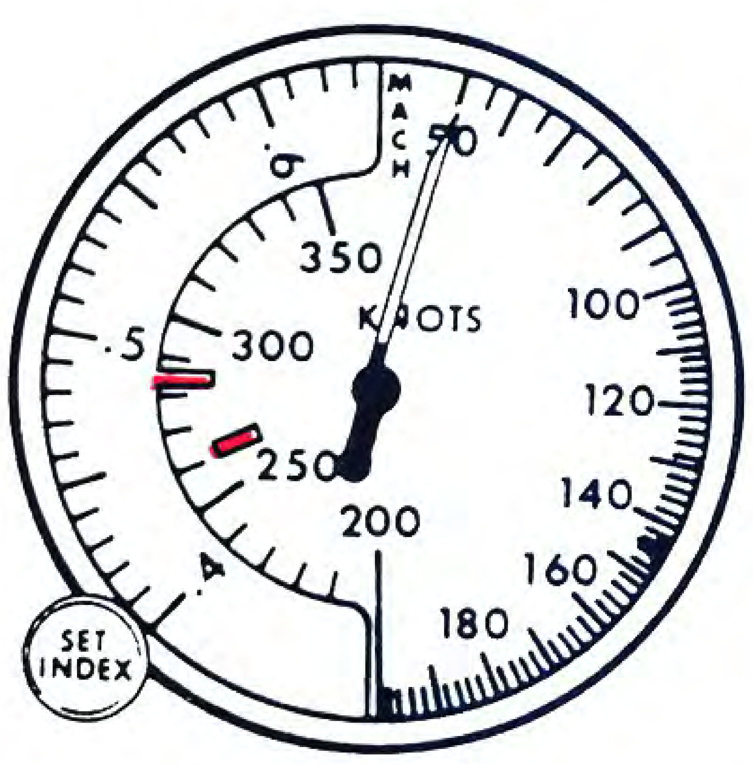
(In Aft Compartment)





AIRSPEED

500-0001 thru -0213



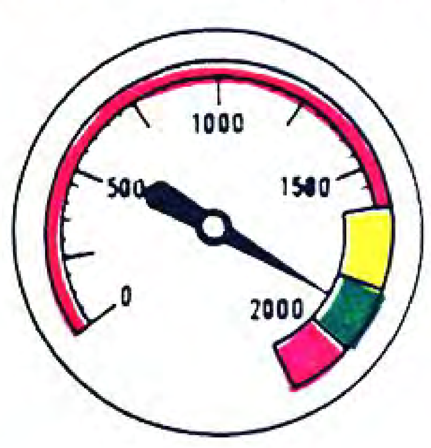
Above 26,000 ft. - .705 Mach

Between 14,000 & 26,000 ft. - 289 KIAS
(with 9500 lb. ZFW) - 277 KIAS
(with 10,500 lb. ZFW) - 262 KIAS

Below 14,000 ft. - 262 KIAS

GEAR AND BRAKE PNEUMATIC PRESSURE

(In Nose Compartment)



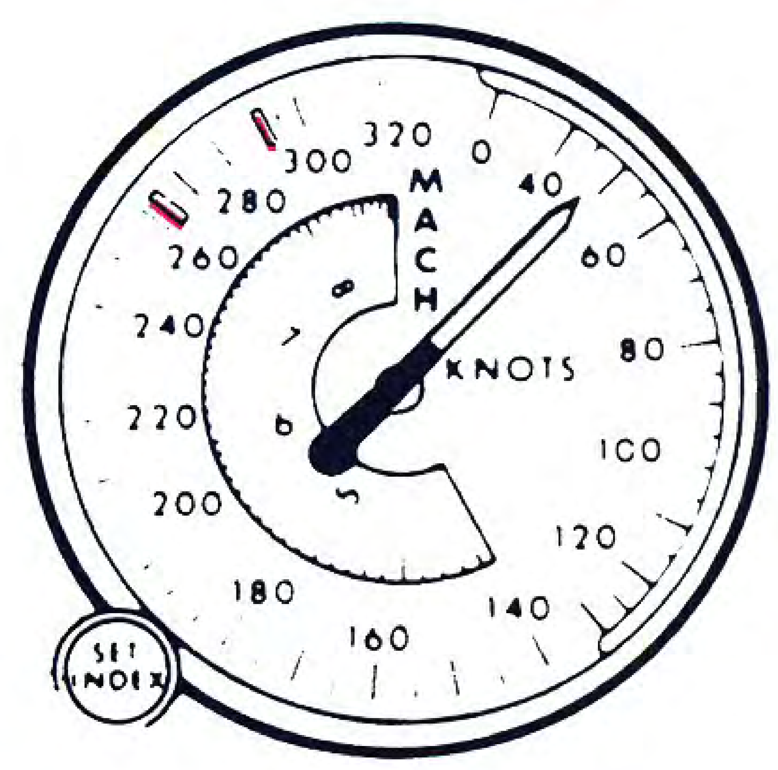
0 to 1600 p.s.i. & above 2000 p.s.i.

1600 to 1800 p.s.i.

1800 to 2000 p.s.i.

AIRSPEED

500-0214 thru -0349



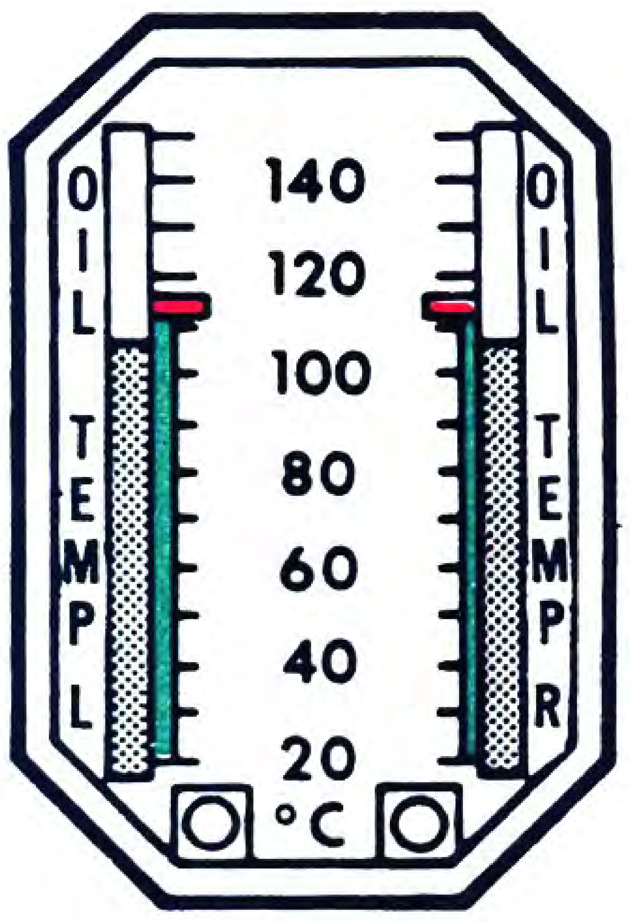
Above 26,000 ft. - .705 Mach

Between 14,000 & 26,000 ft. - 289 KIAS
(with 9500 lb. ZFW) - 277 KIAS
(with 10,500 lb. ZFW) - 262 KIAS

Below 14,000 ft. - 262 KIAS

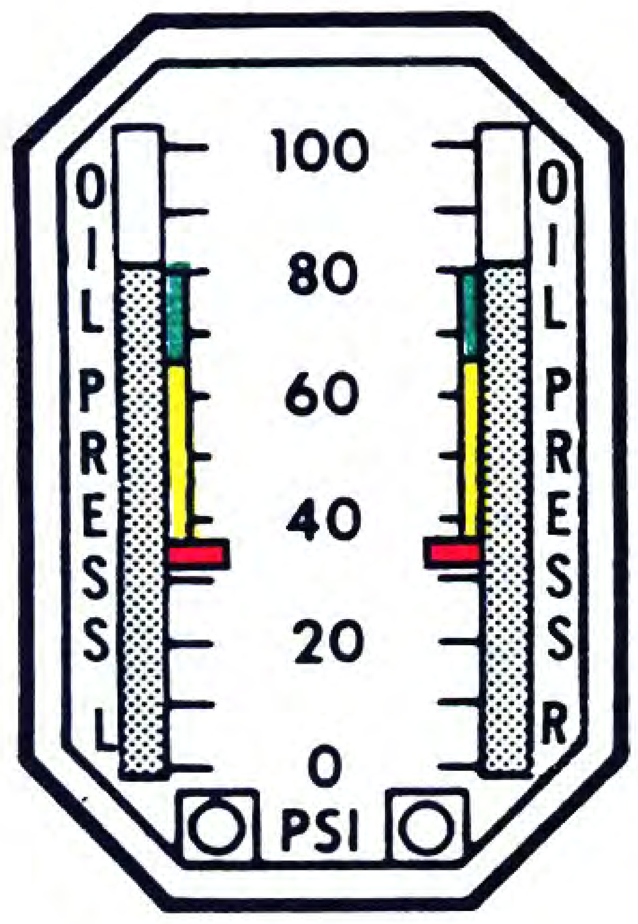
OPERATING LIMITATIONS

ENGINE OIL TEMPERATURE



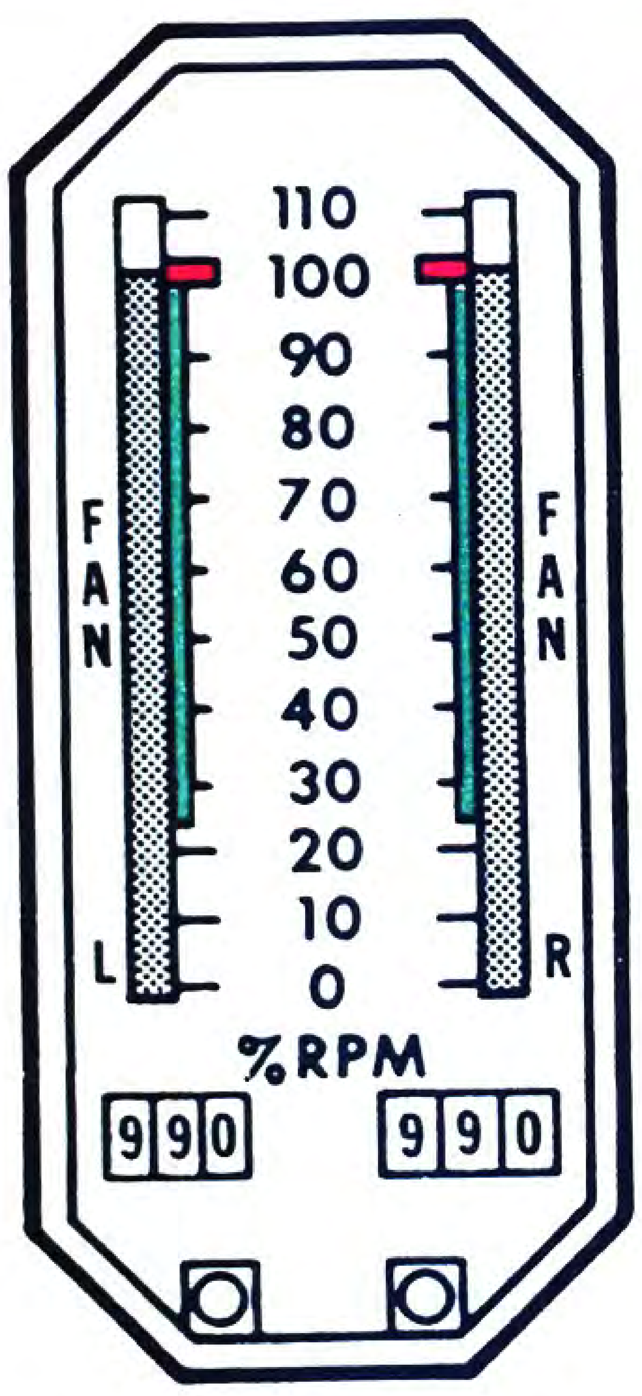
- 🟥 113° C
- 🟩 0 - 113° C

ENGINE OIL PRESSURE



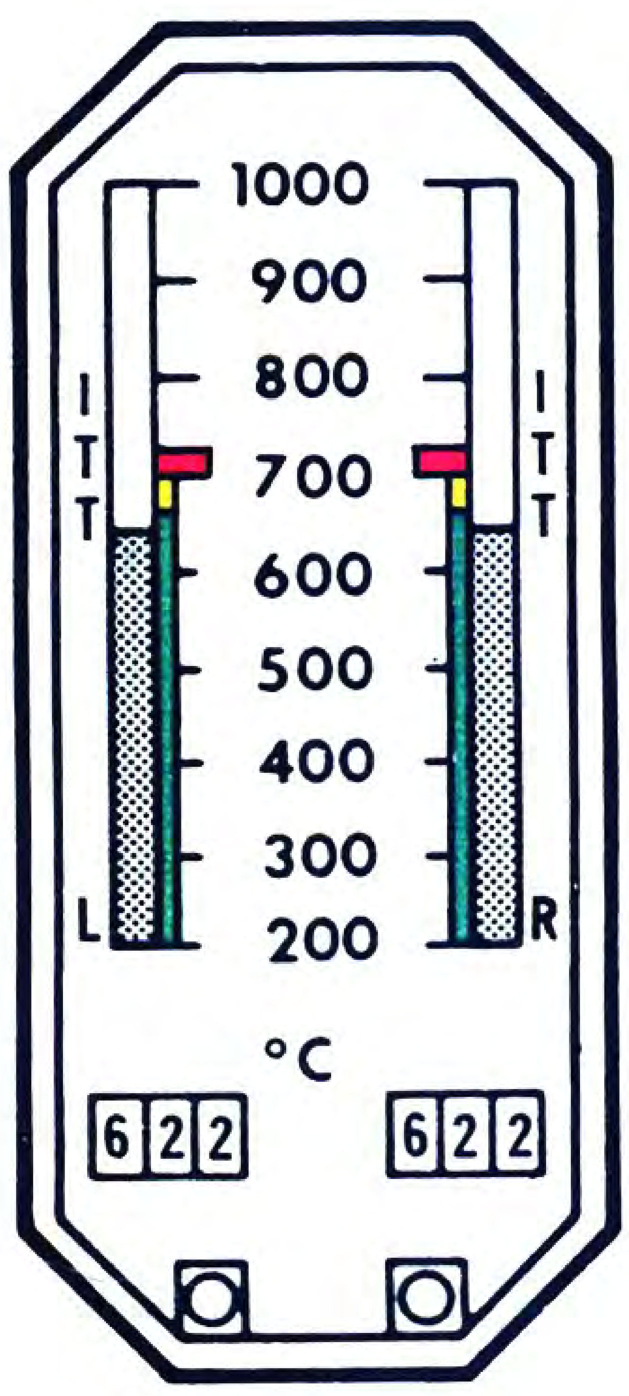
- 🟥 35 p.s.i.
- 🟨 35 to 65 p.s.i.
- 🟩 65 to 80 p.s.i.

ENGINE FAN RPM (N_1)



- 🟥 99% RPM
- 🟩 25 to 99% RPM

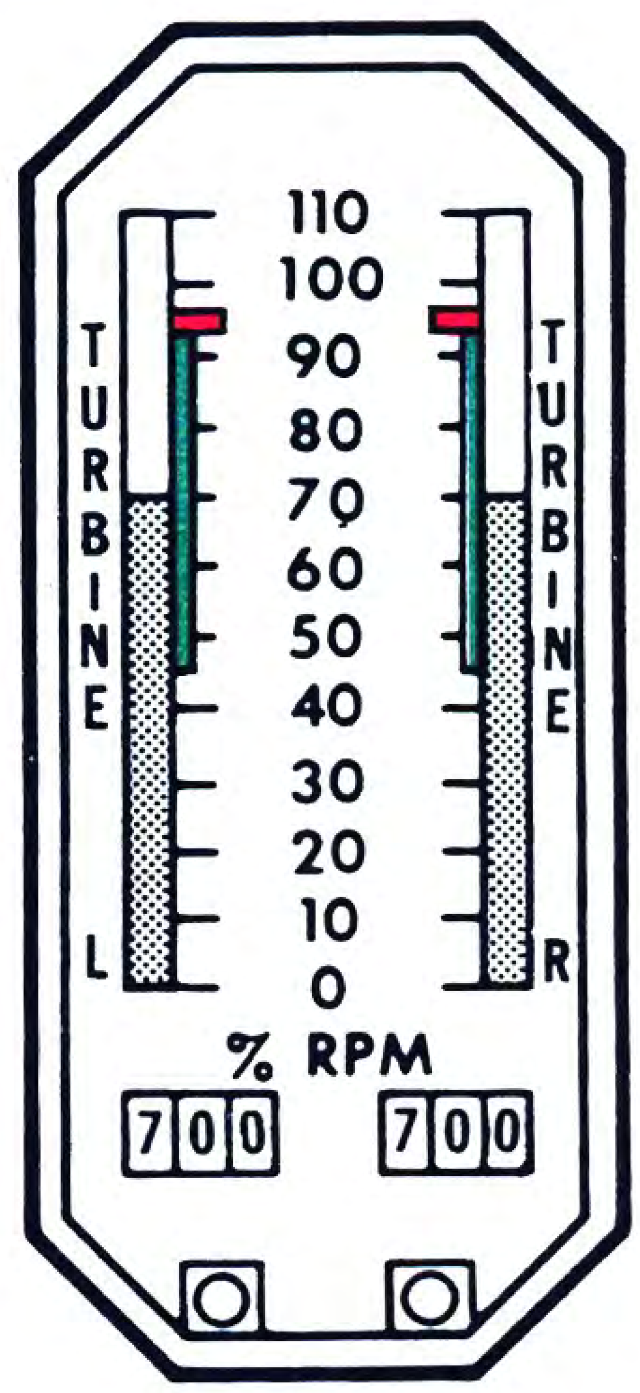
ENGINE INTER-TURBINE TEMPERATURE



- 🟥 700° C
- 🟨 680 to 700° C
- 🟩 *200 to 680° C

* Replacement indicator with lower limit of 150°C may be installed.

ENGINE TURBINE RPM (N_2)



- 🟥 95% RPM
- 🟩 46 to 95% RPM

SECTION II
POWERPLANT and SYSTEMS

Page

ENGINE

Jet engines produce thrust by accelerating air. It is the product of the mass (weight) of the air times the acceleration (increase in velocity) that determines thrust output. To generate a given amount of thrust, a small volume of air can be accelerated to a very high velocity, or a relatively large amount can be accelerated to a lower velocity.

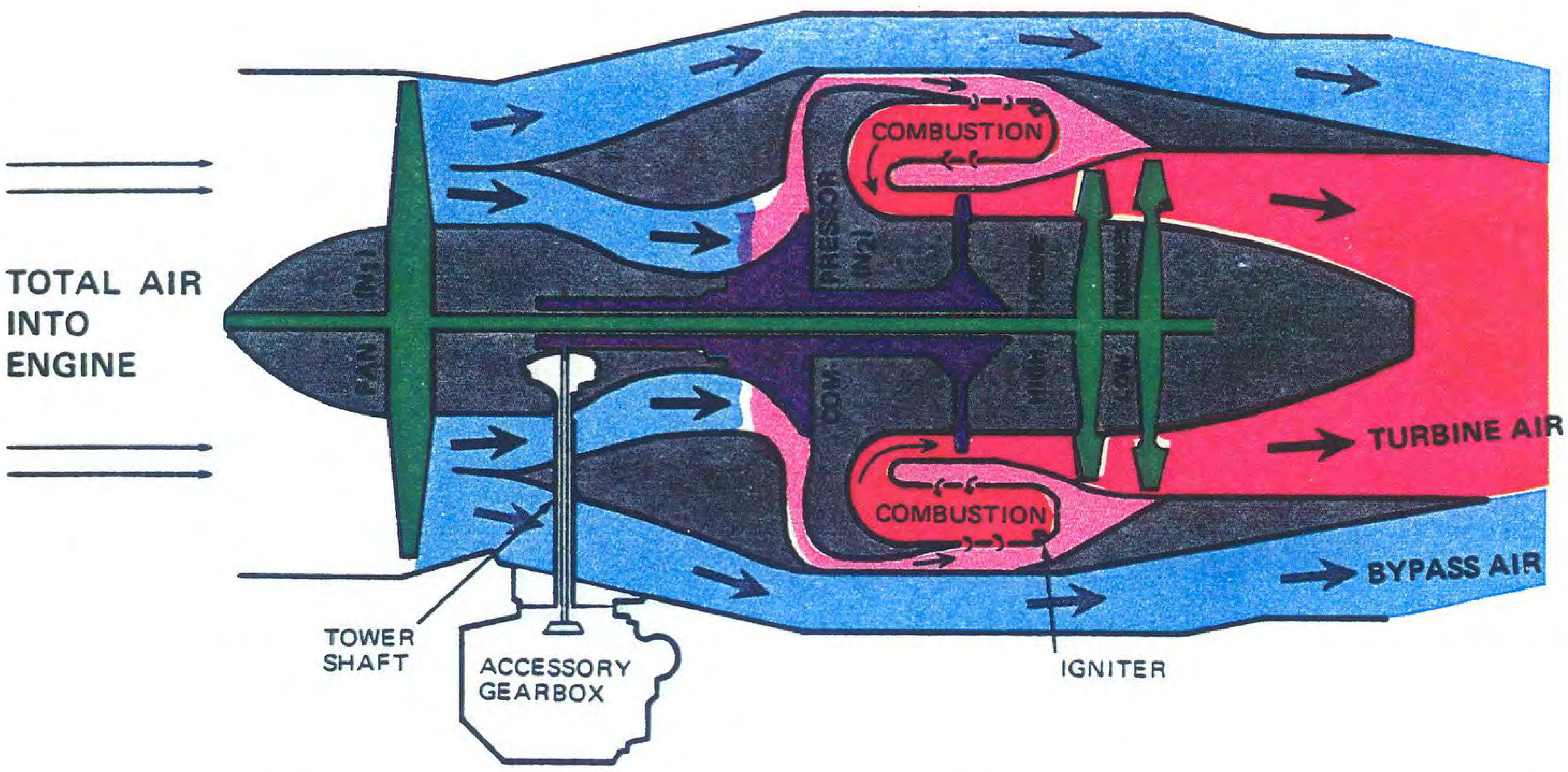
In a turbojet engine incoming air is compressed, mixed with fuel, combusted, and exhausted at a high velocity. In a turbofan engine, only a portion of incoming air is combusted. The hot air then drives the fan which accelerates a large volume of air at a lower velocity. This air is bypassed around the engine and is not mixed with fuel or combusted. The relation of the total mass of bypassed air, to the amount of air going through the combustion section is known as the Bypass Ratio.

The JT15D-1/JT15D-1A, developed for the CITATION by Pratt and Whitney Canada Inc., is a high-bypass turbofan engine rated at 2200 pounds static thrust. A concentric shaft system supports the fan and turbine rotors. The inner shaft connects the fan (N_1) at the front of the engine to the two rear low pressure turbines. The outer shaft connects the centrifugal compressor (N_2) and the forward high pressure turbine.

All intake air passes through the fan. Immediately aft of the fan the airflow is divided by a concentric duct. Most of the total airflow is bypassed around the engine through the outer duct, and is exhausted at the rear. Air entering the inner duct passes through a single set of guide vanes and is compressed by the centrifugal compressor. The high pressure air then passes through a diffuser assembly, and moves aft to the combustion section.

The combustion chamber is of a reverse flow design to save space and reduce engine size. A portion of the air entering the chamber is mixed with fuel and ignited. The remainder enters the chamber liner downstream for cooling.

Fuel is introduced by twelve dual orifice nozzles supplied by a dual manifold. The mixture is ignited initially by two spark igniters which extend into the combustion chamber at the five and seven o'clock positions. After start, combustion becomes self-sustaining. The hot gases expand, reverse direction, and pass through a set of turbine guide vanes to the high pressure turbine. The power generated by this turbine is transmitted by the outer shaft to turn the N_2 compressor.



Only a small part of the energy available in the hot, high pressure air is absorbed by the high pressure turbine. As the expanding gases move rearward, they pass through another set of guide vanes and enter the two stage, low pressure turbine. A greater portion of the remaining energy is extracted there and transmitted by the inner shaft to the forward-mounted fan. The hot gases then exhaust into the atmosphere.

The turbofan is in effect two interrelated powerplants. One section is designed to produce energy in the form of high velocity, hot air. The other utilizes some of this air to provide the power to drive the fan. The fan of the JT15D-1/JT15D-1A, pumping a high volume of cool, low velocity air produces approximately 75% of total engine thrust.

Ignition System

Each engine incorporates an exciter unit and two igniters. The exciter converts battery or generator input to high voltage DC, stores it momentarily until a given energy level is reached, and allows it to discharge in spark form through the igniters. System wiring is such that malfunction of one igniter will not affect normal operation of the other.

Cockpit control consists of two-position RH and LH ignition switches. In NORM, function is automatic during start and with engine anti-ice selected. Moving the Throttle to IDLE after depressing the start button activates ignition until terminated automatically at approximately 40% turbine RPM (N_2). Continuous ignition occurs any time the respective engine anti-ice or ignition switch is ON.

A small green light above each ignition switch illuminates whenever the exciter is receiving electrical power.

Accessory Gearbox

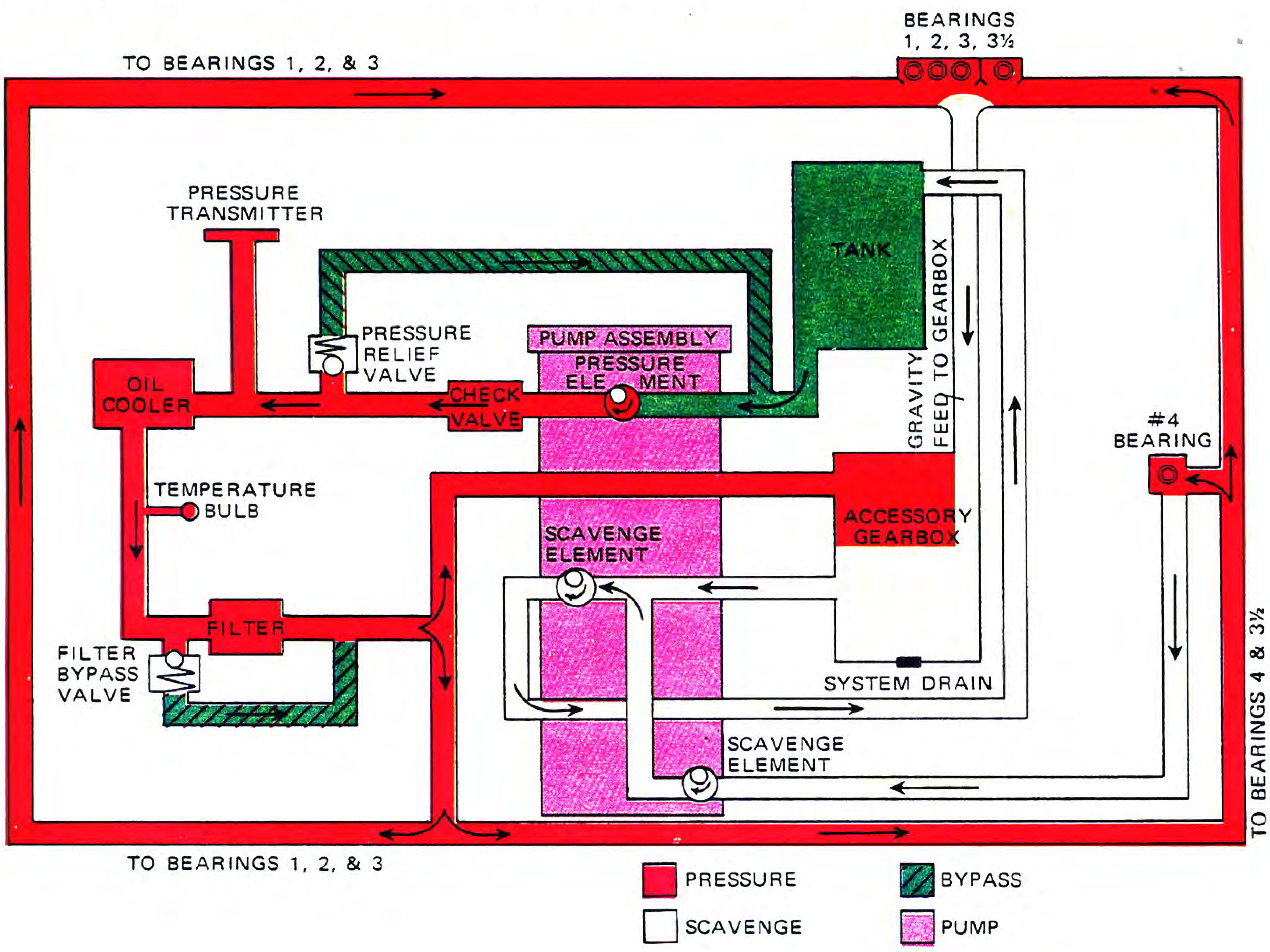
The starter/generator, fuel pump, fuel control, hydraulic pump, oil pump, and N_2 tachometer generator are driven by the accessory gearbox mounted below the engine. Power to drive the gearbox is transmitted from the N_2 section through the tower shaft and a series of bevel gears. Lubrication is provided by the engine oil system.

Oil System

The system provides cooled, pressurized oil for lubrication and cooling of engine bearings and accessory drive gears and bearings. An integral oil tank on each engine has a capacity of 2.39 U.S. gallons, of which 1.50 gallons for the JT15D-1 or 1.25 gallons for the JT15D-1A are usable.

Oil is drawn from the tank by the pressure element of the three-element pump mounted on the accessory gearbox. It passes through a check valve, which prevents gravity flow when the engine is not running, and past a pressure relief valve enroute to the oil cooler. If system pressure becomes excessive, the relief valve reduces it by unseating and allowing oil to return to the pump inlet via a bypass line.

From the cooler, which is a fuel-oil heat exchanger, it passes through a filter before being routed to the engine bearings and accessory gearbox. Should the filter become clogged, a bypass valve opens allowing lubrication to continue.



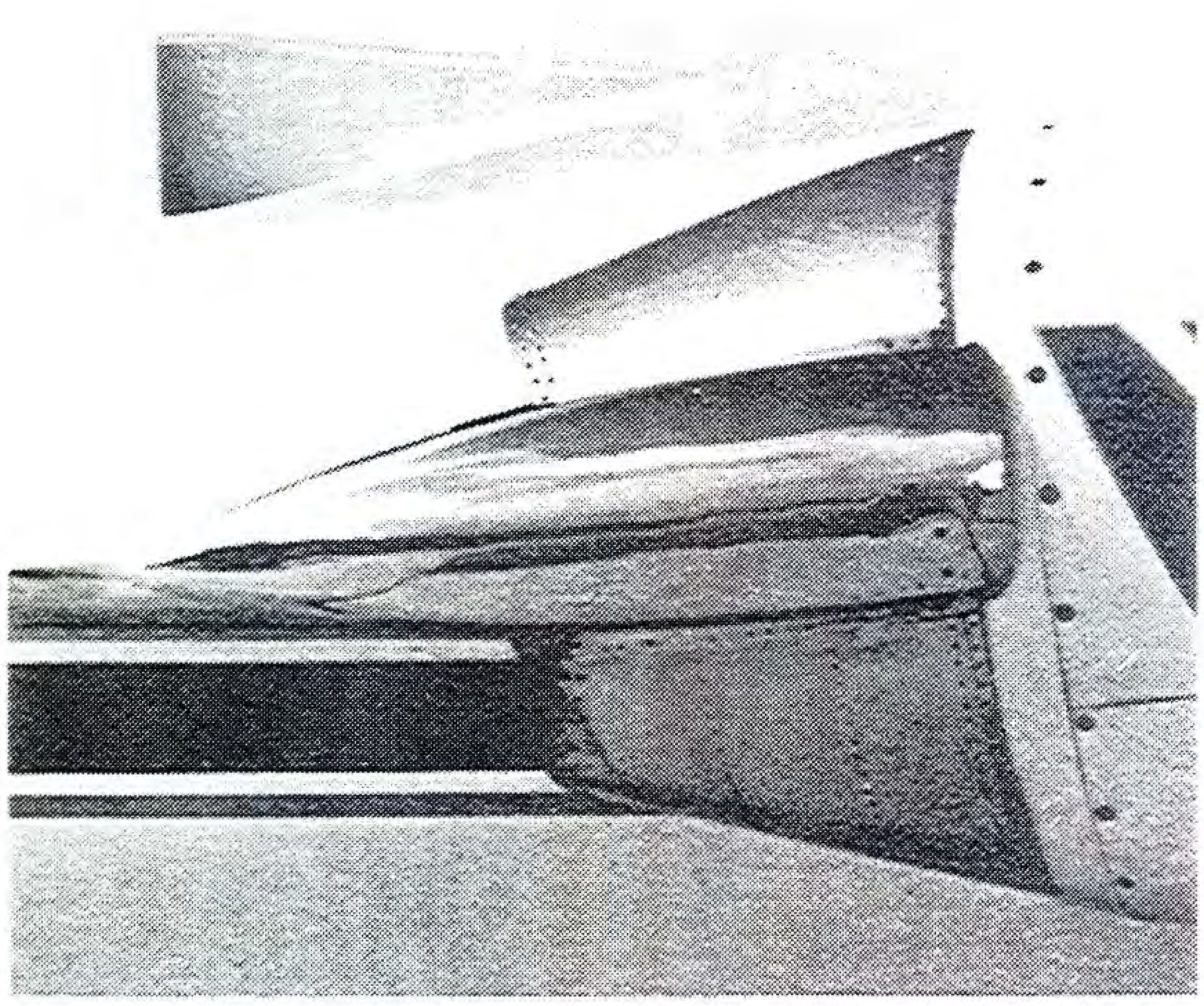
Circulated oil is returned to the tank by the pump's two scavenge elements. Oil from bearings 1, 2, 3, and 3-1/2 gravity drains into the accessory gearbox where it is picked up by one element. The other element scavenges from the number 4 bearing.

Cockpit indicators receive inputs from the pressure transmitter just upstream of the oil cooler and the temperature bulb immediately downstream of the cooler.

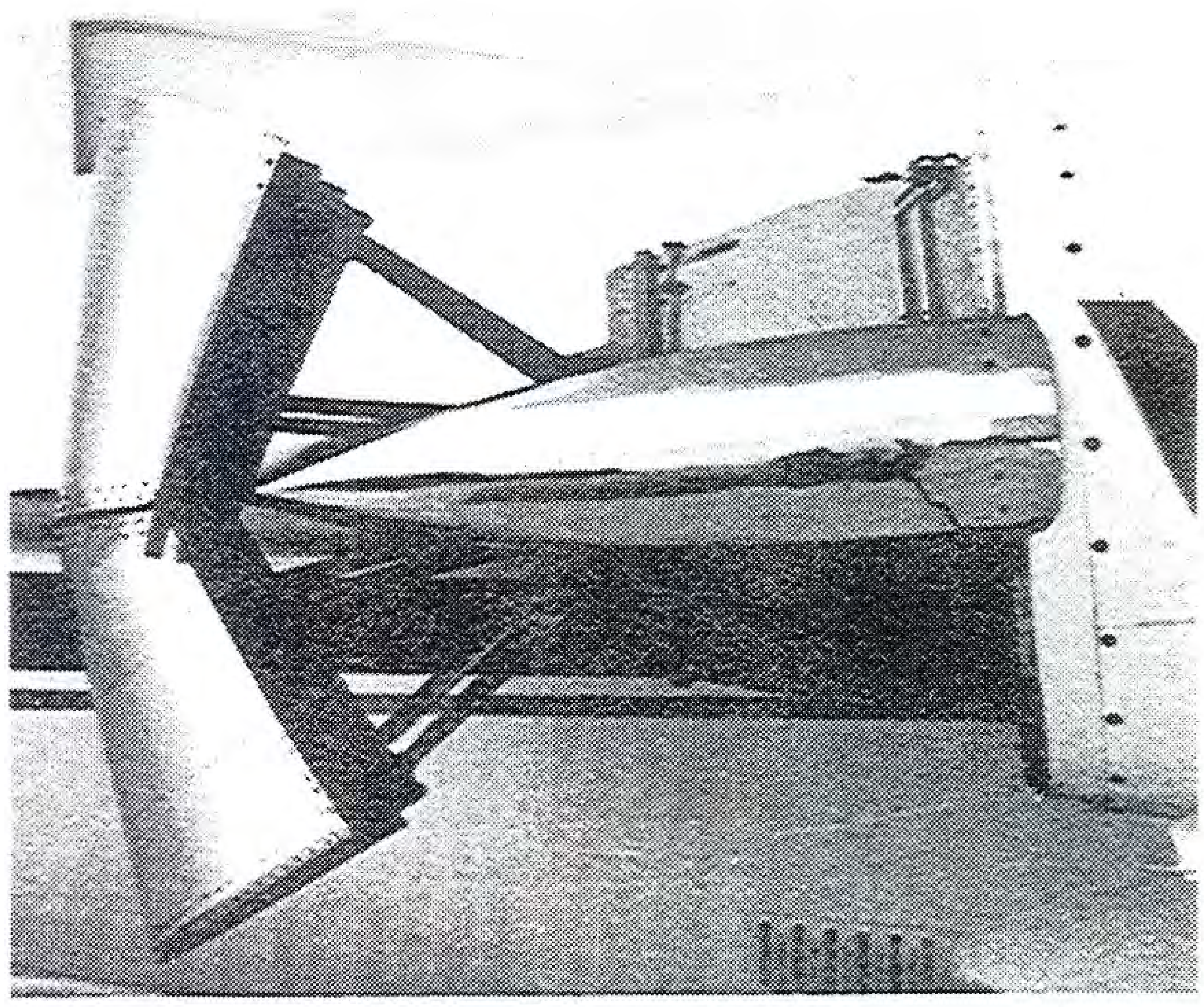
Thrust Reverser System

Description and Operation

The thrust reversers are of the external target type employing two vertically oriented doors or buckets, which, when deployed, direct exhaust gases forward to provide a deceleration force for ground braking. When stowed the reversers fair into external aircraft contours to form the aft portion of the nacelle. The reversers are mounted to the engine fan nozzle through an aluminum support casting and four interconnecting links per door.



STOWED

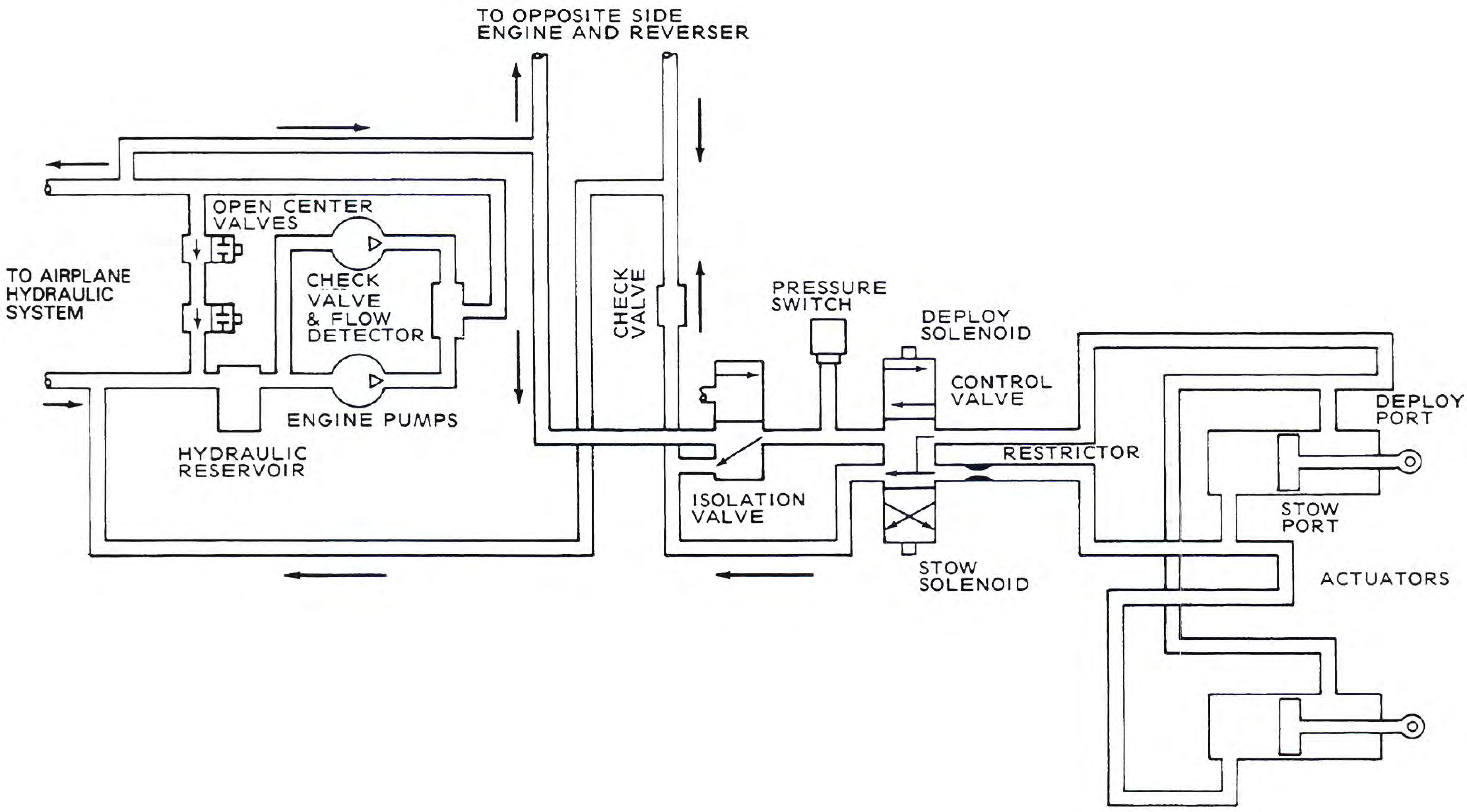


DEPLOYED

Normal Operation

The reverser system is designed for two-position operation: stowed during takeoff and flight and deployed during landing ground roll. The reversers are activated by pilot operation of the thrust reverser throttle levers and deployed by hydraulic pressure supplied by an engine driven pump and directed to the drive actuators. The actuators are connected to a slider mechanism which is in turn connected to the reverser doors by a four-bar linkage system. The system by design incorporates an overcenter feature in the linkage which locks the reverser in the stowed position.

Hydraulic actuators are mounted to the support casting on each side of the reverser. The airplane hydraulic system provides pressure to these actuators which in turn operate the linkage system along a sliding track in the support casting to deploy and stow the reversers.



Thrust Reverser Hydraulic Schematic

Control of the individual thrust reverser is through the reverse thrust lever mounted on each of the engine throttles. The reversers can only be deployed when the primary throttle levers are in the idle thrust position and the airplane is on the ground as sensed by either of the main gear squat switches. The reverse thrust lever also controls engine thrust during reverse thrust operation.

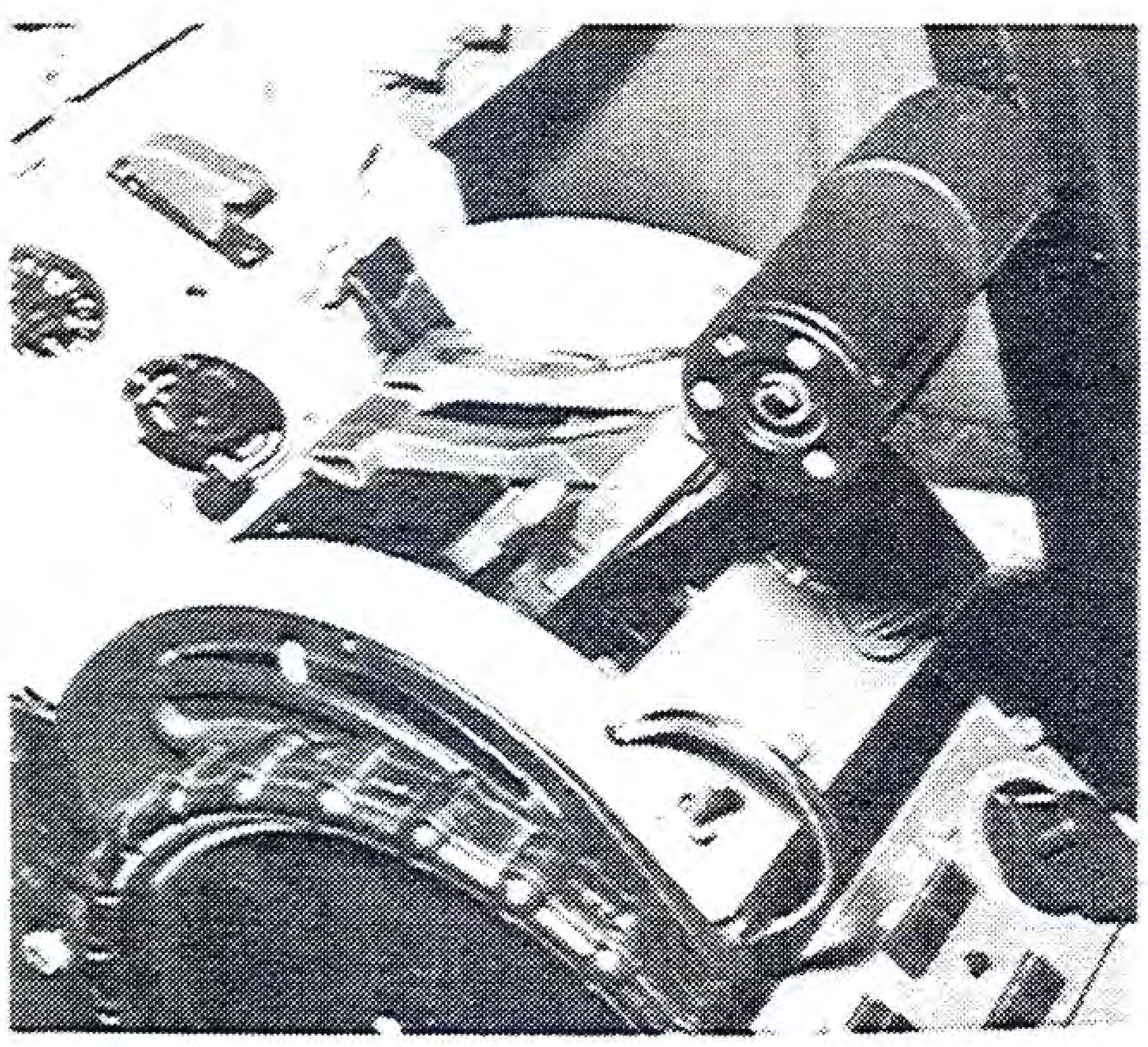
ENGINE

An automatic system is incorporated in the installation to retard engine power to idle if an inadvertent deployment or stow of the reverser should occur. Anytime the reverser is in transit with the engine throttle control above idle, the system moves the fuel control approximately to idle. A spring-loaded overcenter bracket in each throttle system is designed to actuate allowing the fuel control to be moved to idle if the throttles are held above idle during an inadvertent deployment. This bracket can be manually reset by maintenance personnel after the reason for the deployment has been determined. Once the automatic retard system has actuated, the throttle system may be out of rig to the point that full throttle travel would produce considerably less than takeoff thrust and idle throttle position would shut down the engine. The same bracket actuation will occur if the main throttles are advanced while the reversers are being stowed during landing roll or normal taxi. For this reason, the thrust reversers should not be used on touch and go landings and a full stop landing should be made once the thrust reversers are selected.

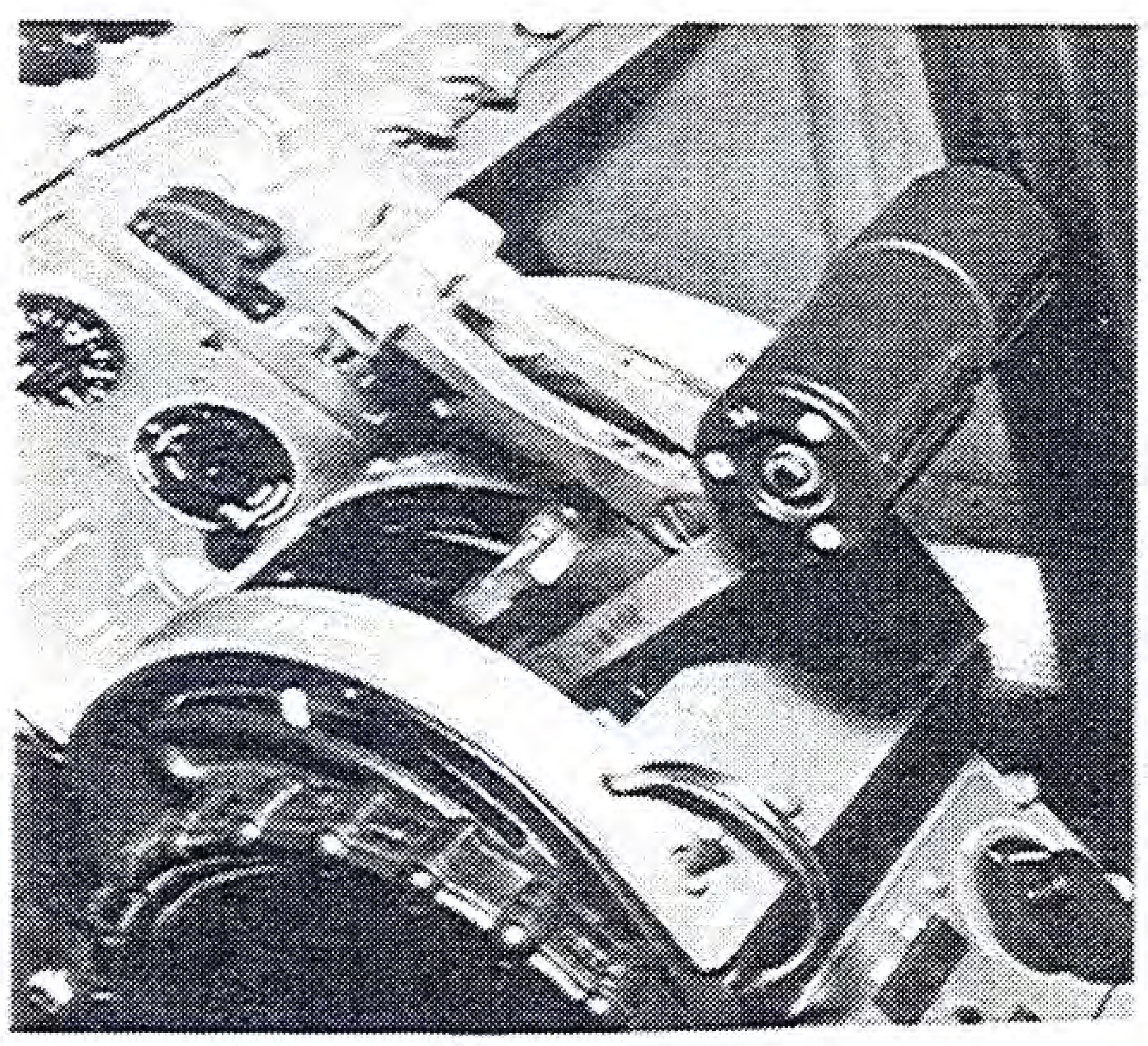
CAUTION

Do not advance the primary throttle after moving the reverse thrust lever to stow until the "UNLOCK" light is out.

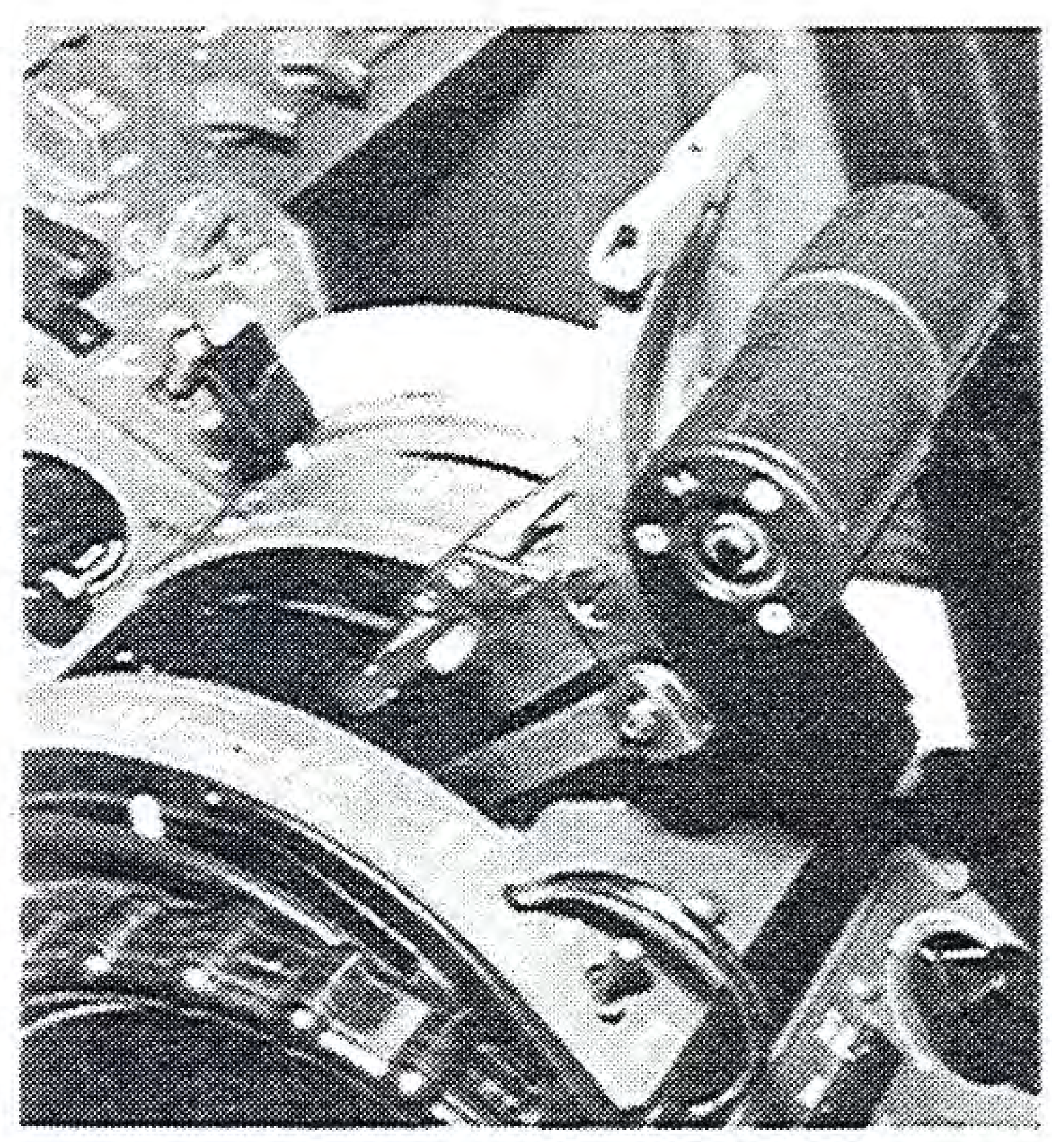
Thrust Reverser Throttle Levers



STOWED

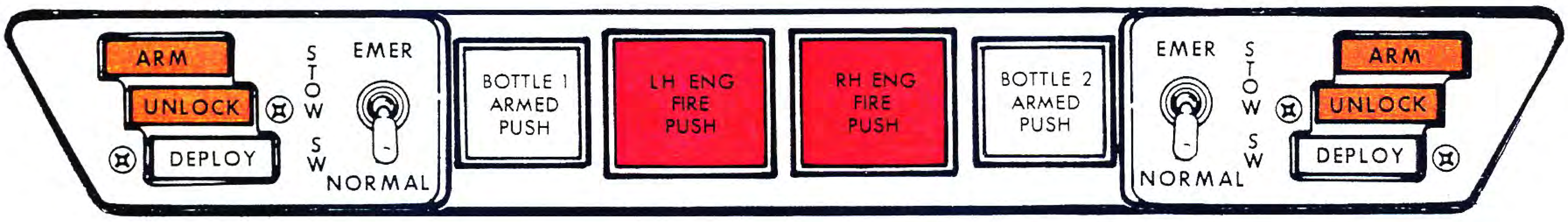


IDLE DEPLOY



FULL REVERSE THRUST

Three reverser indicator lights for each reverser are mounted on the cockpit glareshield for monitoring reverse functions; ARM , UNLOCK , and DEPLOY .



Moving the reverse thrust lever from the STOWED to the IDLE REVERSE position actuates the deploy switch. This electrically opens the isolation valve, moves the reverser control to deploy and pressurizes the airplane hydraulic system. The isolation valve allows the airplane hydraulic system to pressurize the thrust reverser system. The amber ARM light indicates hydraulic pressure to the reverser control valve as sensed by a pressure switch.

During thrust reverser deployment the initial movement of the actuators activates the unlocked switches. Either switch will cause the amber UNLOCK light to illuminate. Further movement of the actuator unlocks the reverser through the overcenter linkage. The remaining travel of the actuators deploys the reverser doors.

At full deployment of the reverser, the deploy switch is activated which in turn illuminates the white DEPLOY light and unlocks the pedestal-mounted throttle lock out cam. The purpose of the lock out cam is to prevent increasing engine thrust, once reverser deployment has been selected, until the reversers have fully deployed.

NOTE:

The DEPLOY light shall illuminate in less than 1.5 seconds after the hydraulic UNLOCK light illuminates. An erroneous sequencing or a delay in the illumination of the thrust reverser lights indicates a failure in the thrust reverser system. Either or both conditions requires a maintenance check before further flight.

WARNING

DO NOT ATTEMPT TO FLY THE AIRPLANE IF THE THRUST REVERSER PREFLIGHT CHECK IS UNSUCCESSFUL.

As previously mentioned, either of the landing gear squat switches must be activated to complete the electrical circuit necessary to initiate deployment of the thrust reversers.

The thrust reverser lever(s) should not be placed in the idle reverse detent position in flight since a single failure of either squat switch could permit deployment of the thrust reverser(s). If the thrust reverser lever is placed in the idle reverse detent position while airborne, the airplane MASTER WARNING light will flash along with illumination of the ARM and HYD PRESS ON annunciator lights. A MASTER WARNING light when thrust reversers are moved to deploy on the ground, means that neither landing gear squat switch has activated. To insure actuation of the squat switches and to eliminate any delay in the deployment of the thrust reversers, it is recommended that the speed brakes be extended immediately following touchdown.

After deployment, power may be increased by moving the thrust reverser throttle levers aft for maximum reverse thrust. For convenience, "STOPS" have been installed on the thrust reverser levers and are set to provide 90% N_1 at sea level on a 16°C (60°F) day. These stops will allow the pilot to keep his attention on the landing rollout instead of diverting his attention to the reverse power settings, except in abnormal ambient temperature condition.

Single engine reversing has been demonstrated during normal landings and is easily controllable. Also, for an increased aerodynamic drag on landing roll, it is suggested that the thrust reversers remain in the deployed idle reverse power position after reverse thrust power has been terminated at 60 KIAS.

To stow the thrust reversers move the reverse thrust lever through the idle reverse detent to the stow position. This actuates a switch in the pedestal which moves the thrust reverser control valve to the stow position. Hydraulic pressure is directed by the valve to the two actuators in the reverser which move the thrust reverser doors to the stowed position. Initial movement of the linkage toward the stowed position deactivates the deploy switch extinguishing the DEPLOY light. As each actuator moves to the fully stowed and locked position, they deactivate a thrust reverser unlocked switch. When both switches in a reverser have been deactivated the UNLOCKED light is extinguished, the aircraft hydraulic system is depressurized and the affected thrust reverser isolation valve closes. This puts the ARM light out as the pressure in the line downstream of the isolation valve drops.

The thrust reversers are not to be used during touch and go landings. A full stop landing must be made once reverse thrust has been selected. Less distance is required to stop, even on a slick runway, once the reversers have been deployed, than is required to restow the reversers and takeoff.

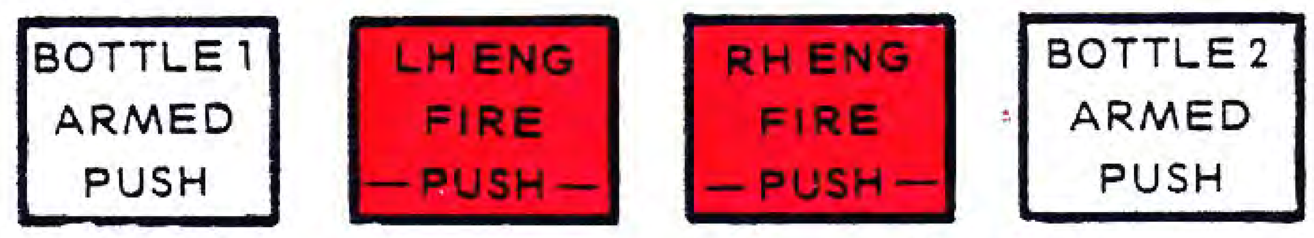
Emergency Stow Operation

An emergency stow switch for each thrust reverser located on the cockpit glareshield will provide the same stow sequence (using the alternate 28 V thrust reverser power source) in the event of a failure of the pedestal-mounted deploy and stow switch or of the respective 28 V DC bus.

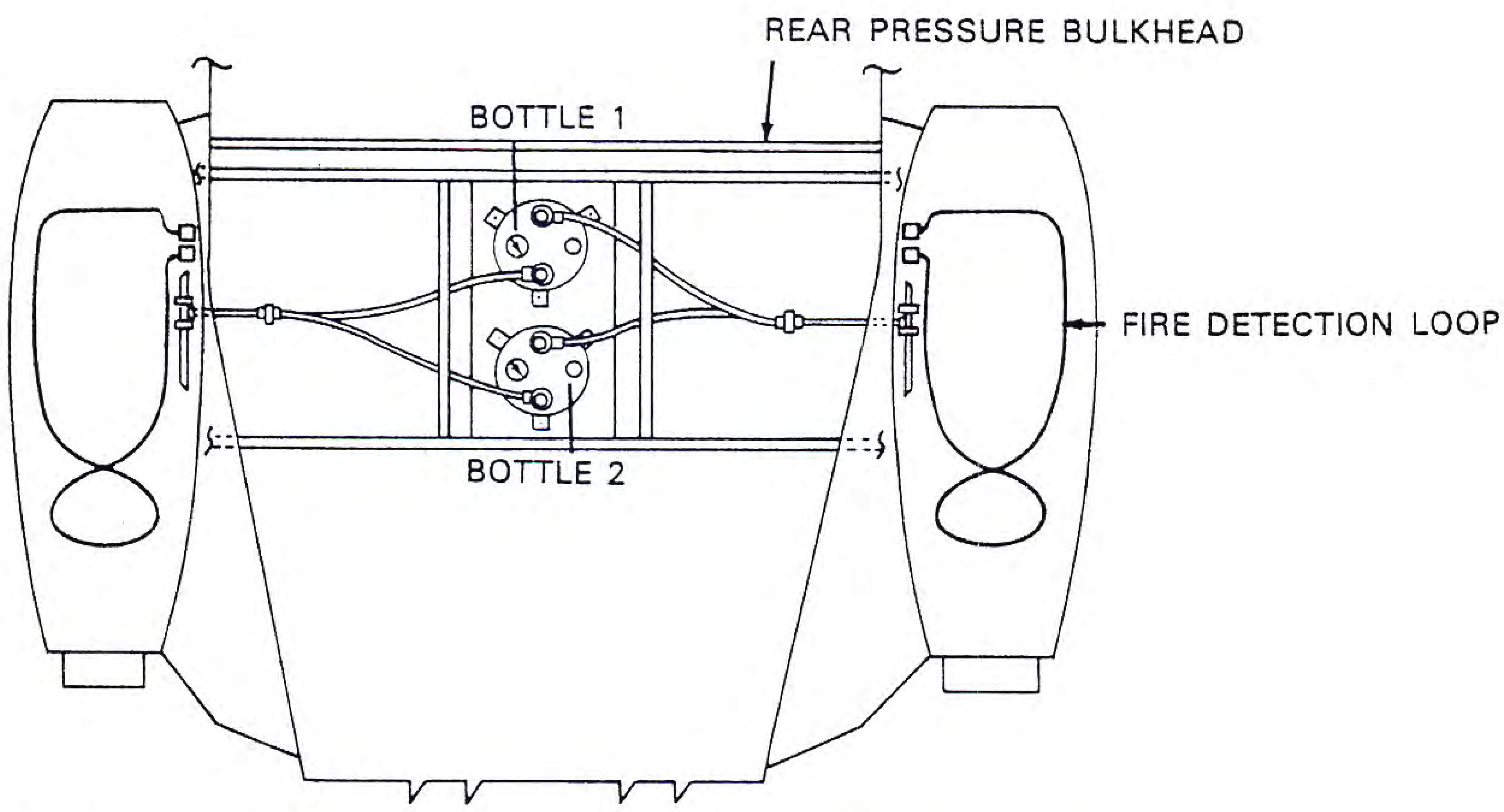
Each emergency stow switch receives its electrical power through the opposite thrust reverser circuit breaker. The emergency stow function can be checked on the ground by deploying the reversers normally and then actuating each emergency stow switch. The DEPLOY and UNLOCK light shall extinguish. The ARM and HYD PRESS ON light remain illuminated. Return the thrust reverser lever to stowed position, then turn each emergency stow switch off. All lights shall be extinguished.

Fire Protection

Engine fire detection consists of a closed-loop sensing system and detector control unit which illuminates the respective red ENG FIRE warning light on the cockpit glareshield if a fire or overheat condition is present. The warning light, under a transparent, spring-loaded guard, also serves as a firewall shutoff switch.



Lifting the guard and depressing the warning light simultaneously closes the respective firewall fuel and hydraulic valves, de-energizes the starter/generator, and arms the two freon extinguishing bottles. Firewall shutoff and extinguisher arming are indicated by illumination of the respective FUEL PRESS LO, HYD PRESS LO, F/W SHUTOFF and GEN OFF annunciator panel lights and both white BOTTLE ARMED lights.



Once armed, either bottle may be discharged to the selected engine by pushing the BOTTLE ARMED light. The light will go out as the light is pushed. System plumbing is such that both bottles can be directed to the same engine if necessary.

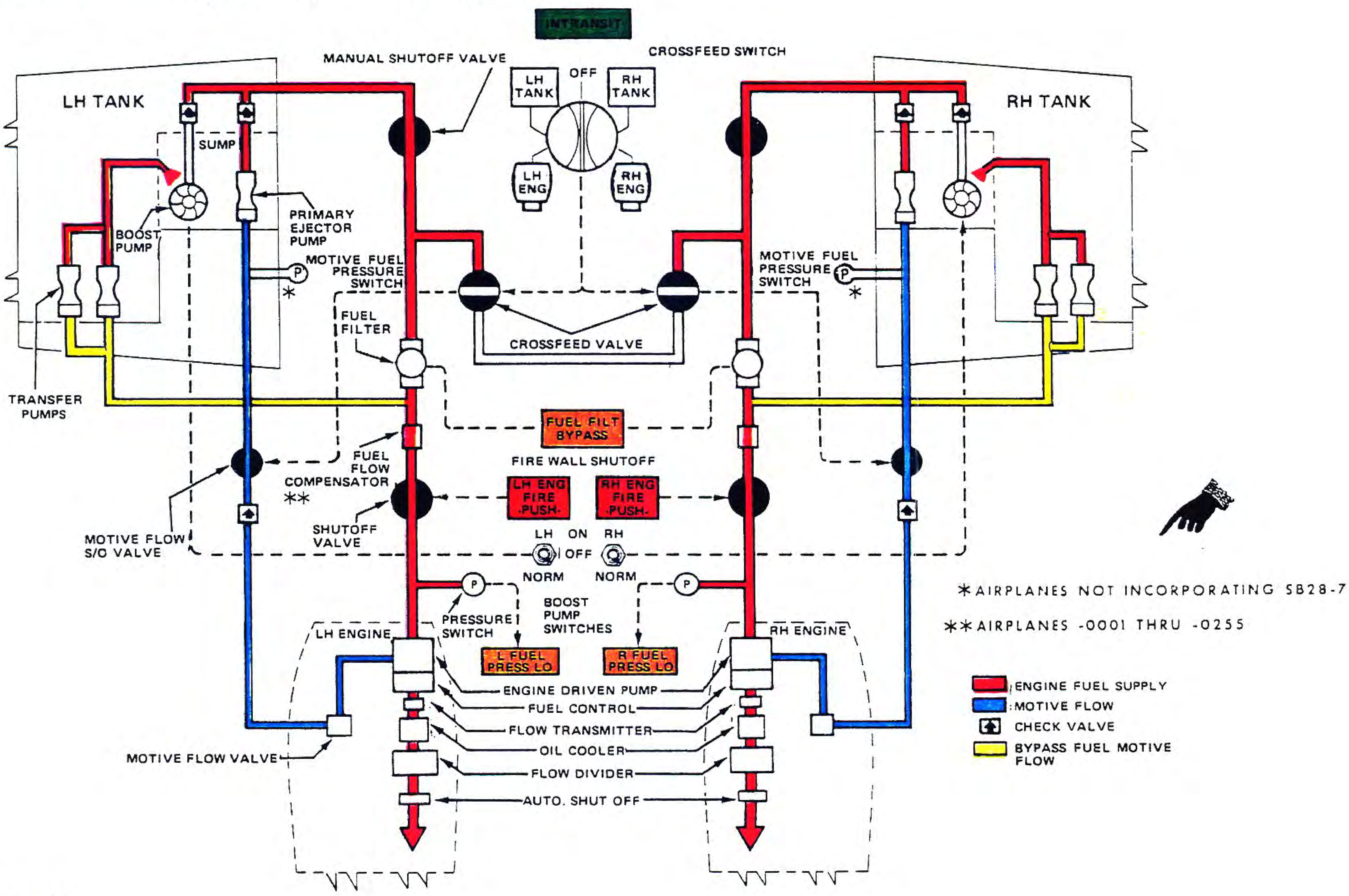
Function of the lights and continuity of the sensor and detector control units is checked by placing the rotary TEST selector in the FIRE WARN position and observing illumination of both red lights. Depressing either fire light will then illuminate both BOTTLE ARMED lights. Since the BOTTLE ARMED lights will come on each time the system is tested or initially activated regardless of freon quantity, it is necessary to check proper bottle servicing on the sight gauges in the tailcone compartment during preflight inspection.

All test, detection and extinguishing features are electrically powered from the Main DC buses requiring either external power, the battery switch in BATT, or a generator on the line for operation.

FUEL

The CITATION fuel system is made up of two distinct, but essentially identical halves. Normal operation supplies fuel to the engine from its respective integral wing tank. Each cell holds approximately 282 U.S. gallons for a total aircraft capacity of 564 gallons (3806 lbs.) For 500-0001 thru -0213 not incorporating SB21-9, each cell holds approximately 272 U.S. gallons for a total airplane capacity of 544 gallons (3645 lbs.). Crossfeed capability is incorporated and when selected, enables both engines to receive fuel from a single tank.

System operation is fully automatic throughout the normal flight profile. Fuel system control and monitoring is available through the boost pump switches, crossfeed switch, fuel quantity and flow indicators, and annunciator panel lights which warn of abnormal system operation. A low fuel level warning system functions independently of the normal fuel quantity indicating system.



Fuel Cell

Each tank encompasses all internal wing area forward of the spar, inboard to the wing root, and outboard to the wing tip. On 500-0001 thru -0213 not incorporating SB21-9, the fuel cell extends outboard only to the wing tip fairing. A fuel sump area, electric boost pump, primary ejector pump, two transfer ejector pumps, and four fuel quantity probe assemblies are internally incorporated. The sump area houses the electric boost pump, primary ejector pump, and five quick drains to preclude water and sediment buildup. The sump is designed to provide a minimum of five seconds fuel supply during negative gravity maneuvers not exceeding 0.5G. Fueling is accomplished through an overwing port in each cell.

A vent system insures ambient pressure within the tank and fuel expansion overflow capability. A float-type valve restricts flow through the vent during inflight maneuvering. Design features of the vent prevent it from becoming blocked by inflight ice accumulation.

Electric Boost Pump

The electric boost pump provides fuel pressure for engine starting, crossfeeding, and acts as a backup for the primary ejector pump. Operation is indicated by illumination of the L or R FUEL BOOST ON annunciator panel lights.

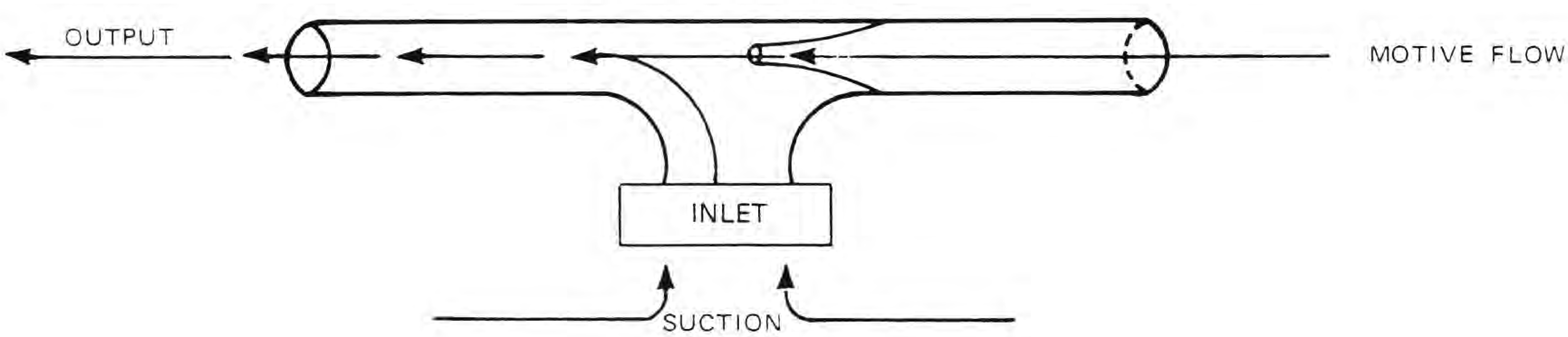
The pumps are controlled by a pair of three-position switches located on the left switch panel. The switches are marked OFF, NORM, and ON. In the OFF position, the boost pump is de-energized except when activated by engine start, or selection of crossfeed from that tank. In NORM, function is also automatic for start and crossfeed, and if activated by the pressure switch should output from the primary ejector pump be insufficient. The respective boost pump, when in OFF or NORM, is disabled any time the throttle is in cut-off to preclude pump activiation by low pressure sensing during shutdown. The ON position causes the selected pump to operate continuously regardless of throttle position.

To insure uninterrupted fuel flow to the engines, the boost pump switches must be positioned ON when the low fuel lights illuminate or at 170 pounds or less indicated fuel.

Ejector Pumps

Three ejector pumps in each fuel cell utilize existing fuel pressure in conjunction with a venturi to produce a high-volume flow. As high pressure fuel is forced through the ejector orifice, a low pressure area is created at the pump inlet drawing in a comparatively large volume of fuel and pushing it out at low pressure.

EJECTOR PUMP



The primary ejector pump uses bypass fuel from the engine-driven pump as its motive flow source to pick up fuel from the sump area and deliver it to the engine.

Two transfer ejector pumps in each tank operate similarly except that they use bypass fuel from the main supply line as a motive flow source. Their function is to insure a constant supply of fuel to the sump by scavenging from the lowest point in the cell.

Crossfeed

Controlled by a selector on the left switch panel labeled LH TANK . . . OFF . . . RH TANK, crossfeed allows both engines to be supplied from one fuel cell.

Selecting either tank automatically turns on the electric boost pump in that cell, opens both crossfeed valves, and three seconds later closes the motive flow shutoff valve on the side not selected. Returning the selector to OFF reverses the sequence. A green INTRANSIT light above the selector illuminates any time the crossfeed valves are not fully closed or open, or do not coincide with switch position.

When crossfeed is selected, it is possible for a pressure spike to activate the fuel boost pump in the tank opposite the one selected. If this occurs, both fuel boost pumps would be operating causing equal fuel pressures on both sides preventing crossfeeding. When initiating system operation, monitor the FUEL BOOST ON annunciator panel lights and if both illuminate, cycle the fuel boost switch for the non-selected tank to OFF and back to NORM. This deactivates the boost pump in the tank not selected and allows normal crossfeed.

Operationally, it is seldom necessary to balance the fuel load by crossfeeding unless single engine operations have been conducted or an uneven load was acquired during fueling. Maximum allowable fuel imbalance is 800 pounds.

Engine Fuel System

The single-stage, engine-driven pump mounted on the accessory gearbox supplies high pressure flow to the fuel control unit. Fuel enters the pump at 20-30 PSI from the primary ejector pump. The engine-driven pump increases this pressure to 500-700 PSI. Part of the pump output is bypassed through the motive flow valve to drive the primary ejector pump and the remainder is directed downstream to the fuel control. This positive pressure to the fuel control must be maintained by the engine-driven pump for the engine to continue to operate.

The fuel control unit is mounted on the engine-driven fuel pump and determines the proper fuel schedule for all phases of engine operation.

A flow divider downstream of the fuel control unit provides proper fuel distribution to the combustion chamber by dividing the flow from the fuel control between the primary and secondary fuel manifolds. It also acts as a fuel shutoff valve, bypassing fuel back to the pump. When the throttle is closed, fuel flow is terminated at the flow divider and the fuel manifold is drained. On 500-0001 thru -0213 not incorporating SB71-2 a fuel canister is used which collects the fuel at engine shutdown and vents it

Fuel Shutoff

Electrically-operated firewall shutoff valves can be individually closed by depressing the LH or RH ENG FIRE button. Actuation of a shutoff valve will be indicated by illumination of the respective L or R F/W SHUTOFF annunciator panel light.

Protection against severe overspeed or explosive structural failure of the engine is provided by an automatic fuel shutoff. It is actuated through mechanical linkage should .070 inch rearward displacement of the turbine shaft take place. Fuel flow to the manifold is terminated, automatically shutting down the engine.

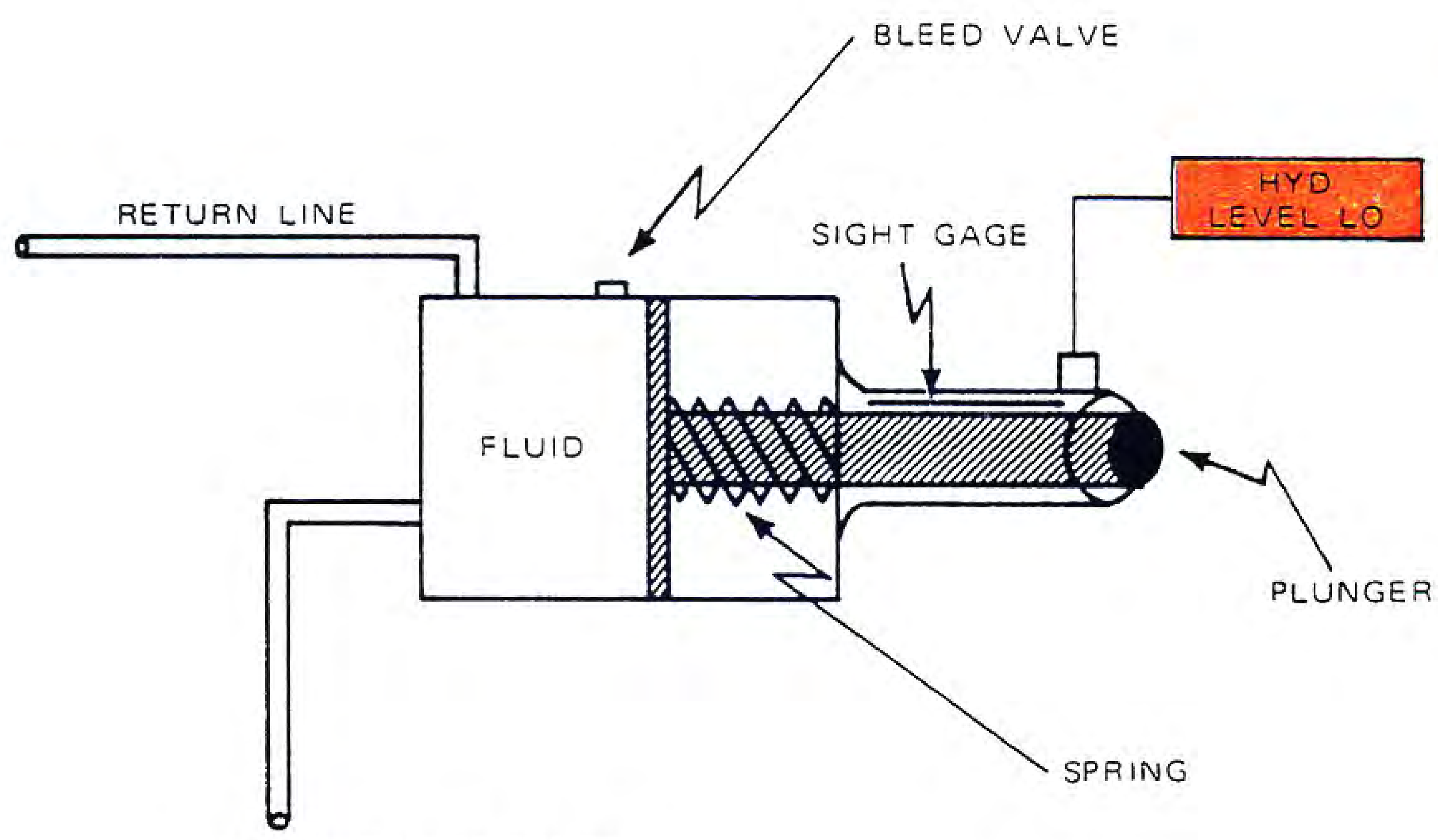
A manual shutoff and tank drain is located in each wing root for use by maintenance personnel.

HYDRAULIC

An open center hydraulic system operates the landing gear, speedbrakes and optional thrust reversers. A separate independent system is used for the main wheel brakes.

In the open center system, fluid continually circulates between the hydraulic lines and the reservoir at a pressure of approximately 60 p.s.i. This very low pressure greatly reduces the quantity of hydraulic fluid required in the reservoir because there is minimum fluid heat buildup. Low pump wear and low system leakage rates are additional benefits of the open center system.

Reservoir



The fluid for the system is contained in an accumulator type reservoir located in the aft tailcone area. The quantity of fluid is shown by a plunger-type sight gauge located on the aft side of the reservoir The refill, full and overfill indications correspond to .2, .5, and .6 gallons respectively. A microswitch attached to the accumulator plunger will activate a HYD LEVEL LO annunciator panel light any time the fluid level drops below the refill position. Servicing requires equipment capable of delivering hydraulic fluid under pressure. Bleeding or relieving an overfill condition is accomplished by opening a drain valve located on the reservoir. Excess fluid is drained overboard through the underbelly vent mast.

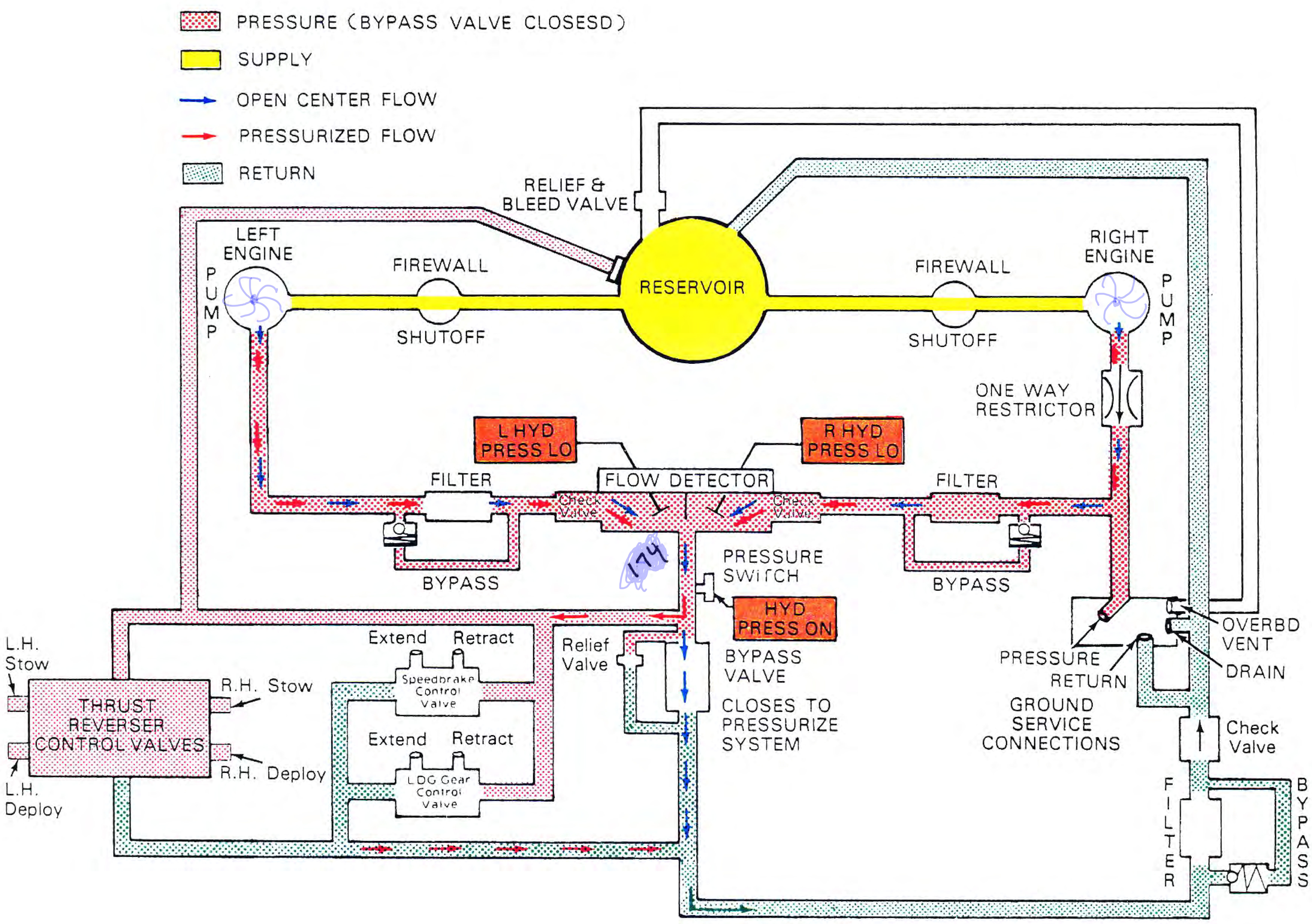
Pumps

Hydraulic pressure is provided by two positive displacement engine-driven pumps, each mounted on the engine accessory case. Either pump is capable of supplying enough pressure to operate the gear, speedbrakes and reversers. From each pump, hydraulic fluid is routed through filters and bypass valves to the flow detector assembly. This consists of two check valves with a common outlet and a differential flow detector. If the individual pump pressures should differ by 25 p.s.i. or more, the respective HYD PRESS LO annunciator panel light will illuminate.

C

Normal Operation

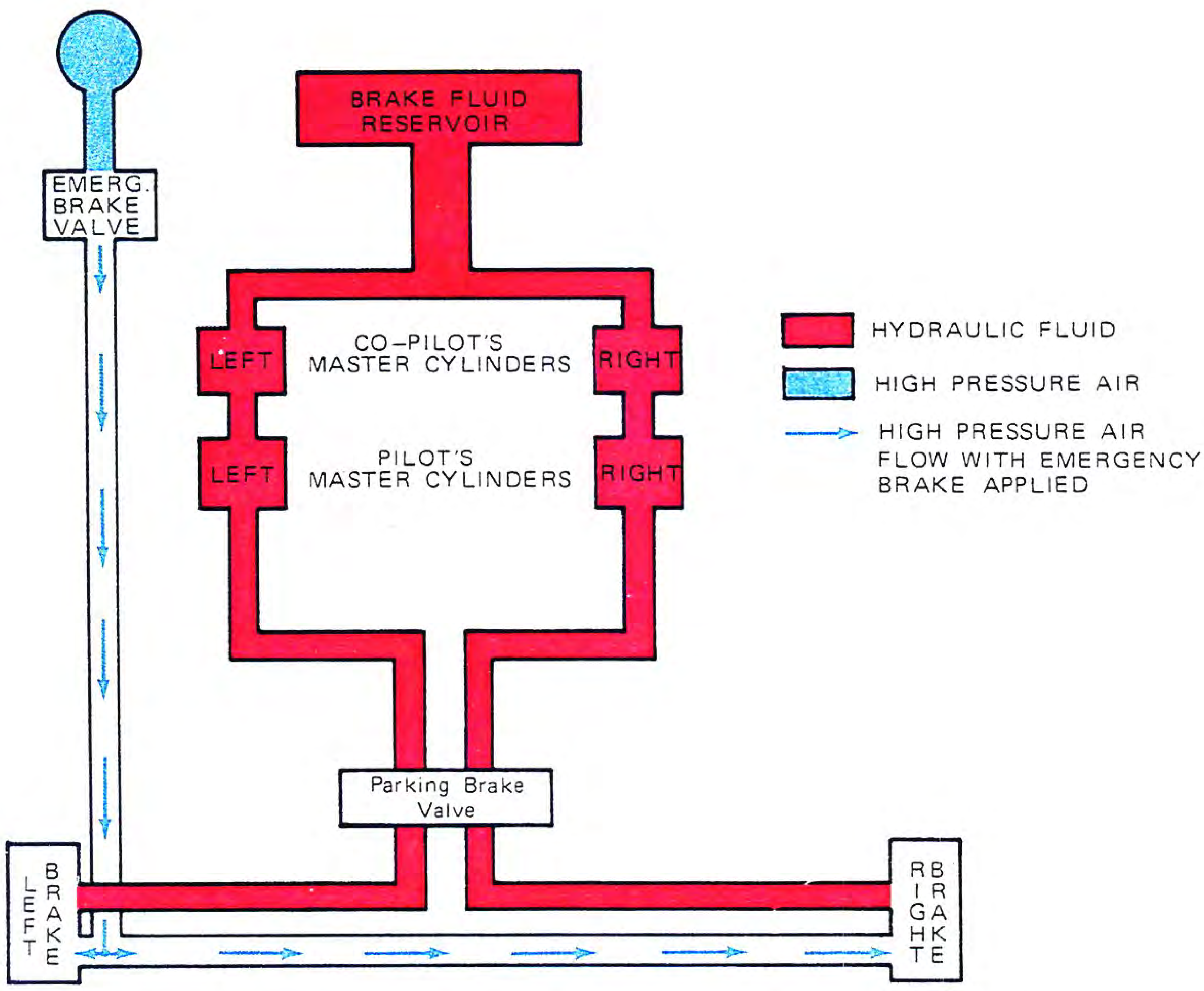
When either the landing gear, speedbrakes or optional thrust reversers are actuated, a bypass valve in the return line closes enabling the system to pressurize to 1,500 p.s.i.. At the same time, either the speedbrake landing gear or thrust reverser control valve opens allowing pressure to go to the selected system. A relief valve which maintains system pressure at 1,500 p.s.i. is in parallel with the bypass valve. The relief valve cracks at 1,350 p.s.i. and is fully open at 1,500 p.s.i.. The HYD PRESS ON light illuminates on the annunciator panel any time the system is pressurized. Once the selected cycle is complete, the respective control valve closes, the bypass valve opens, and the system reverts to the low pressure, open center state.



C

Wheel Brakes

An independent, unpressurized system is used for the wheel brakes. Fluid is supplied from a reservoir mounted on the right front side of the forward pressure bulkhead. A sight gauge on the reservoir allows the pilot to visually inspect the brake fluid quantity during preflight. The fluid used in the brake system is the same type as the main hydraulic system.



Four brake master cylinders, one for each of the pilot's and co-pilot's pedals, are connected in series. When the brakes are applied, fluid to the inlet port of the master cylinder exerts pressure which forces fluid from the outlet port to the brakes. The amount of pressure going to the brakes is proportional to the amount of pressure exerted on the inlet side of the master cylinder by the brake pedals. With the brakes released, a check valve is held open allowing fluid to move freely in either direction.

A parking brake valve is incorporated in the system to maintain pressure on the brakes after the pedals have been depressed and the parking brake control handle pulled. With the handle off, the check valves are open and fluid can move freely in either direction. The parking brake valve assembly also has two thermal relief valves which open at approximately 1,000 p.s.i. to protect the brake system from being damaged by excess pressure resulting from expanding fluid.

Pneumatic pressure from the emergency air bottle backs up the normal system.

LANDING GEAR AND BRAKES

The landing gear is electrically controlled and hydraulically actuated. Each landing gear assembly uses a single wheel assembly and an oil over air strut. The nose gear has a chined tire for water and slush deflection. The main landing gear doors are mechanically connected to the main gear struts and extend and retract with the individual gear assemblies. The nose gear utilizes three doors. The rear door is mechanically connected to the nose gear strut and extends aft, or retracts forward with the nose gear assembly. The two forward double-action doors are mechanically linked to the nose gear. These doors close with the nose gear fully extended or retracted.

The gear actuators incorporate an internal lock to hold the gear in the extended position. They are held retracted by mechanical uplocks that are normally released hydraulically. The landing gear completes a retraction or extension cycle in approximately four seconds. The gear can be extended at airspeeds up to 176 KIAS.

Control

The landing gear control panel contains the landing gear handle, an audible warning system and horn silence switch, three gear safe indicators and a red unlocked indicator. The landing gear handle has two positions, full down and full up. The gear handle must be pulled out to clear a detent before it can be repositioned. Operation of the gear and doors will not begin until the handle has been positioned in one of the two detents. A gear handle locking solenoid activated by the left main gear squat switch physically prevents inadvertent movement of the gear handle while on the ground.

Extension and Retraction

In a landing gear retraction cycle, the following takes place:

(1) With weight off the left landing gear squat switch, power is applied to the solenoid lock, allowing the landing gear handle to be placed in the up position.

(2) Actuation of the gear handle to the UP position:

...lights the GEAR UNLOCKED warning light when a gear unlocks.

...closes the bypass valve in the hydraulic return line, pressurizing the system to 1,500 p.s.i..

...positions the landing gear control valve to route hydraulic fluid to the retract side of the hydraulic cylinders.

(3) The landing gear are mechanically held in place by the uplatches.

(4) Actuation of the three gear up microswitches:

...opens the bypass valve in the hydraulic system returning it to open center operation

...removes power from the landing gear control valve

...extinguishes GEAR UNLOCKED indicator light

The reversed sequence during a gear extension is identical with the following exceptions:

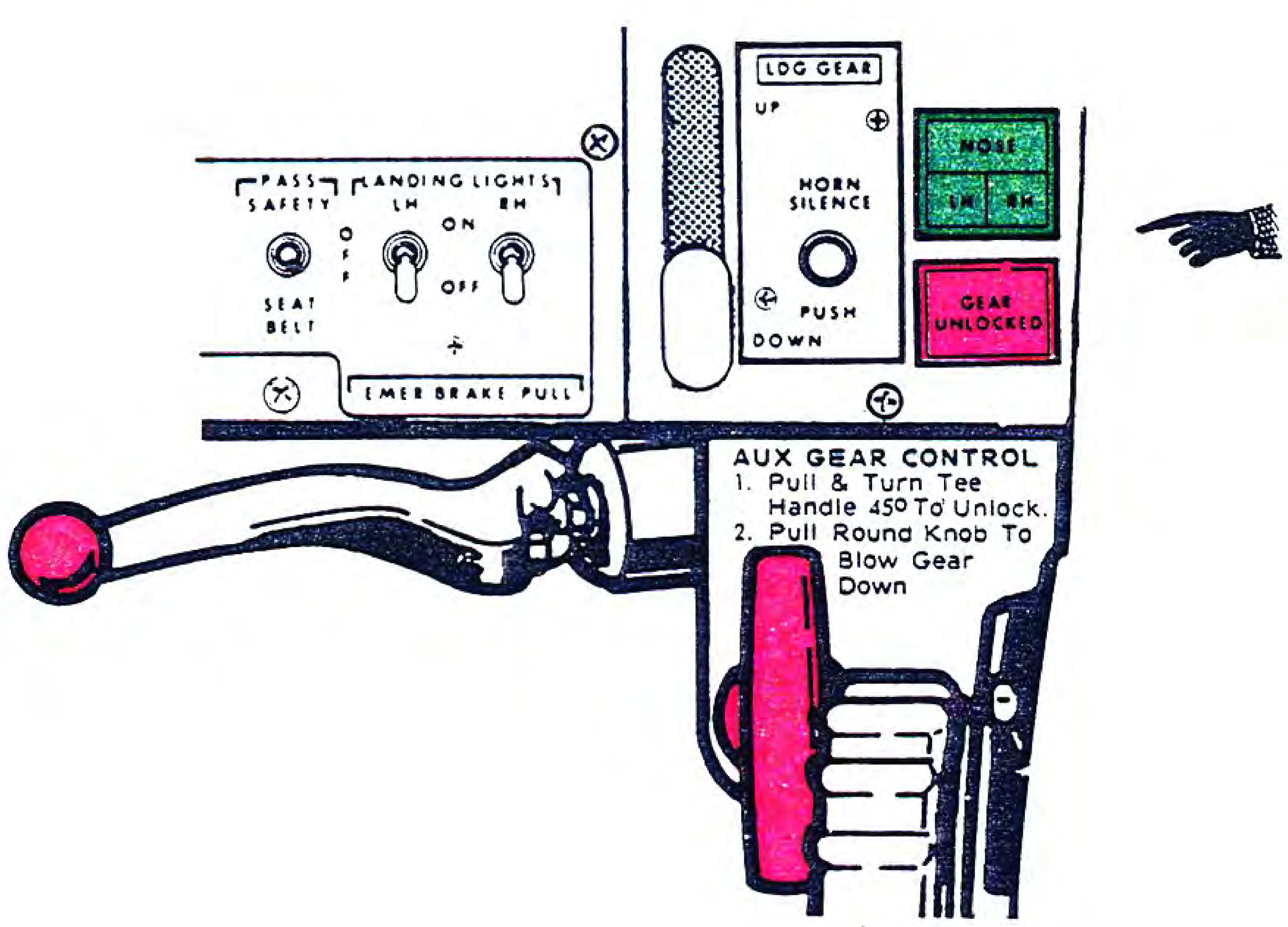
(1) Solenoid lock on landing gear handle is not in use.

(2) Gear handle to the DOWN position causes fluid to be routed by the control valve through the uplocks to release them, and then to the extend side of the actuating cylinders.

(3) "Gear Down" microswitches return hydraulic system to open center operation, and, when all gear are down-and-locked, extinguish GEAR UNLOCKED light and illuminate the green LH, RH, and NOSE gear indicating lights.

Position and Warning System

The landing gear position and warning system provides visual and audible indication of landing gear position. Three green safe lights and a red GEAR UNLOCKED light are located in a group adjacent to the gear control handle. Each green light corresponds to one gear, NOSE, LH, or RH and indicates that it is in the down and locked position. The red light indicates an unsafe gear position (intransit or not locked). The landing gear warning system sounds an audible warning if either throttle is retarded below approximately 70% N_2 and the gear is not down and locked. The warning horn can be silenced for this condition by depressing the horn silence switch. The horn will reset if the throttle is advanced. If the flaps are extended beyond the T.O. & APPR. (15°) position and the gear are not down and locked, there will be an audible warning that cannot be silenced.



Emergency Extension

In the event of normal system malfunction, a manually operated system is provided to release the landing gear for free fall extension.

The manual system is actuated by the red AUX GEAR CONTROL T-handle located under the pilot's instrument panel. The handle is pulled and rotated clockwise to lock. This action mechanically disengages the landing gear uplocks, allowing the landing gear to free-fall to the down and locked position and also unlocks the red, collar type, blow down knob. Yawing the airplane may be required to achieve green light indications and the pneumatic system should be used to assure positive locking of all three gear actuators.

Pulling the red, collar-type knob on the T-handle shaft mechanically ports the emergency air bottle into the extend side of all three landing gear actuators. The gear are driven to the down and locked position and normal indications will appear in the cockpit providing the gear handle is down. After actuation of the pneumatic system, the knob should be left in the extended position .

Wheel Brakes

Toe-actuated multiple disc brakes are installed on the main gear wheels. Braking can be accomplished by either of two independent systems; the normal brake hydraulic system, or the back-up pneumatic system. Normal braking can be applied from either cockpit seat. The emergency brake control is installed under the left instrument panel only.

If both pilots apply normal brakes simultaneously, the pilot exerting the most force on the pedals will be the one controlling the braking. The amount of pressure applied to the brakes is always proportional to the amount of force applied at the brake pedals.

An optional skid warning system, which warns the pilot of impending wheel lock up due to excessive braking, is discussed under the Test and Warning Chapter of this Section.

Anti-Skid System

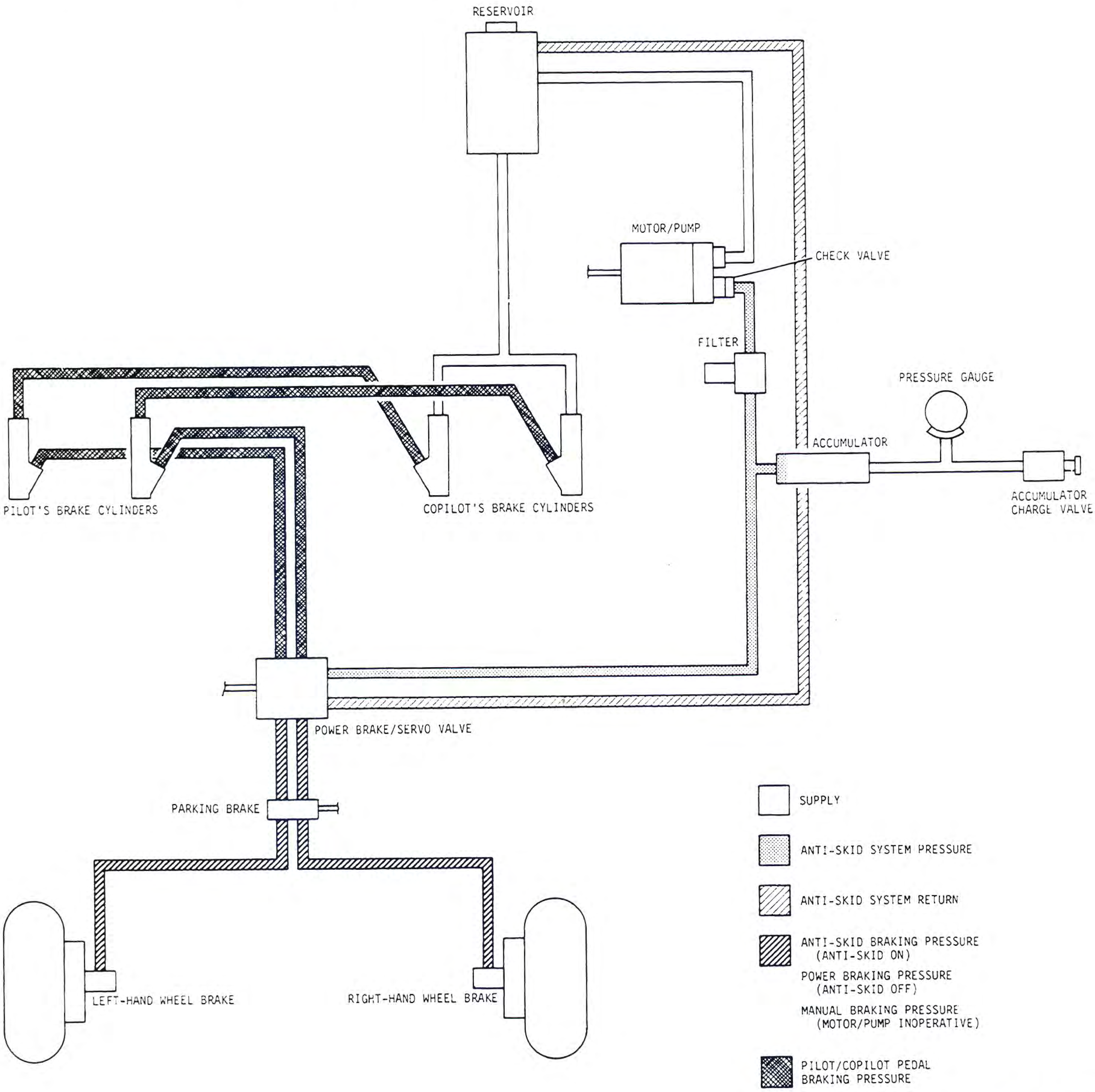
The optional anti-skid system enables the pilot to apply the maximum effective braking possible under all runway conditions. The system consists of electro-mechanical wheel speed transmitters, an electronic control module, a power brake and anti-skid valve, hydraulic pump, accumulator, reservoir, pressure and control switches and two indicator lights.

The wheel speed transmitter is bolted in the main gear axle with the drive shaft connected through a drive cap to the main wheel. As the wheel turns, the transmitter generates a 36 Hz signal for each wheel revolution that is sent to the control module as a variable frequency. The control module accepts the output of the left and right wheel speed transmitters and converts these signals to a DC voltage that is directly proportional to wheel speed. The voltage from the left and right wheel are averaged to provide a composite or reference voltage. Any significant variation between either wheel speed voltage and the reference voltage produces an error signal that activates the power brake and anti-skid valve which controls the amount of braking being applied against each wheel. At touchdown, the transmitter voltage reaches maximum as soon as the wheel spins up. As long as no skid occurs, the transmitter voltage follows wheel speed and the reference voltage follows the voltage of the transmitters. When excessive deceleration of a wheel occurs, transmitter voltage suddenly drops. An error signal is generated which energizes the servo valve segment of the power brake and anti-skid valve. The servo valve controls the movement of spools within the main body of the power brake and anti-skid valve which modulate the braking effort being applied by the pilot as required to maintain transmitter voltage and reference voltage within the skid limits, preventing the skid condition. When the airplane speed drops below ten knots the anti-skid function disengages.

Hydraulic power for the anti-skid system is provided by an electrically driven hydraulic pump located in the left-hand nose of the aircraft. An accumulator is installed in the system to maintain system pressure when the pump is not running. The pump is controlled by a pressure switch that opens when the pressure reaches 1300 psi and closes when the system pressure drops to 900 psi.

A switch on the instrument panel allows the pilot to select anti-skid ON or OFF. When the switch is in the ON position the anti-skid function is operational. With the control switch in the OFF position, the ANTI-SKID INOP light will illuminate on the annunciator panel and the pilot has power braking available without the anti-skid function. If the power system should fail, application of braking force will move shuttle valves in the power brake and anti-skid valve connecting the pilot and copilot master brake cylinders directly to the wheel brakes and manual braking will be available.

The anti-skid control module incorporates test circuitry which continually monitors the anti-skid system. If a fault is detected, the ANTI-SKID INOP light will illuminate on the annunciator panel. If hydraulic pressure in the power system drops below 750 psi the PWR BRK PRESS LO light will illuminate.



Parking Brake

The parking brake is a part of the normal brake system and employs check valves that prevent the return of fluid after the brakes have been released. Parking brakes are set by depressing the toe brakes and pulling out the black parking brake handle located under the lower left side of the instrument panel. The parking brake should not be set if the brakes are very hot. This increases brake cool down time due to decreased airflow, and may result in sufficient heat transfer from the brakes to cause the brake thermal relief valves to open or to melt the thermal relief plugs in the wheel causing deflation of the tire.

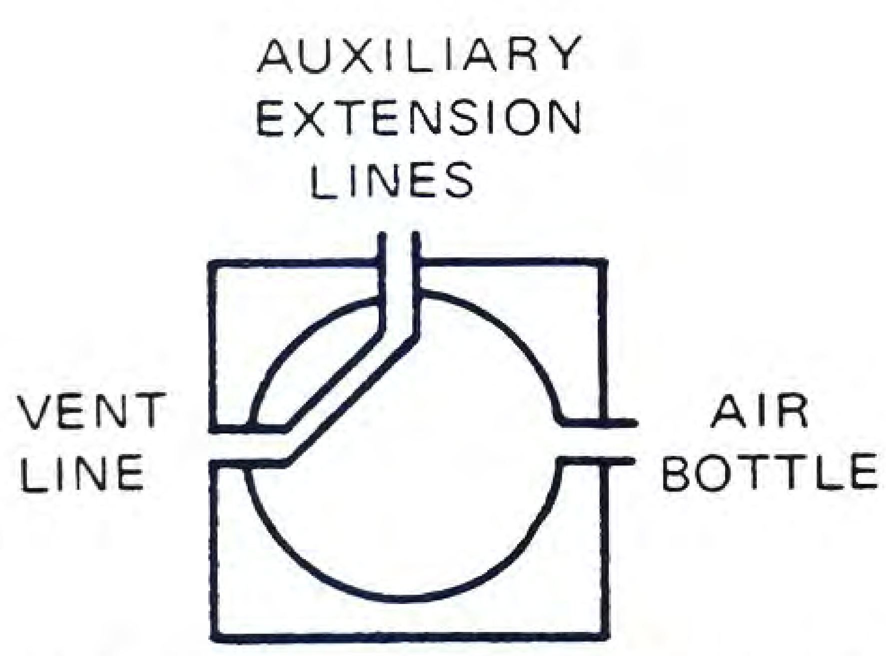
Emergency Braking

In the event of normal hydraulic braking system failure, a pneumatic system is available. The pneumatic pressure required is contained in the emergency air bottle and is controlled by a red lever located to the left of the AUX GEAR CONTROL T handle. Pulling the lever aft will apply equal pressure to both main landing gear brake assemblies. Releasing the back pressure on the lever and allowing it to move forward will relieve the pressure. The air pressure to the brakes may be modulated to provide any braking rate desired, but differential braking will not be available. The emergency air bottle, when fully charged, contains sufficient pressure for ten or more full brake applications. For the most efficient use of the system, apply sufficient air pressure to the brakes to obtain the desired deceleration rate. Maintain that pressure until the aircraft is stopped. When the handle is released, residual air pressure from the brakes is exhausted overboard. Normal braking should not be applied while using the pneumatic brakes. Depressing the pedals will keep the shuttle valves in the brake lines open allowing high pressure air from the pneumatic system to enter the brake hydraulic reservoir and possibly rupture it. Adequate emergency braking for most conditions will be available from a properly serviced air bottle even if the landing gear have been extended pneumatically.

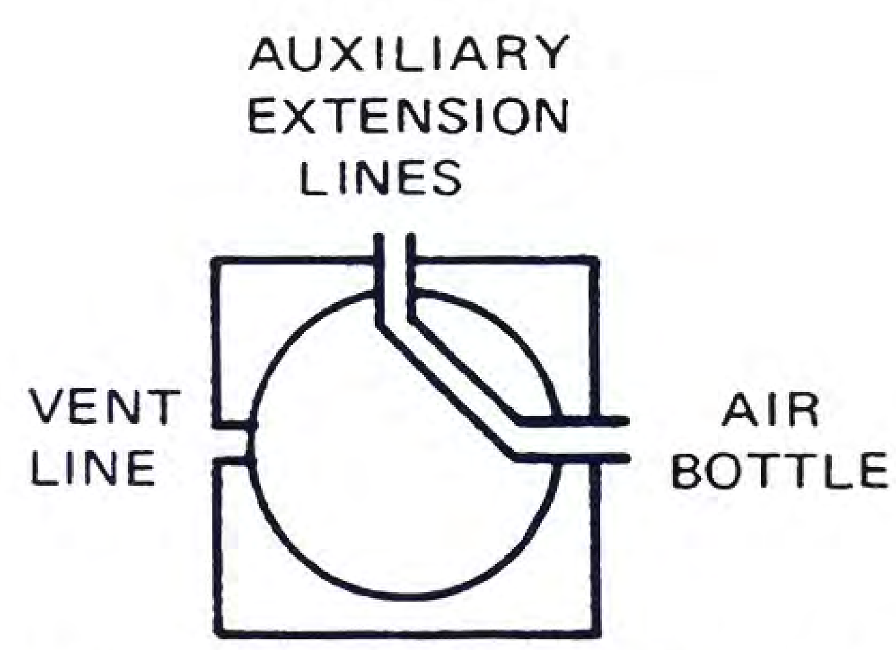
PNEUMATIC

An air bottle is located on the right side of the forward pressure bulkhead to provide for emergency extension of the landing gear, and/or emergency braking. The bottle is properly serviced at 1,800 - 2,000 p.s.i. and can be checked on preflight by a gauge visible in the right forward baggage compartment. A relief valve on the bottle will rupture at 4,000 p.s.i. if the bottle becomes over pressurized.

The bottle has outlets to the vent line, the gear auxiliary extension line, and the brake air pressure line. The landing gear auxiliary extension line is normally connected to the vent line.



VALVE WITH CONTROL HANDLE
IN NORMAL POSITION



VALVE WITH CONTROL HANDLE
IN EXTEND POSITION

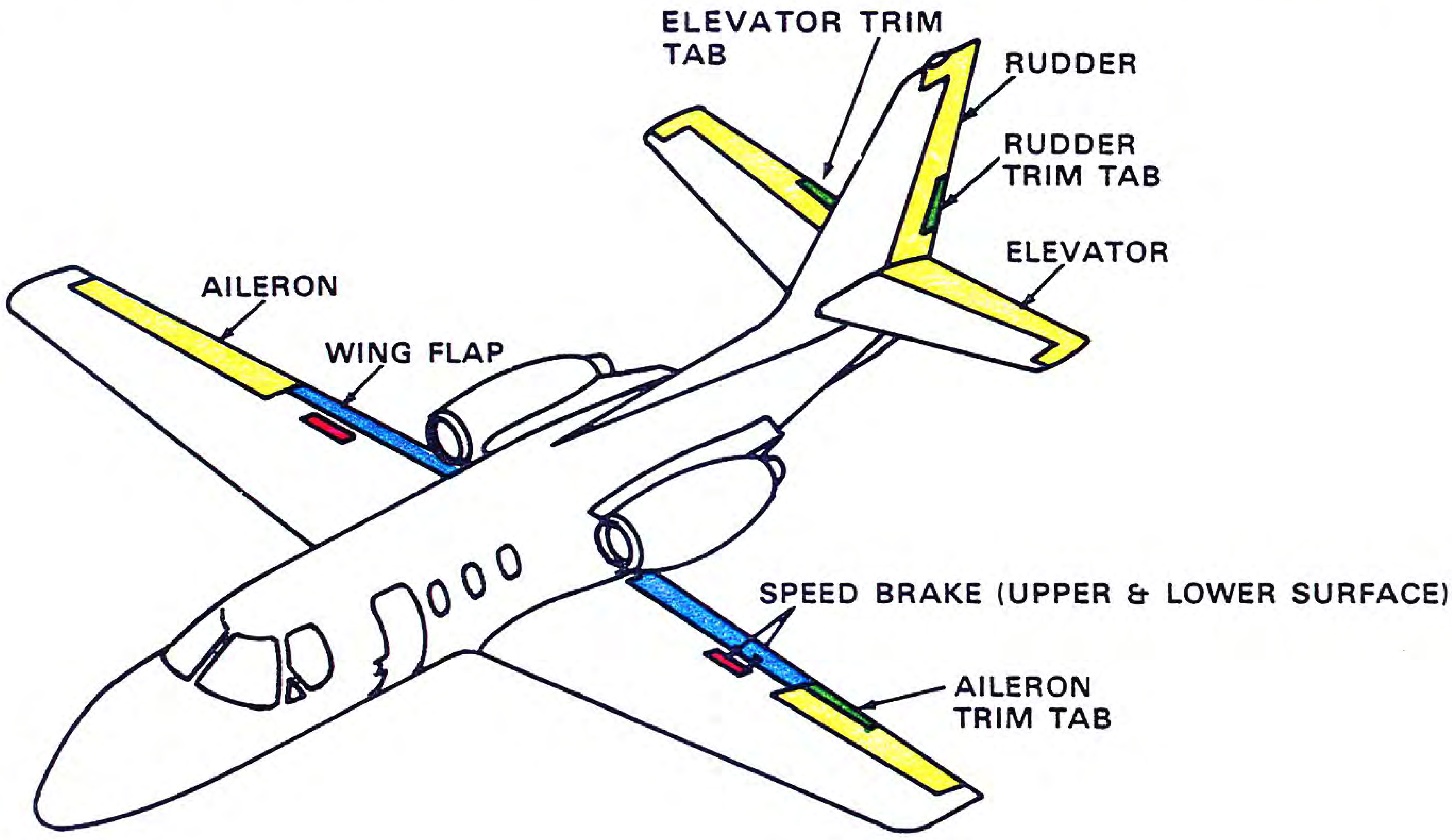
When the collar-type knob on the AUX GEAR CONTROL T-handle shaft is pulled, a valve is repositioned to direct air from the bottle through the auxiliary extension lines to the extend side of the landing gear actuators.

Emergency braking is controlled through a manually operated, two-way pressure regulating valve. Air from the bottle is connected directly to the inlet port of the valve by the brake air pressure line. The outlet port is connected to the brakes and is normally vented to an exhaust line. When the emergency brakes are applied, the vent is closed, the inlet port opens, and high pressure air is applied to the brakes. Releasing the emergency brake handle opens the vent relieving pressure. This allows modulation of the system to obtain the desired braking force. Each time the handle is cycled causes some air pressure to be vented overboard reducing the emergency bottle supply.

FLIGHT CONTROLS

All aerodynamic controls, with the exception of the flaps and speedbrakes, are mechanically actuated by cables. The ailerons, elevator, and rudder have trimmed control surfaces and cockpit trim position indicators.

Flaps are electrically powered and can be operated to 15° at 202 KIAS or below, and 40° (full travel) at 176 KIAS or below. Spoiler-type speedbrakes are hydraulically actuated and electrically controlled and can be extended throughout the flight regime.



Ailerons

The ailerons provide excellent lateral control throughout the entire operating envelope. Full range of travel is 21° (±1) up, and 16° (±1) down. Neutral for the ailerons is 2° down from the faired position to enhance low speed control. One trim tab, located on the left aileron, is mechanically controlled by a knob on the center pedestal. An indicator on the pedestal shows the amount of trim selected in relation to a neutral position. Full travel of the tab is 20° (± 1) up and down.

Elevator

Elevator control is mechanical through four cable assemblies. Full elevator travel is through a range of 20°(±1) up to 15°(±1) down. An elevator trim tab installed on the right elevator can be positioned electrically or mechanically through cockpit trim tab actuators. On 500-0001 thru -0129, full travel of the tab is 7°(±1) up, and 18°(±1) down. On 500-0130 and On, full travel of the tab is 10°(±1) up, and 19°(±1) down. An elevator trim wheel on the pedestal provides manual trim control. A trim switch located on the left side of the pilot's control wheel controls an electric trim motor which in turn positions the elevator tab. An optional trim switch is located on the copilot's control wheel. If the electric trim malfunctions, it can be overriden by the manual trim system; or disabled by pressing the AP/TRIM DISC switch on the pilot's or copilot's yoke.

Rudder

Rudder control is very effective at all flight speeds. Full rudder deflection is 22° (±1) either side of center. The rudder trim tab is a servo type which reduces pedal pressures and provides adjustable trim. For each degree of angular displacement of the rudder, the trim tab will move approximately one-half degree in the opposite direction. The rudder trim is mechanically operated by the rudder trim wheel on the center pedestal. With the rudder in the trail position, the trim tab will deflect 10° (±1) left and right. An indicator on the pedestal shows trim tab position relative to neutral.

Nose Gear Steering

The nose gear is mechanically steered by the rudder pedals to 20° either side of center. (On 500-0001 thru -0100 the mechanical steering limits are 11° either side of center). Steering is accomplished through mechanical linkage with a bungee that allows the nose gear to center before entering the wheel well on retraction. Additional castering of the nose wheel can be achieved against the bungee by application of differential power and braking. For ground handling and towing, maximum deflection of the nose wheel is 95° either side of center.

Speedbrakes

The speedbrakes are installed on the upper and lower surfaces of each wing to permit rapid rates of descent without exceeding V_{MO}/M_{MO} and to spoil lift during landing roll. The speedbrakes are electrically controlled and hydraulically actuated by a switch located on the throttle quandrant and may be selected to the fully extended or fully retracted positions. The angular travel for the upper speedbrake panels is 60° (±2). The lower speedbrake panels deflect 83° (± 2).

When the speedbrake switch is positioned to EXTEND, electrical power is applied to close the bypass valve in the hydraulic system return line and open the speedbrake control valve. This allows hydraulic fluid at 1500 p.s.i. to flow to the extend side of the speedbrake actuators. Once the speedbrakes are extended, the speedbrake control valve closes to create a hydraulic lock and hold the speedbrakes open. The bypass valve opens and the hydraulic system returns to an open center condition. Moving the speedbrake switch to RETRACT again pressurizes the system, and the speedbrake control valve allows fluid to go to the retract side of the speedbrake actuator.

When the speedbrakes are fully retracted, the control valve closes, the hydraulic system bypass valve opens, and open center operation resumes.

On airplanes incorporating SB27-9 microswitches in the tailcone prevent speedbrake extension at engine power settings above approximately 85% N_2 unless the speedbrake switch is manually held in the EXTEND position. On airplanes not incorporating SB27-9, if the speedbrakes are extended at lower power settings and the throttles are subsequently advanced above 85%, the speedbrakes will retract and the switch will return to the RETRACT position.

In the event of an electrical failure while the speedbrakes are extended, the control valve fails to the open position and the speedbrakes will trail. If a dual hydraulic pump failure or fluid loss should occur with the speedbrakes extended, moving the switch to RETRACT will de-energize the speedbrake control valve and the speedbrakes will trail.

Flaps

The slotted trailing edge flaps are mechanically controlled and electrically actuated by two geared motors connected in parallel. The design of the drive system and parallel operation of the flap motors is designed to preclude the possibility of a split flap condition. Flap travel is from 0 to 40 degrees and any intermediate position can be selected. A mechanical detent is installed at the T.O. & APPR. (15°) position of the flap lever. The full flap position is reached by pushing down on the flap lever when passing through the T.O. APPR. detent. A warning horn will sound any time the flaps are selected past the T.O. & APPR. position with the gear not down and locked. The horn cannot be silenced.

Control Lock

The control lock is mechanically operated and when engaged locks the ailerons, elevators and rudder in the neutral position, and the throttles in the OFF position. The control lock handle, located below the instrument panel on the left side, controls the system. When the handle is pulled straight aft to the detent, the flight controls and throttles are locked. To release the control lock system, rotate the T-handle 45°clockwise and push it in. The controls should be neutralized before engaging the lock. Towing the aircraft with the controls locked may cause excessive force to be placed on the springs in the rudder mechanism and should be avoided.

ELECTRICAL

Electrical power is normally supplied by two 28 volt DC, 400 ampere, engine-driven starter/generators. A 24 volt, 39 ampere hour, nickel cadmium battery is located in the tailcone compartment to supply power for starting and emergency requirements. A receptacle below the left engine pylon is provided for connection of an external power unit.

On 500-0001 thru -0274, alternating current is provided by two 600 VA static inverters that convert 24 or 28 volt DC into 115 and 26 volt, 400 Hz, AC power. When the inverter transfer switch is in the NORM position, the left-hand (No. 1) inverter supplies power to the Flight Director AC bus and the right-hand (No. 2) inverter supplies power to the Radar AC bus. Both inverters operate continuously. With the inverter transfer switch in the X OVER position, No. 1 inverter powers the Radar AC bus and No. 2 inverter powers the Flight Director AC bus. This provides for AC power selection to either bus in the event of an inverter failure as indicated by illumination of the F/D AC PWR FAIL or RAD AC PWR FAIL annunciator light.

On 500-0275 thru -0349, alternating current is provided by two 300 VA (or optional 600 VA) static inverters that convert 24 or 28 volt DC into 115 and 26 volt, 400 Hz AC power. Only one inverter operates at a time as indicated by the position of the Avionic Power Switch in INV 1 or INV 2. Illumination of the AC FAIL annunciator indicates a failure of the selected inverter requiring repositioning the Avionic Power switch to the other inverter.

DC Power

The DC power distribution system consists of the starter/generators, battery, indicators, switches, and bus networks. 500-0275 thru -0349 have an avionics master switch not available on earlier aircraft. Normally the left generator powers the left main DC bus, and the right main DC bus receives power from the right generator. Both operate in parallel, but in the event either generator is off the line, the battery bus acts as a cross tie so that the remaining generator will power both main DC buses. These supply power for all DC functions except engine starting.

ELECTRICAL

Generators

A generator control unit provides static regulation, overvoltage, feeder fault, and ground fault protection for each generator. Three-position L and R generator switches are marked GEN, OFF and RESET. In the GEN position, generator control is automatic for regulation, protection, and load bus connection. This is the normal switch position for battery starting and all flight modes. Placing the switch to OFF isolates the generator from its load bus. The momentary RESET position resets a generator that has been tripped as a result of an overvoltage, feeder fault, or engine fire switch actuation.

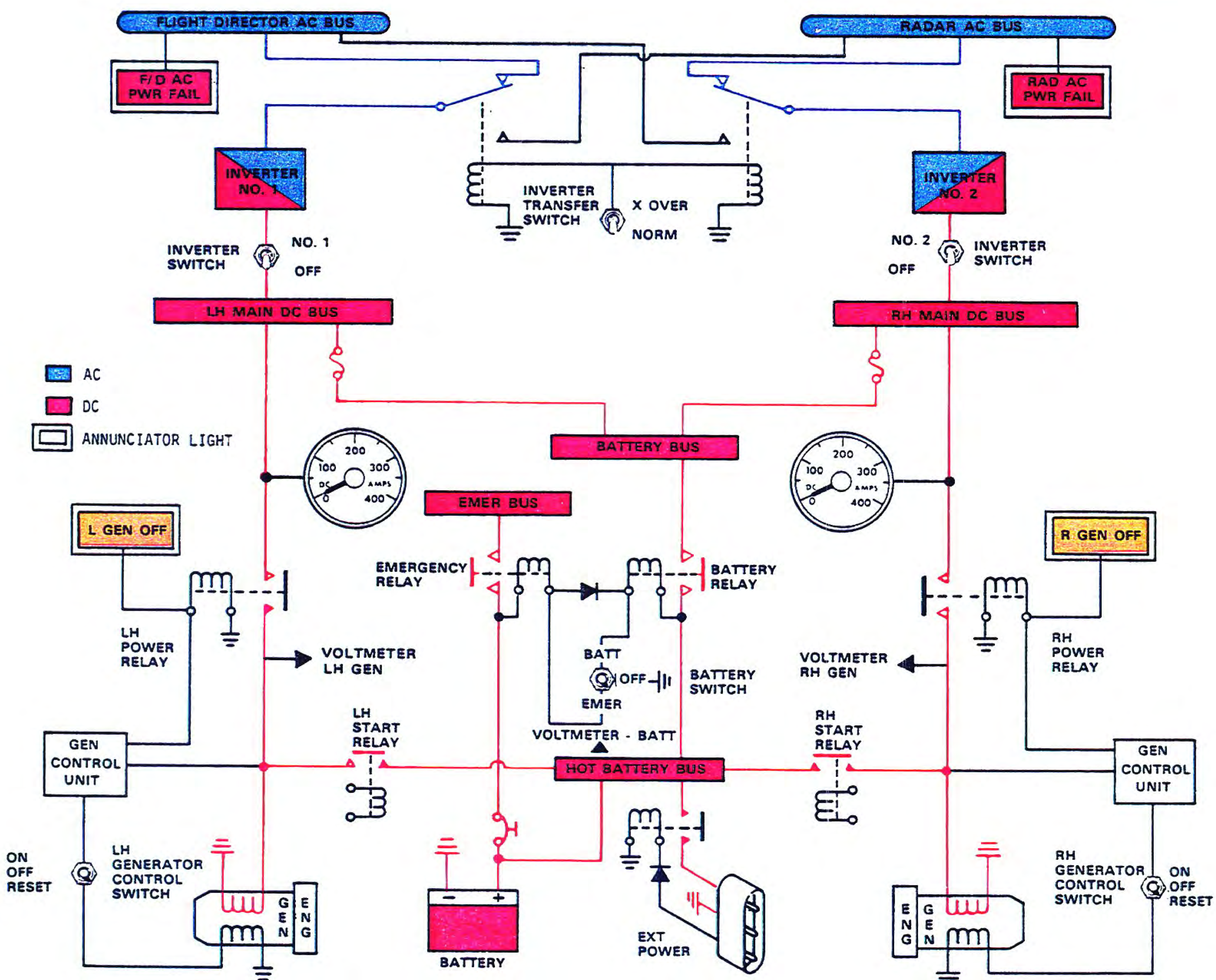
Each starter/generator is capable of a 50% overload (600 amps) for five minutes. Maximum total aircraft load with all electrical equipment operating is approximately 425 amps. For operation above 35,000 feet sustained generator load is limited to 325 amps.

Battery

The battery is a secondary source of DC power available to supply the distribution system prior to start, or in the event of generator failure. The three-position control switch is labeled BATT, OFF, and EMER. Placing the switch to the BATT position closes the battery and emergency relays and powers the battery bus, emergency bus, and both main DC buses. This position also enables external power to supply the entire system. In the OFF position, battery or external power is isolated from all but the hot battery bus.

The hot battery bus is energized any time the battery is installed or external power is connected. It powers the emergency exit lights, tailcone light, passenger advisory light, optional nose baggage compartment light, and in 500-0071 thru -0274 an aft baggage compartment light.

In the EMER position, battery or external power is connected only to the emergency bus which supplies COMM 1, NAV 2, the PN-101 compass system, and cockpit floodlights.

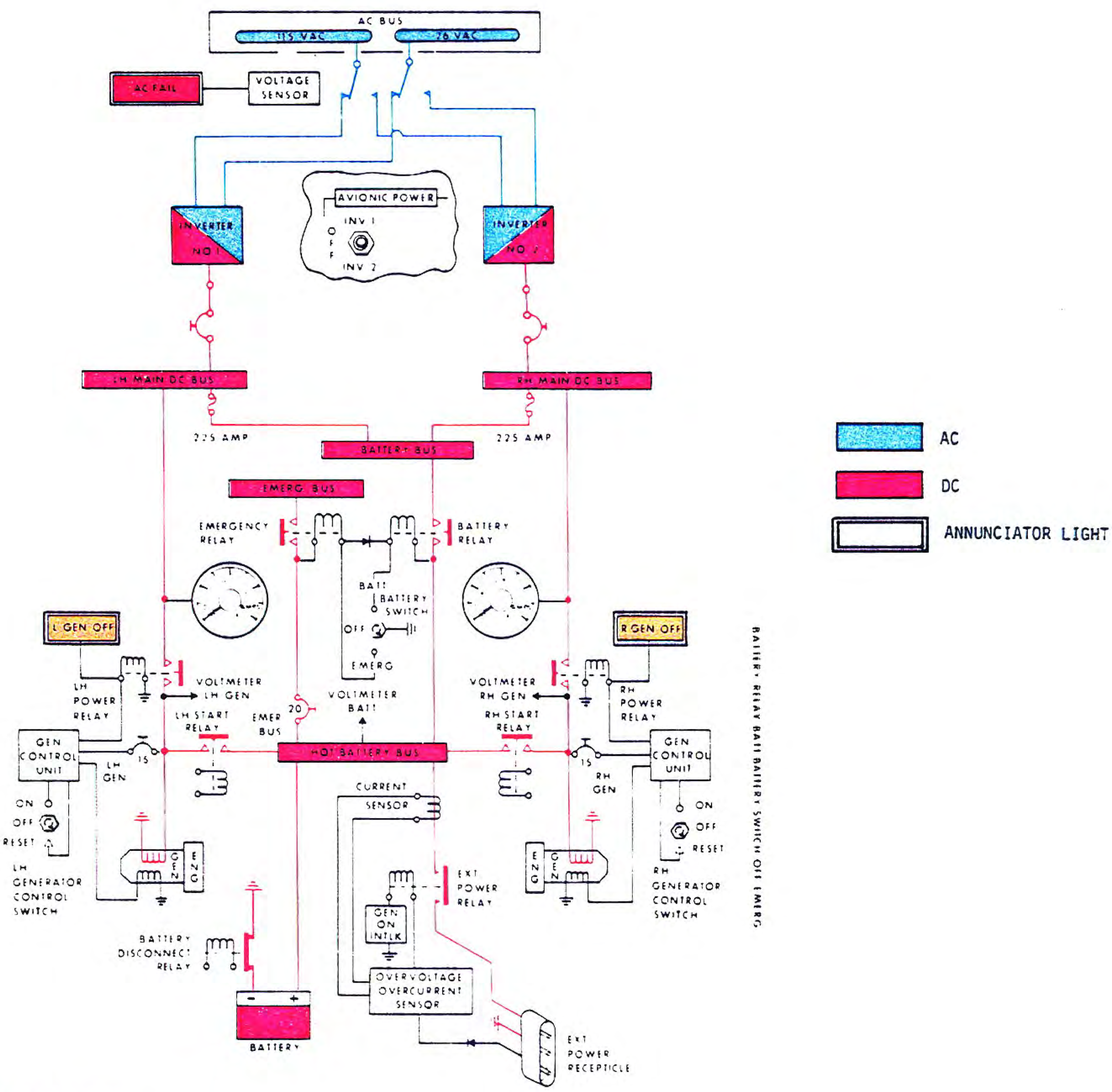


External Power

External DC power can be connected to the aircraft through a receptacle located on the left side of the fuselage. When external power is connected, the external power

The hot battery bus is energized any time the battery is installed or external power is connected. It powers the emergency exit lights, tailcone light, passenger advisory light, optional nose baggage compartment light, and an aft baggage compartment light. A battery disconnect relay between the battery and ground is located in the left-hand junction box. During each engine start using external power, the battery disconnect relay will automatically open, interrupting battery power to the hot battery bus. The relay will close automatically at the end of the start cycle.

In the EMER position, battery or external power is connected only to the emergency bus which supplies COMM 1, NAV, the co-pilot's compass system, and cockpit floodlights.



External Power

External DC power can be connected to the aircraft through a receptacle located on the left side of the fuselage. When external power is connected, the external power relay energizes and connects the power source to the hot battery bus. Positioning the BATT switch to ON energizes the battery and emergency relays allowing external power to be connected to the entire DC system. Ground power requirements dictate a 28 volt unit, with an 800 to 1,000 amp peak capacity and a soft start capability.

DC Power Indicators

The indicators consist of two ammeters, a voltmeter and two generator failure lights. The ammeters function as loadmeters indicating the load being carried by each generator.

The voltmeter is wired through the battery switch and will indicate the voltage of the hot battery bus any time the battery switch is in the BATT or EMER position. The voltmeter selector switch can be rotated to the LH or RH GEN positions to check generator voltage output. Since the voltmeter reads the highest voltage on the bus, an accurate check of one generator is obtained only with the opposite one off the line.

Should either generator fail, the associated power relay will open, removing the generator from the system and illuminating the appropriate L or R GEN OFF annunciator panel light. Should both generators fail, the master warning light will also illuminate. This is the only condition under which amber annunciator light illumination will trigger the master warning.

Emergency Battery

Placing the battery switch in the EMER position opens the battery relay. The emergency relay will remain closed. This disconnects the main DC buses and the battery bus from the battery and connects it directly to the emergency bus. All electrical equipment will be inoperative except COMM 1, NAV 2, the co-pilot's compass system, and cockpit floodlights.

With both generators off the line and the battery switch in the EMER position, annunciator lights, gear indicator lights, pitot heat, fire warning and fire bottle discharge are some of the more important items that the pilot should be aware will be inoperative.

Going to EMER with either or both generators on the line will have no effect except that the battery will not charge. Placing the battery switch to OFF with either or both generators on the line will turn off COMM 1, NAV 2, the co-pilot's compass system, cockpit floodlights, and the battery will not charge. The emergency bus must be energized for those four items to be powered. This requires the battery switch to be in either BATT or EMER regardless of other power that may be supplied to the main DC buses.

Engine Starting

Depressing either engine start button closes the respective start relay and provides DC power to the engine starter. Power to close the solenoid start relays and energize ignition comes from the battery bus requiring the battery switch to be in the BATT position. Automatic ignition sequencing takes place with both engine ignition switches in the NORM position.

A white light in each start button indicates that solenoid power has been supplied to the respective start relay. After the engine starts, a fuel pressure switch in the motive flow line removes the power from the start relay, engine ignition, and button light. In the event that the start relay does not open, an overspeed sensor in the starter will open to prevent starter damage. The start sequence can be terminated at any time by pushing the cockpit STARTER DISENGAGE switch between the start buttons which will open the start relay and halt the start sequence. During engine start, when the generator output exceeds battery voltage and/or is in parallel with the other generator (within 40 amps), the starter/generator reverts to generator operation. The power relay closes and supplies power to the respective DC bus. Current will then flow from either main DC bus through the battery bus, battery relay and hot battery bus, providing battery charging.

The CITATION is equipped with a cross start capability which utilizes the generator of an operating engine to assist starting the second. This is accomplished by both start relays closing when the second start is initiated routing power through the hot battery bus to the other engine. On all cross starts, the operating engine should be set at 48-50% N_2 to assure proper torque on the generator shaft. Excessive, or low RPM may cause damage. For that reason, the cross generator start capability is disabled with weight off the left main gear squat switch to preclude its use with high flight idle RPM at altitude.

When starts are being made on external power, the generator switches are placed in the OFF position until both engines are out of the start sequence. This prevents motorizing a generator and insures both starts are made on APU power. It is possible that if the voltage of the external power unit exceeds 28 volts that neither generator will come on the line until the external power is disconnected since the power relays will not close until generator voltage exceeds bus voltage. For battery starts and under all normal flight conditions, the generators are left in the GEN position.

AC Power

The AC power distribution system consists of the AC POWER switches, two 115 VAC/26 VAC, 400 Hz static inverters, a Radar bus, a Flight Director bus, crossover circuitry and annunciator panel lights. Each inverter converts 28 volts DC into AC power, with a maximum output of 600 VA.

The No. 1 inverter normally powers the flight director and autopilot through the Flight Director AC bus. The No. 2 inverter normally powers the weather radar and the optional Bendix radio altimeter, when installed, through the Radar AC bus. (The optional Collins radio altimeter uses 28 volt DC from the right main bus and incorporates its own inverter). Weather radar stabilization, however, gets its information from the flight director system vertical gyro.

Should an inverter fail, a two-position switch is provided to cross inverter power over from its normal bus to the opposite one. In NORM, the No. 1 inverter powers the Flight Director AC bus, and No. 2 powers the Radar AC bus. Placing the switch to the XOVER position connects the No. 1 inverter to the Radar bus, and the No. 2 to the Flight Director bus. The pilot is able to select whether the radar or the flight director/autopilot remains operative in the event of an inverter failure.

A red F/D AC PWR FAIL or amber RAD AC PWR FAIL light will illuminate on the annunciator panel with the loss of an inverter. The F/D AC PWR FAIL light also causes the master warning lights to flash. Any time an inverter voltage exceeds 130 VAC or falls below 90 VAC, the appropriate warning light will illuminate. It is not possible to tell from the cockpit if the inverter has completely failed or if an abnormally high or low voltage condition caused the failure light. Therefore the failed inverter should be turned OFF prior to selecting XOVER. This will prevent an irregular voltage condition from affecting equipment on the opposite bus.

When AC power is not being supplied to the radar bus, the radar should be turned off to preclude overheating of the DC components. When AC power is not supplying the Flight Director bus, weather radar antenna stabilization will be lost because its information source, the flight director vertical gyro, will not be powered.

that if the voltage of the external power unit exceeds 28 volts that neither generator will come on the line until the external power is disconnected since the power relays will not close until generator voltage exceeds bus voltage.

An overcurrent and overvoltage protection system is provided during use of an APU. The control unit monitors the external power unit voltage and will de-energize the external power relay if the voltage is above 32.5 volts. During an engine start using the external power unit, a signal is applied by the current to the control unit. If the signal indicates more than 1200 $\pm$ 100 amps for two seconds or more, the control unit will de-energize the external power relay and terminate the start. External power cannot be reapplied to the aircraft until the current has been interrupted after the start termination for the current protection or until the voltage is reduced below 32.5 volts for the voltage protection.

For battery starts and under all normal flight conditions, the generators are left in the GEN position.

AC Power

The AC power distribution system consists of a 3 position AC POWER switch, two 115 VAC/26 VAC, 400 Hz static inverters, an AC bus and an annunciator panel light. Each inverter converts 28 volts DC into AC power, with a maximum output of 300 VA.

Either inverter normally supplies the total AC power requirements for all equipment. This equipment includes the flight director, autopilot, radar, course information for the NAV receivers, the RMI's, pilot's ADI and HSI and the pilots altimeter. If a second flight director is installed the second flight director and co-pilot's ADI and HSI also require AC power and are supplied from the same inverter as supplies the other systems.

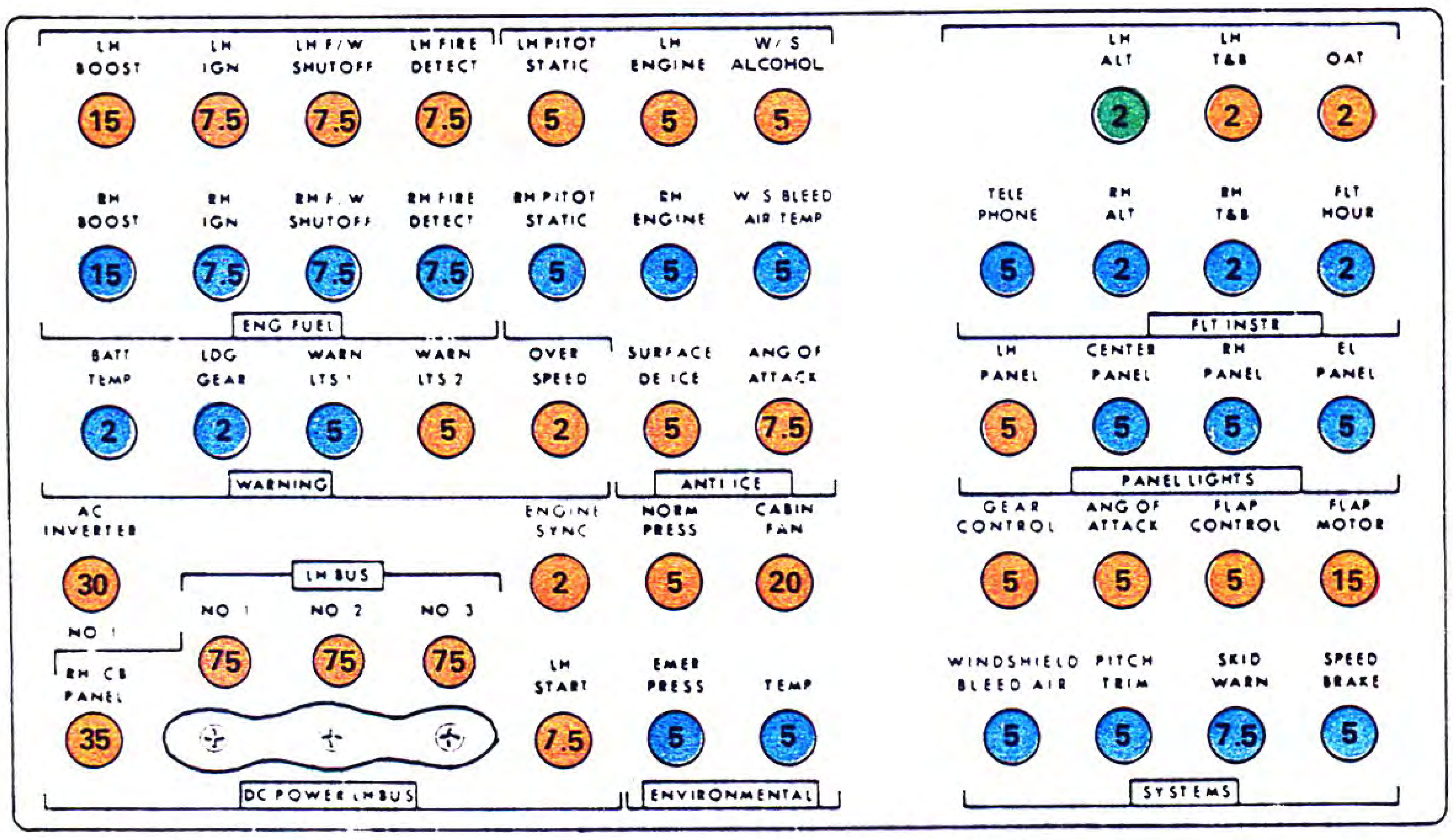
Should an inverter fail a red AC FAIL light will illuminate on the annunciator panel. Switching the three position AC power switch to the other inverter will reapply AC power to all systems and extinguish the AC FAIL light on the annunciator panel.

The AC FAIL circuit breaker mounted in the RH circuit breaker panel provides power for the following functions: AC FAIL light, autopilot disengage light and horn, go-around switch and AC POWER switch. AC power is not available from the number 2 inverter when the AC Fail circuit breaker is disengaged. If the number 2 inverter is on line when the circuit breaker disengaged, the AC POWER switch must be moved to the number 1 inverter position to restore AC power.

Circuit Breakers

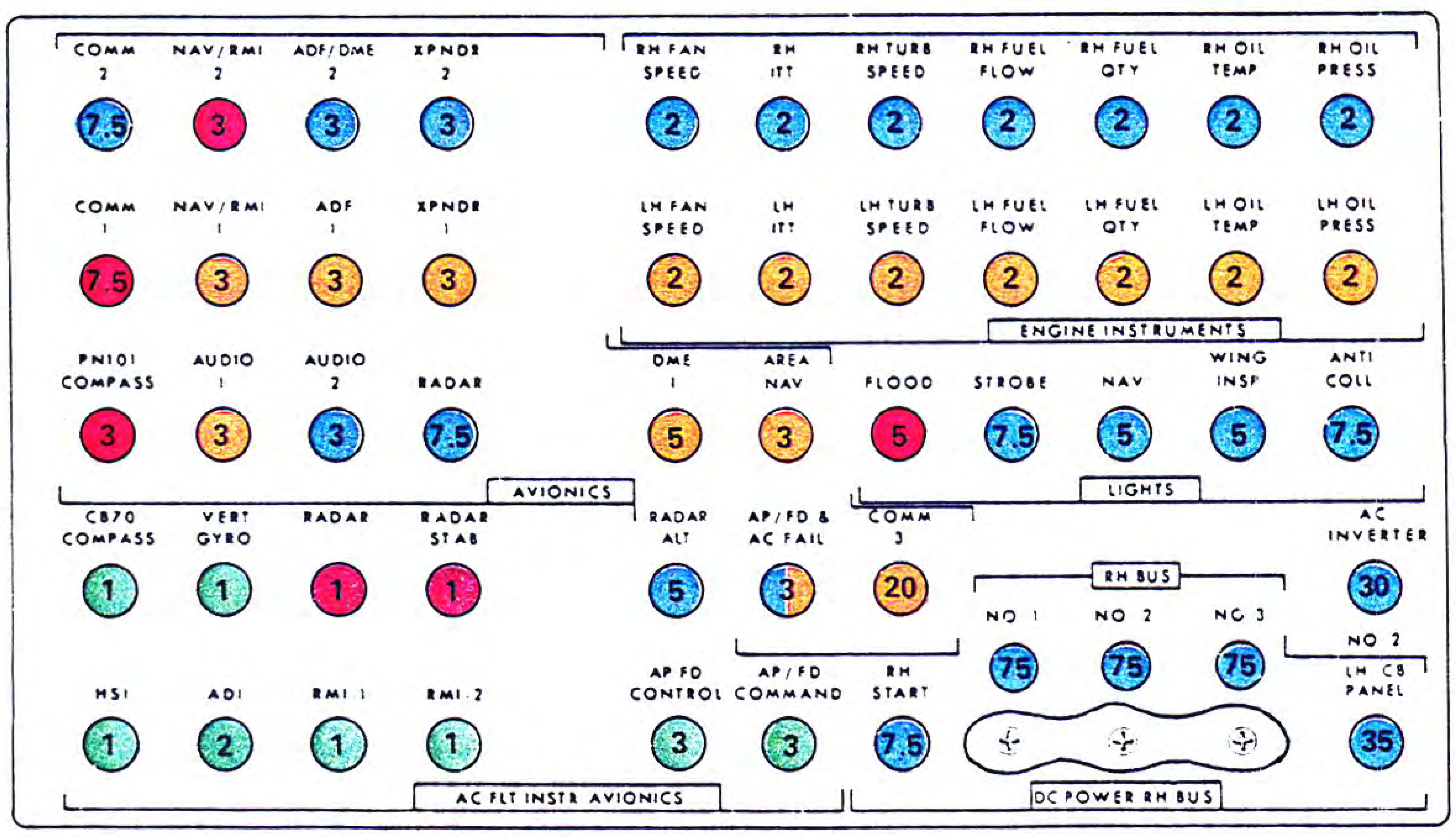
Panels on both sides of the cockpit contain all the electrical system protective breakers accessible in flight. The amperage rating is marked on each circuit breaker and they are of a push-to-reset type.

Left Circuit Breaker Panel



- LH Main DC Bus
- RH Main DC Bus
- Emergency DC Bus
- Flight Director AC Bus
- Radar AC Bus

Right Circuit Breaker Panel



Panel configuration may vary slightly due to differences in installed equipment. These diagrams represent 500-0101 thru -0274 with some options installed.

Other circuit breakers not accessible in flight are located inside, and on, the left and right junction boxes in the tailcone compartment. Heated leading edge anti-ice is protected by ten tailcone compartment circuit breakers; five for the left wing just forward of the tailcone access door, and five behind the air cycle machine for the right wing.

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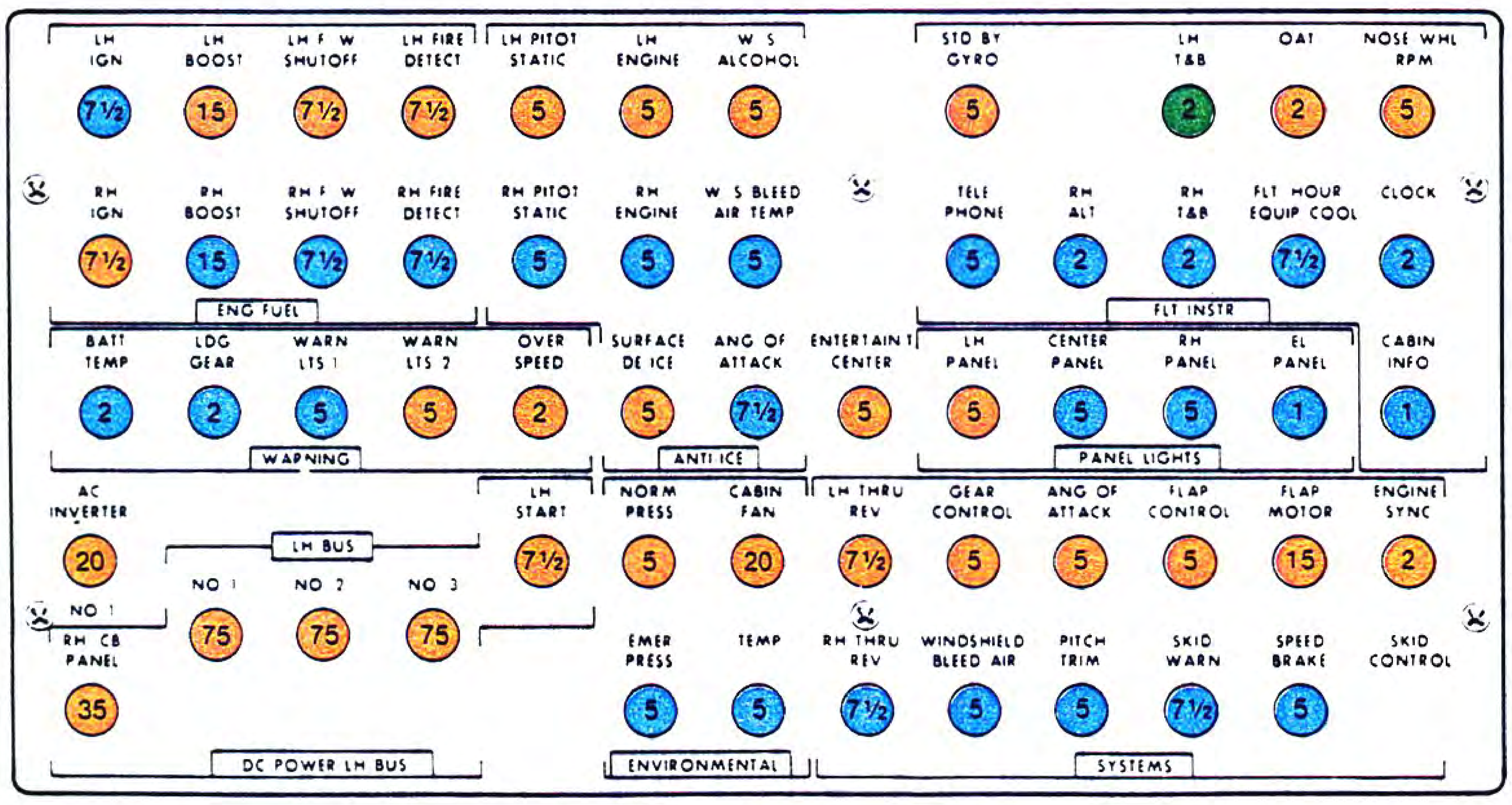
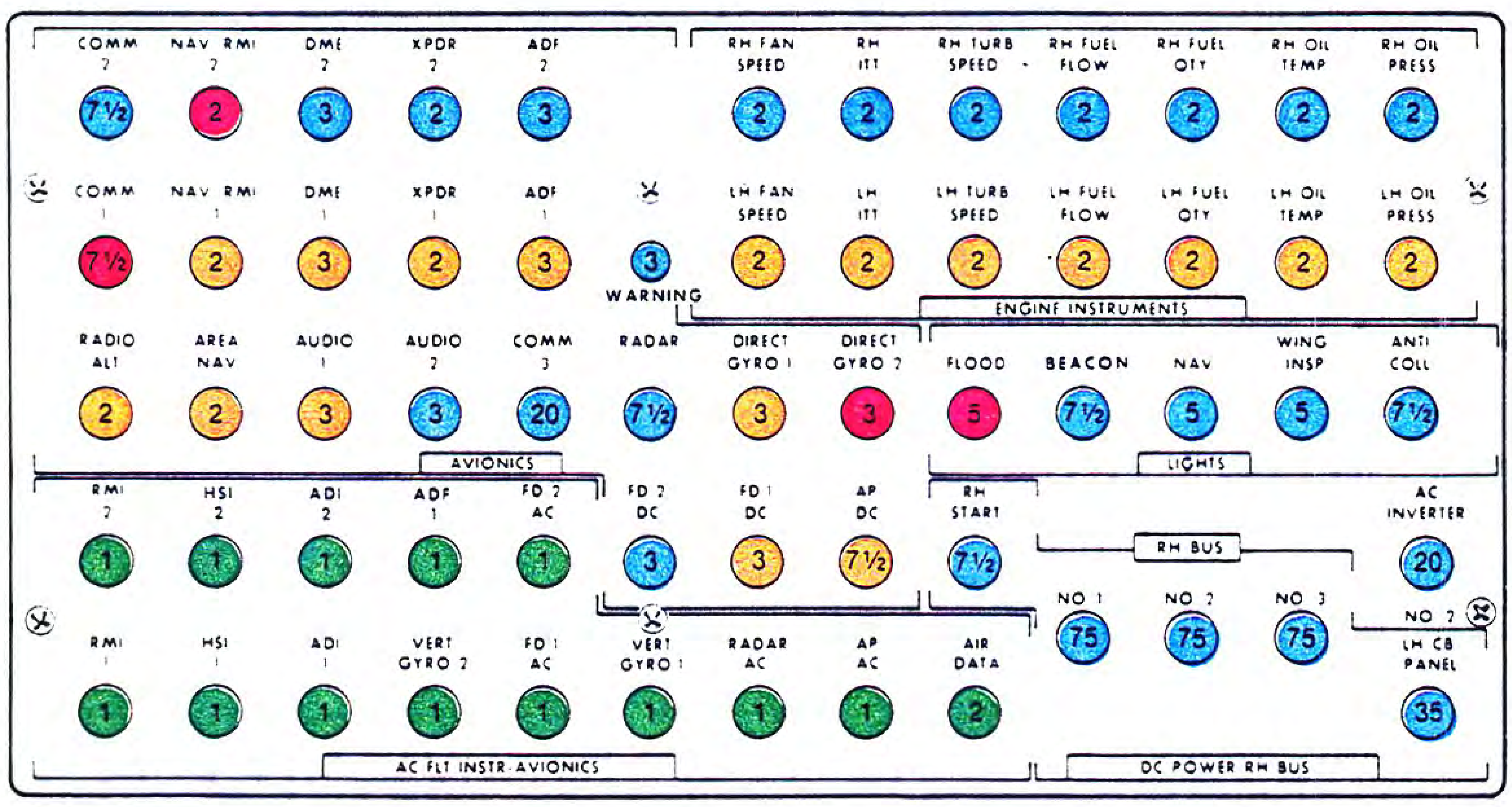


LH Main DC Bus
RH Main DC Bus
Emergency DC Bus
AC Bus

Right Circuit Breaker Panel

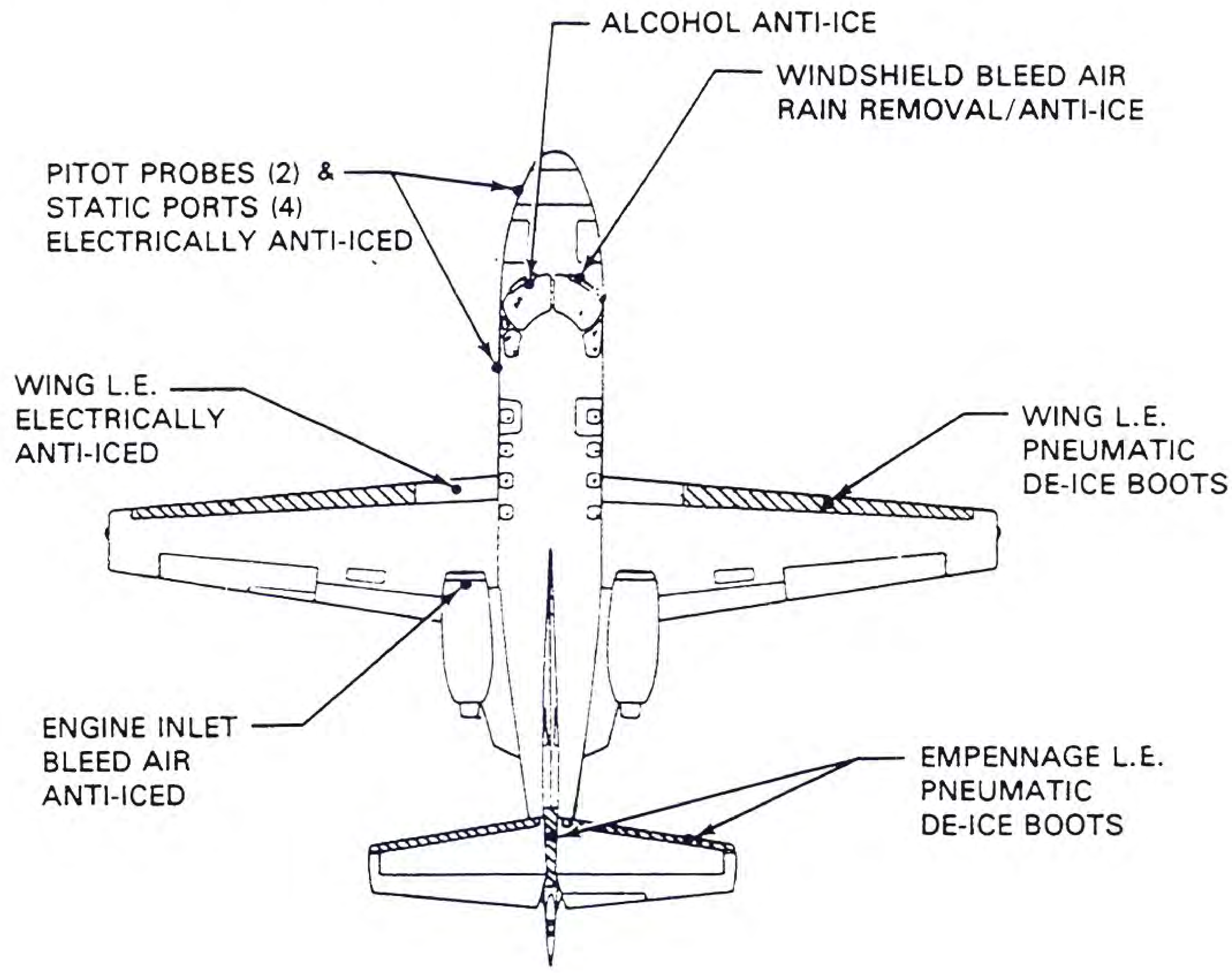


Panel configuration may vary slightly due to differences in installed equipment.

Other circuit breakers not accessible in flight are located inside, and on, the left and right junction boxes in the tailcone compartment. Heated leading edge anti-ice is protected by ten tailcone compartment circuit breakers; five for the left wing just forward of the tailcone access door, and five behind the air cycle machine for the right wing.

ICE and RAIN PROTECTION

The anti-ice systems are designed to prevent ice formation on the pitot tubes, static ports, windshields, angle of attack probe (if installed) and protect against engine ice damage. The various anti-icing functions use electrical power or engine bleed air and are actuated by switches on the left switch panel and control knobs on the co-pilot's panel. Anti-ice systems should be turned on when operating in visible moisture with an indicated OAT between +4°C and −30°C (+40°F and −22°F).



The optional airframe de-ice system provides for removal of ice formed on the leading edge of the wing (outboard of the heated area) and tail aerodynamic surfaces by pneumatically expanded boots.

Pitot-Static Anti-Ice

Electric elements heat the pilot's and co-pilot's pitot tubes, the static ports, and angle of attack probe if installed. The PITOT & STATIC anti-ice switch on the lower left panel controls these elements.

Engine Anti-Ice

Electrical elements and bleed air provide engine ice protection. Any time an engine is operating, hot air flows continually to the nose cone and temperature probe forward of the fan in the engine inlet. Turning on an ENGINE ANTI-ICE switch (LH or RH) with sufficient engine RPM will open valves that route bleed air to the engine cowl leading edge and stator vanes just aft of the fan. Approximately 60% N_2 is required to open, and keep these valves open.

ICE and RAIN PROTECTION

Selecting ENGINE ANTI-ICE also electrically heats a 53" section of the inboard wing in front of the engine, and initiates continuous ignition. Operation of the inboard leading edge and auto-ignition is dependent only on a source of electrical power and not engine RPM.

Each inboard wing section incorporates five heating elements and a thermal control switch. With engine anti-ice selected, each side will draw approximately 120 amps of electrical power until the section reaches 66°C (150°F) on 500-0001 thru -0213, 78°C (172°F) on 500-0214 and on. The control switch then causes the elements to cycle off and on to maintain a temperature between 61° and 66°C (141° and 150°F) on 500-0001 thru -0213, 54° and 78°C (130° and 172°F) on 500-0214 and on.

Cockpit indications of system function are obtained from the RPM, ITT, and AMPS gauges and the amber L and R ENG ICE FAIL annunciator panel lights. Opening of the stator and inlet cowl valves will be shown by an ITT rise and RPM decrease indicating bleed air extraction is taking place. Electrical power to the inboard wing leading edges will cause an increase in generator load on the ammeters.

With the respective switch on, an ENG ICE FAIL light will illuminate for any one of the following conditions:

1. Either the cowl or stator valve fails to open. (A five-second delay is normal from the time the switch is turned on until the valves move.)
2. Cowl leading edge temperature below 77°C (170°F).
3. Inboard wing section below 16°C (60°F).
4. Failure of one or more wing heating elements.
5. Failure of the temperature controller. (If the system is cycling with a failed leading edge heater controller, the L or R ENG ICE FAIL light will illuminate each time the system cycles off.)

The time for the lights to extinguish after initiating operation will vary with outside air temperature and engine power setting. Normally, no more than two minutes are required at cruise or climb thrust settings. During descent into anticipated icing conditions, due to the normally associated low power settings, it is advisable to turn on the system well before entering the visible moisture environment. Once the conditions necessary to extinguish the lights are satisfied, minimum power will sustain operation.

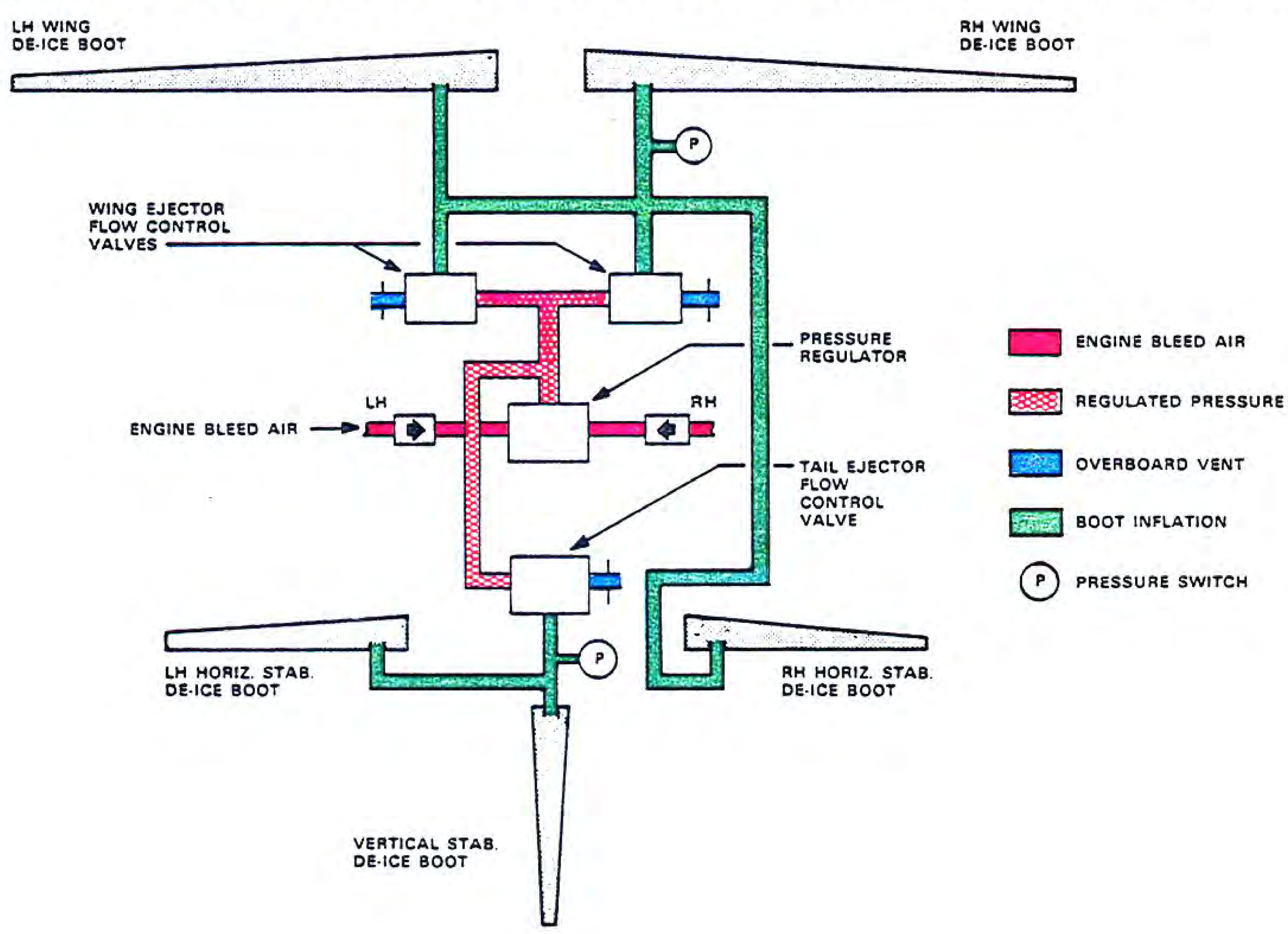
Engine anti-ice is, as the name implies, designed as a preventative system. Its use should be anticipated and the system actuated any time flight in visible moisture with indicated OAT from +4°C to -30°C (+40°F to -22°F) is imminent. Failure to turn on the system before ice accumulation has begun may result in engine damage due to ice ingestion. For sustained ground operation in visible moisture at +4°C to −30°C(+40°F to −22°F) an ambient air temperature, the system should be turned on one minute out of four with N_2 set above 65%.

Because of engine bleed air extraction with system operation, maximum allowable power settings are reduced as shown in Section IV of the AIRPLANE FLIGHT MANUAL.

Airframe De-ice

The airframe de-ice boots are controlled by a three-position SURFACE DE-ICE switch which is spring-loaded to OFF and provides two six-second cycles following momentary actuation. Boot cycling is controlled by three control valves. On the first six-second cycle, one valve opens the inflate line to the vertical stabilizer and the left horizontal stabilizer. Two control valves actuate on the second cycle to direct air to both wings and the right horizontal stabilizer. The time circuit will elapse twelve seconds after initiation and de-energize the control valves. The boots deflate by bleeding the air back through the control valve and dumping it overboard. The boots are held deflated by vacuum.

In the event the boots remain inflated or it is desirable to stop boot inflation and terminate the cycle, place the surface de-ice switch to the RESET position. This overrides the timer circuit and immediately deactivates the control valves. It is not necessary to go to the reset position after every boot cycle. Returning the switch to the OFF position prepares the system for the next actuation. Satisfactory operation of



the deice boot cycle is verified by illumination of the surface de-ice annunciator light and visual inspection of the wing leading edges. Illumination of the surface de-ice light indicates there is bleed air pressure to the boots for inflation. The light will blink off momentarily between each cycle. Operation of the boots should be functionally checked prior to icing encounters while on the ground or in flight with the OAT above -40°C (-40°F).

Surface de-ice should be used when ice buildup is estimated between 1/4 and 1/2 inch thickness. Early activation of the boots may result in ice bridging on the wing. If accumulation is in excess of 1/2 inch, boot cycling may not clear it. A wing inspection light is provided to illuminate the left wing to observe ice buildup during night flight.

Windshield Anti-Ice

The windshield bleed air system provides windshield anti-ice under all normal operating conditions. This system also provides external windshield defog and rain removal. The system supplies engine bleed air through an electrically actuated pressure regulating shutoff valve in the tailcone of the aircraft and manually positioned valves which regulate air to each windshield. The manual valves are located at each bleed air nozzle and are left in the OFF position for all normal operation. A check should be made to insure that the rain removal knob is pushed IN, prior to turning the windshield bleed switch on. When windshield anti-icing is required the W/S bleed valves are turned ON and the W/S TEMP bleed switch is turned to LOW if the indicated OAT is above −18°C (0°F) or to HI if the Indicated OAT is −18°C (0°F) or below. Normal system operation is indicated by an increase in air noise as the bleed air discharges from the nozzles. A temperature sensor is located near the discharge nozzles and automatically controls the windshield bleed air temperature by modulating crossflow air through a heat exchanger in the tailcone. An additional temperature sensor is located int the bleed air line, which automatically actuates the electrical shutoff valve and illuminates the windshield air overheat annunciator light should the bleed air temperature exceed the normal control valve. This condition should not occur unless a sustained high power, low airspeed condition is maintained or a system malfunction occurs. If the windshield air overheat light illuminates, the manual bleed air valves should be modulated to reduce the flow. If the light remains on for over 60 seconds, position the manual valves to OFF. The windshield air overheat light will also illuminate if the electrical shutoff valve in the tailcone opens with the windshield bleed air switch in the OFF position.

In the event of a complete electrical system failure the bleed air control valve would open and the overheat annunciator would be inoperative. If the manual bleed air valves are open, they should be closed as soon as practical subject to icing conditions. Damage to the windshield could result from continued operation without electrical control.

Self-test of the temperature monitor system is normally accomplished during the preflight warning systems check by turning the windshield bleed air switch to either the HI or LOW position and selecting the W/S TEMP position on the rotary test switch. Proper system function is verified by illumination of the windshield air overheat annunciator light. Self-tests may also be accomplished in flight, if desired.

If the windshield bleed air anti-ice system fails, a backup alcohol anti-ice system is provided for the left-hand windshield only. The system is controlled by a two-position W/S ALCOHOL switch which, when moved to the ON position, activates an electric pump which sprays alcohol on the pilot's windshield. Sufficient alcohol is provided for approximately ten minutes continuous operation with a fully serviced reservoir.

Rain Removal

This system utilizes the normal windshield bleed air anti-ice system for rain removal with augmenter doors to provide increased airflow over each windshield in heavy rain. These doors are manually operated by pulling the PULL RAIN handle located under the WINDSHIELD BLEED AIR knobs on the co-pilot's panel. For rain removal, the manual bleed air controls on the co-pilot's panel should be turned to the MAX position, the PULL RAIN handle pulled out and the W/S BLEED switch positioned to LOW. Augmenter door opening will be difficult should the W/S BLEED switch be turned on first.

ENVIRONMENTAL

The pressurization and air conditioning systems utilize engine bleed air to pressurize and air condition the cabin, and defog the cabin and cockpit windows. During normal operation, most functions are automatic. The only manual adjustments required are for individual comfort, such as cabin rate of climb and temperature. Ram air for cabin ventilation is available when the pressurization system is not in use.

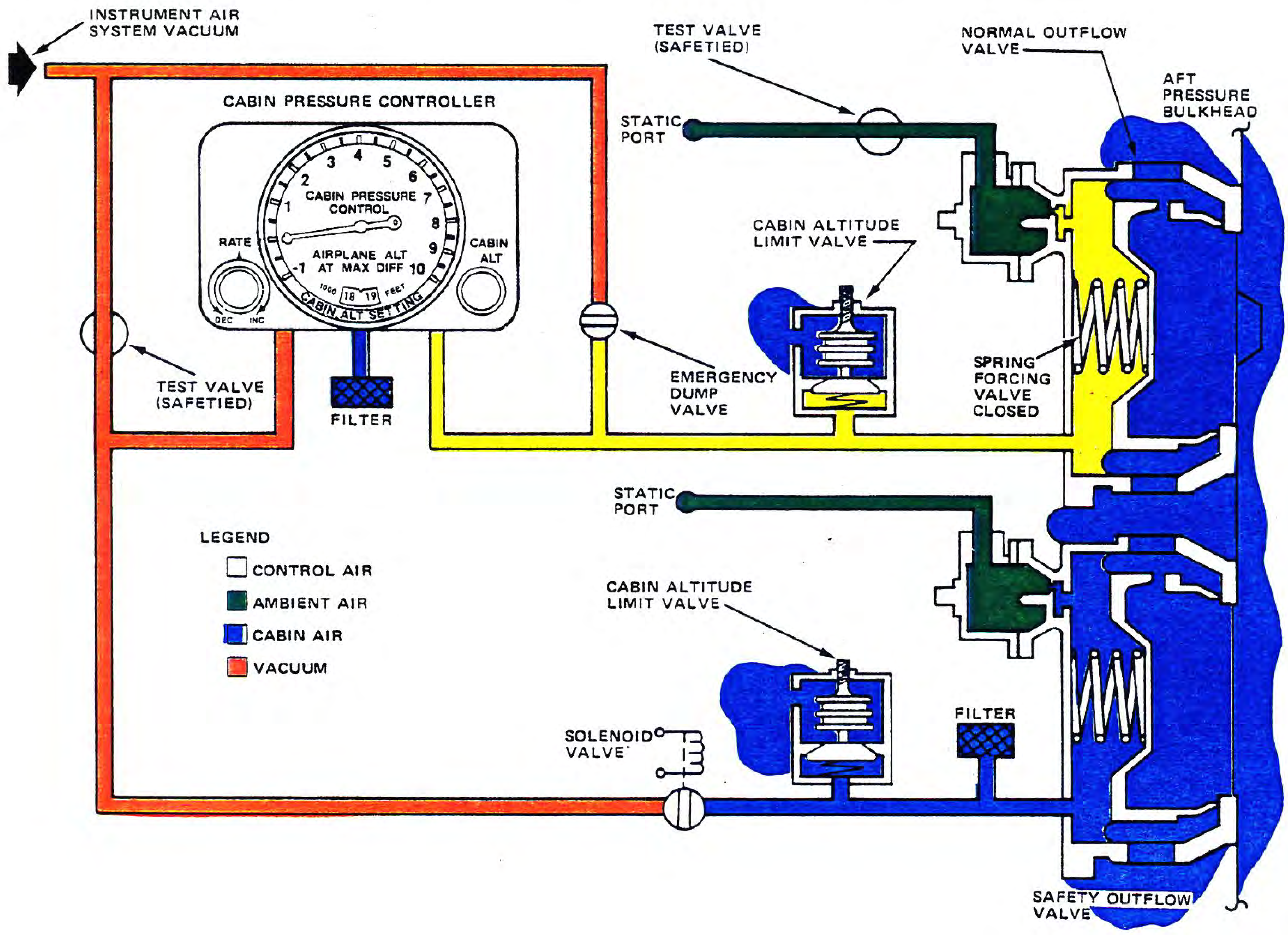
Pressurization

Two elements are required to provide cabin pressurization. One is a constant source of air. The other is a method of controlling the flow of air into or out of the aircraft to achieve the desired differential pressure and resultant cabin altitude. In the CITATION, the inflow of air to the cabin is constant (through a wide range of engine power settings) and the outflow of air is controlled by the two outflow valves located in the aft pressure bulkhead.

Outflow Valves — 500-0001 thru -0213

There are two forces at work on the normal valve at all times. The first is a spring which is always attempting to close the outflow valve, restricting the outflow of air and causing the cabin to descend. Offsetting this spring is the control air (vacuum) regulated by the cabin pressure controller. This tends to pull the outflow valve off the seat and allow air to escape, ascending the cabin. In the event that control vacuum should exceed limits due to a malfunction, a cabin altitude limit valve is provided to prevent cabin altitude from exceeding 13,000′. If the control vacuum exceeds the barometric reference in the cabin altitude limit valve, it will open and release cabin air into the control air line reducing the vacuum. This will cause the outflow valve to move toward the closed position and re-establish cabin pressure. An emergency dump valve located in the vacuum line can be utilized to route vacuum directly to the normal outflow valve and dump all cabin pressure.

The safety outflow valve prevents cabin differential pressure from exceeding 8.0 p.s.i. and depressurizes the aircraft on the ground. Any time cabin differential pressure exceeds 8.0 p.s.i., the safety outflow valve is forced open. On aircraft touchdown, the squat switch actuates a solenoid valve opening the safety outflow. This assures that the aircraft is de-pressurized during all ground operations.



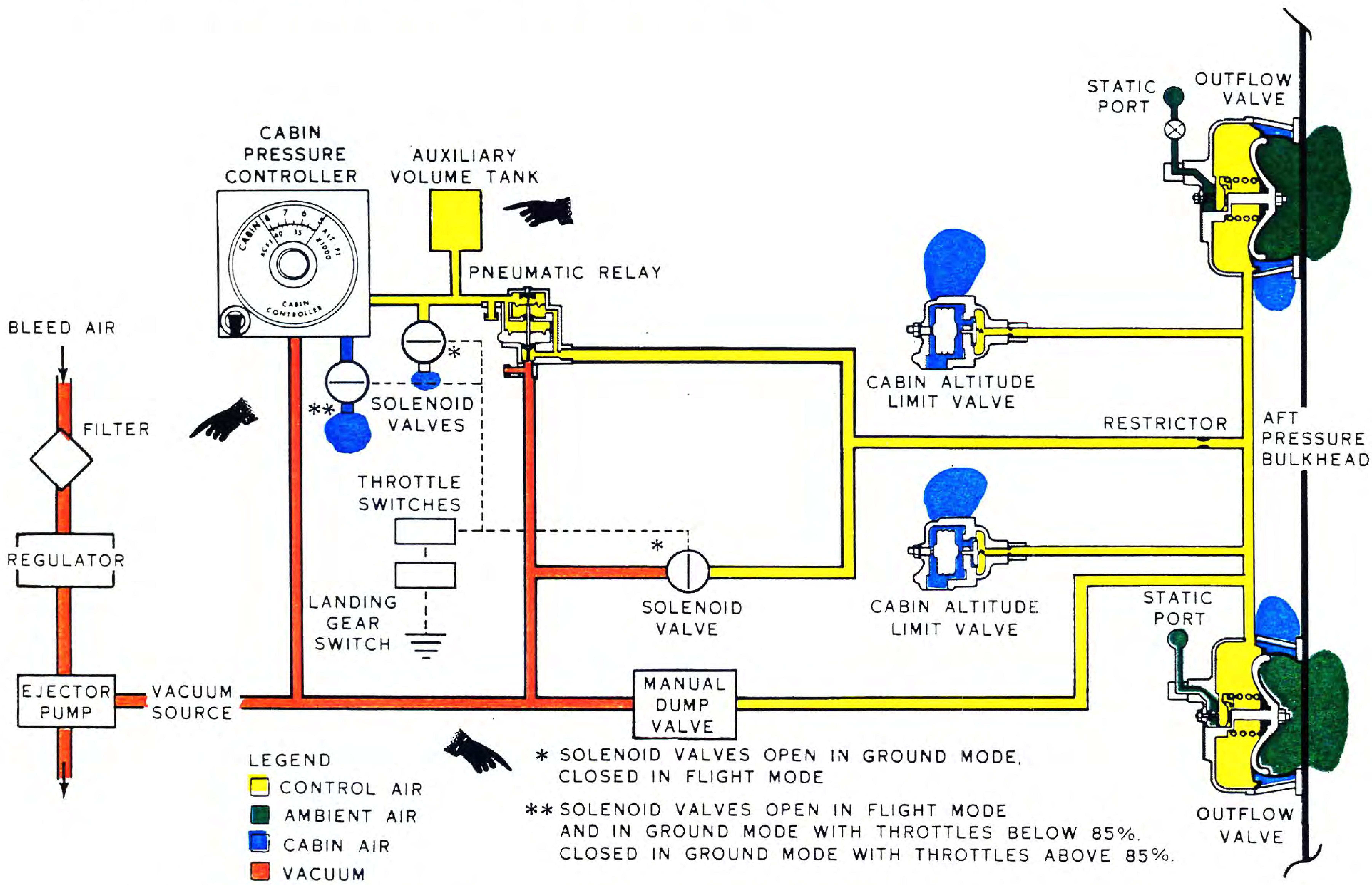
500-0001 thru -0213

Outflow Valves — 500-0214 thru -0349 and 500-0001 thru -0213 Incorporating SB21-9.

There are two forces at work on the primary and secondary outflow valves at all times. The first is a spring which is always attempting to close the respective valve, restricting the outflow of air and causing the cabin to descend. Offsetting this spring is the control air (vacuum) regulated by the cabin pressure controller and amplified by the pneumatic relay. This tends to pull the outflow valve off the seat and allow air to escape, ascending the cabin. In the event that control vacuum should exceed limits due to a malfunction, cabin altitude limit valves are provided to prevent cabin altitude from exceeding 13,000′. If the control vacuum exceeds the barometric reference in the cabin altitude limit valves, they will open and release cabin air into the control air line reducing the vacuum. This will cause the outflow valves to move toward the closed position and reestablish cabin pressure. An emergency dump valve located in the vacuum line can be utilized to route vacuum directly to the outflow valves and dump all cabin pressure.

The primary outflow valve is calibrated to regulate cabin differential pressure at 8.5 p.s.i. The secondary outflow valve is calibrated to regulate cabin differential pressure at 8.8 p.s.i. During ground operation, vacuum is routed directly to both outflow valves driving them to the full open position. This assures that the airplane is depressurized during all ground operations.

During the takeoff roll, advancement of the throttles closes three solenoid valves, moving the outflow valves into the controlling range and trapping ambient pressure for reference by the Cabin Pressure Controller.



500-0214 thru -0349 and 500-0001 thru -0213 incorporating SB21-9

Pressurization Source — All

Engine bleed air is used as the source of high pressure air to provide cabin pressurization. During normal operations, the bleed air passes through the air cycle machine for cooling before entering the cabin.

Each engine has two ports from which compressor discharge air (bleed air) is bled off the engines. One is used for cabin pressurization, the other for engine anti-ice. Two control valves, one mounted in each pressurization bleed air line, limits the bleed airflow from the respective engine through the air conditioning system and into the cabin. A shutoff and pressure regulating valve installed in the right bleed line allows bleed air pressure to the air conditioner at a higher flow rate for ground operations. The emergency pressurization control valve installed in the left bleed air line is used to route uncontrolled bleed air to the cabin for emergency pressurization.

The pressurization source selector switch is a six-position switch labeled OFF, GND, LH, BOTH, RH and EMER. In the OFF position, both bleed air control valves, the ground shutoff and pressure regulating valve and the auxiliary pressurization valve are closed allowing no bleed air to enter the cabin. In the GND position, with the right engine operating, the shutoff and pressure regulating valve is open allowing approximately 18 lbs./min. bleed air to flow through the air cycle machine to ventilate the cabin. With this position selected, the BLEED AIR GROUND light on the annunciator panel will illuminate. In the LH position, the left flow control valve will open allowing left engine conditioned bleed air (6 lbs./min.) to enter the cabin. In the RH position the right flow control valve will open allowing right engine conditioned bleed air (6 lbs./min.) to enter the cabin. In the BOTH position, the left and right flow control valves will open allowing both left and right conditioned bleed air (12 lbs./min.) to enter the cabin. In the EMER position, the emergency pressurization valve opens allowing hot bleed air from the left engine to enter the cabin directly and the EMER PRESS ON annunciator light will illuminate. The air cycle machine is bypassed with emergency pressurization selected, cabin temperature will rise, and AUTO or MAN TEMP SELECT will be disabled. Cabin temperature can be controlled to some extent with the left throttle. Retarding the left throttle will lower bleed air temperature, but excessive reduction will allow the cabin altitude to climb.

Pressurization Controller — 500-0001 thru -0213

It is the function of the controller to meter control air (vacuum) to the normal outflow valve so that desired cabin altitude and rate of climb are achieved.

The controller consists of two chambers separated by a moveable diaphragm. One chamber senses cabin pressure while the other chamber is sealed. Pressure differences between the two chambers causes the diaphragm to move and route control air to the outflow valve. Cabin pressure is then increased or decreased until equilibrium between the two chambers is established.

Desired cabin altitude is selected by rotating the cabin altitude selector knob. This applies a spring bias to the moveable diaphragm and changes the pressure differential at which equilibrium between the two chambers is achieved.

The rate at which the cabin climbs or descends is controlled by the cabin rate knob. This valve bleeds air between the two sealed chambers and, in conjunction with an isobaric bellows, determines the rate at which the spring pressure is applied to the moveable diaphragm when a new cabin altitude is selected.

The cabin altimeter and cabin rate of change indicators are located on the right instrument panel above the windshield bleed air control knobs. The cabin altimeter presents existing cabin altitude on the outer scale, and pressure differential on the inner scale. The pressure differential needle will indicate a malfunction of the normal outflow valve whenever a pressure differential in excess of 7.6 is shown on the gauge. The cabin rate of change indicator shows the rate at which the cabin is ascending or descending.

Pressurization Controller — 500-0214 thru -0349 and 500-0001 thru -0213 Incorporating SB21-9.

It is the function of the controller to meter control air (vacuum) to the primary and secondary outflow valves so that desired cabin altitude and rate of climb are achieved.

The controller consists of two chambers separated by a moveable diaphragm. One chamber senses cabin pressure while the other chamber references ambient pressure trapped prior to liftoff. Pressure differences between the two chambers, resulting from an increase in cabin altitude, cause the diaphragm to move and route control air to the pneumatic relay. The pneumatic relay amplifies this signal and in turn, controls the two outflow valves. Cabin pressure is then increased or decreased until equilibrium between the two chambers is established.

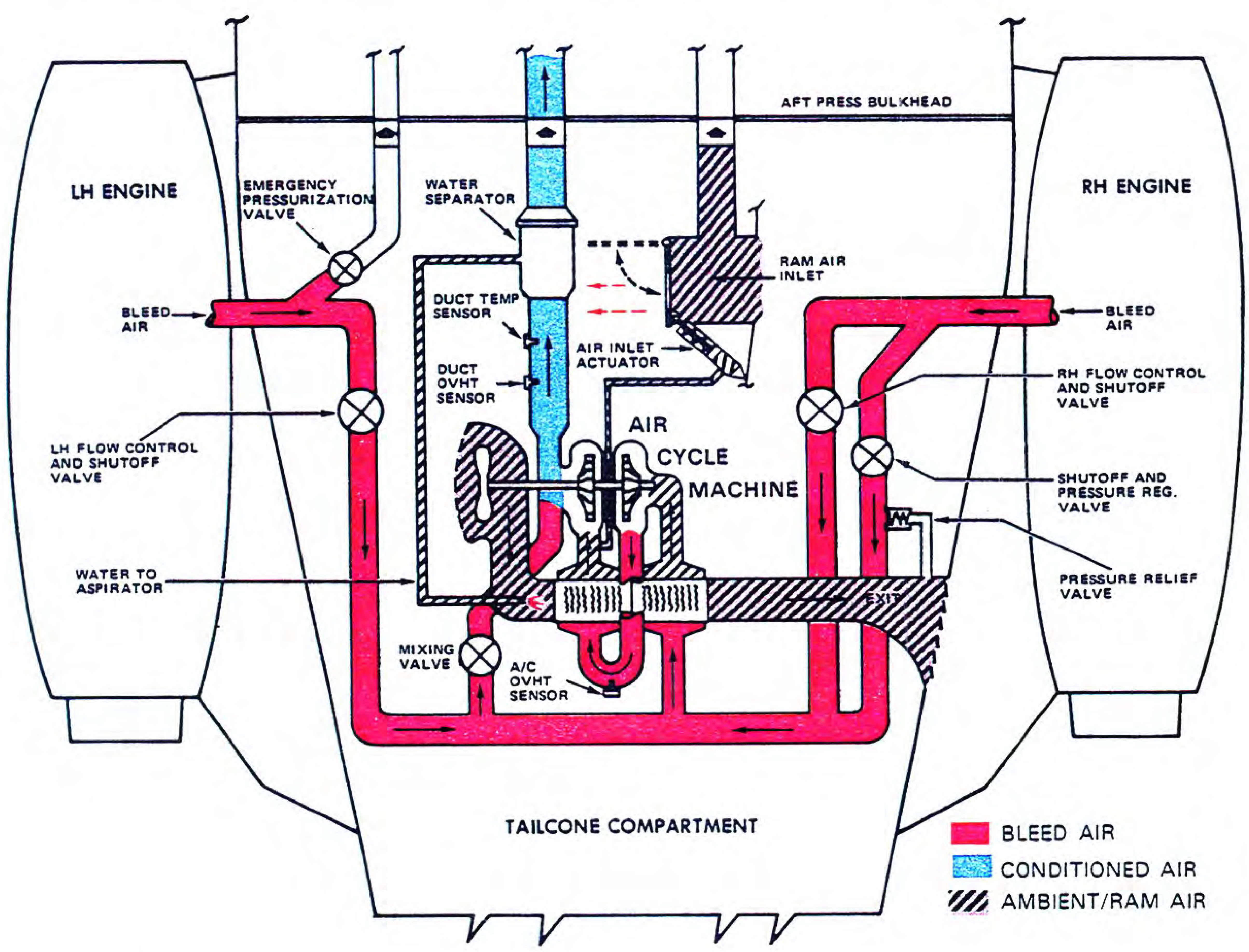
Desired cabin altitude is selected by rotating the cabin altitude selector knob. This applies a spring bias to the moveable diaphragm and changes the pressure differential at which equilibrium between the two chambers is achieved.

The rate at which the cabin climbs or descends is controlled by the cabin rate knob. This valve bleeds air between the two sealed chambers and, in conjunction with an isobaric bellows, determines the rate at which the spring pressure is applied to the moveable diaphragm when a new cabin altitude is selected.

The cabin altimeter and cabin rate of change indicators are located on the center pedestal adjacent to the pressurization controller. The cabin altimeter presents existing cabin altitude on the outer scale, and pressure differential on the inner scale. The pressure differential needle will indicate a malfunction of the primary or secondary outflow valve whenever a pressure differential in excess of 8.5 or 8.8 respectively is shown on the gauge, the cabin rate of change indicator shows the rate at which the cabin is ascending or descending.

Air Conditioning

Air conditioning for the cabin is provided by routing engine bleed air through the air cycle machine which conditions it prior to distribution to the cabin. Cabin overhead and underfloor ducting is used to distribute the conditioned air.



The air cycle machine located in the tailcone compartment cools engine bleed air to approximately 1°C (34°F). Bleed air enters the air cycle machine through any of the three bleed air ducts (left, right, ground) and passes over a heat exchanger for initial cooling. The air is then compressed by a turbine driven compressor and passed over a second heat exchanger. Finally the air drives a turbine which extracts energy and cools the air further. Expansion provides the final cooling. The advantages of the compression cycle are twofold: (1) The compressor section provides a load for the turbine to work against and (2) Compressing and heating the air increases the efficiency of the second heat exchanger.

500-0001 thru -0040

A small fan driven by the air cycle machine pulls air from the tailcone compartment, passes it over both heat exchangers and dumps it overboard through a vent located on the tailcone below the right engine. The source of air into the tailcone is controlled by a pneumatically actuated door. Whenever the air cycle machine is in operation, high pressure air is tapped off prior to the turbine and routed via a control line to the air inlet actuator. This forces the ram inlet door open and allows air to flow into the tailcone compartment. If for any reason the air cycle machine is not operating, the pressure source is removed and a spring closes the door. Ram air is then forced into the cabin through a check valve.

500-0041 thru -0349

Fresh air enters the tailcone through the flush scoops in the dorsal fin. A small fan driven by the air cycle machine pulls it over both heat exchangers and dumps it overboard through a vent located on the tailcone below the right engine. Whenever the air cycle machine is in operation, high pressure air is tapped off prior to the turbine and routed via a control line to the fresh air door actuator, holding the door closed. If for any reason the air cycle machine is not operating, the source of pressure is removed and a spring opens the door and fresh, unpressurized air is brought into the cabin through a check valve.

All Aircraft

An air conditioning overheat sensor is installed between the compressor and turbine section of the air cycle machine to prevent excessively hot air from entering the air conditioning duct. If this sensor indicates that the compressor section is producing air that is too hot, it will close all shutoff valves in the bleed air ducts and open the emergency pressurization valve when airplane is in flight. This will secure the air cycle machine and pressurize the cabin by the emergency method. This condition will be indicated by the illumination of the EMER PRESS ON annunciator light as well as the increased noise level associated with high velocity air entering the cabin. If the temperature drops within 12 seconds, the system will automatically return to normal operation. If temperature is not reduced within 12 seconds it will be necessary to rotate the pressurization source selector knob in the cockpit to the EMER position and then reselect LH, RH or BOTH, to reset the system for normal operation.

To warm the cabin to a desirable temperature, a mixing valve adds hot engine bleed air to the cold exhausted air from the air cycle machine. The mixing valve is controlled by the automatic or manual temperature control located on the pressurization environmental control panel. With the AUTO TEMP SELECT rheostat in the MAN position, the mixing valve can be controlled manually by the MAN HEAT/MAN COOL switch. The switch has three positions, spring-loaded to the center (OFF) position. When the switch is deflected toward MAN HEAT, the mixing valve is driven open, allowing more hot bleed air to mix with the cold exhausted air from the air cycle machine. When the switch is released, the mixing valve will remain at that postion. Holding the switch toward MAN COOL will drive the mixing valve to the closed position. The mixing valve, when manually controlled, will travel from full open to full closed in approximately ten seconds. When the automatic temperature control rheostat is in any position other than manual, the cabin temperature will be automatically controlled. Two air duct temperature sensors linked to the automatic temperature control rheostat will drive the mixing valve to the desired position. Should the duct temperature become excessively hot, the AIR DUCT O'HEAT annunciator panel light will illuminate. This is an advisory light and corrective action, lowering the cabin temperature, should be accomplished to prevent system damage.

A water separator is provided to dehumidify the conditioned air before entering the cabin. The conditioned air enters the water separator where it is filtered and the excess water is removed. The conditioned air is then ducted through a check valve into the cabin flow ducts for distribution. The condensate is then injected into the air flowing over the heat exchangers to increase cooling.

The cabin air distribution system consists of an overhead conditioned air duct and outlets, and an underfloor conditioned air duct which supplies the footwarmer manifolds and the window defog outlets.

When the air temperature selected is cold, a butterfly valve directs the air through the overhead and underfloor air ducts. As the temperature selected becomes warmer the butterfly valve will close, reducing airflow through the overhead air duct. When a hot temperature is selected (over 38°C, 100°F), the butterfly valve will be fully closed, allowing all hot air to flow through the underfloor air duct.

If increased air circulation is desired, position the cabin fan switch to the HI or LOW position. This actuates the cabin fan, recirculating air through the overhead ducts.

The co-pilot's panel contains the COCKPIT & DEFOG FAN control. This switch, which has three positions (HI, OFF and LOW), controls defog and ventilation airflow in the flight compartment.

An optional freon air conditioner installation is intended to provide cooling and air circulation for ground and low altitude flight. It may be operated by itself or in conjunction with the standard environmental control system (ECS). The freon air conditioner consists of one cockpit evaporator, two cabin evaporators and a condenser/compressor mounted either in the tailcone or the nose baggage compartment, with associated controls, wiring and plumbing. The cockpit evaporator fans may be operted independently, for cockpit air circulation, or all evaporator fans may be operated simutaneously for complete airplane air circulation. The compressor is operated whenever cooling is desired. Fans may be operated at either high or low speed. Closing the cockpit overhead Wemacs will increase the cooling airflow to the cabin.

An electric motor drives the air conditioner compressor which pumps freon through the system. The hot gaseous freon from the compressor is condensed to a liquid by airflow through the condenser. The airflow is provided by an axial fan also driven by the compressor motor. The cooled liquid freon is expanded to a low temperature gas by expansion valves at each evaporator. The cold gas in the evaporators removes heat from the cockpit and cabin air as it is circulated through the evaporators by the evaporator fans.

A three-position switch controls operation of the various motors. FANS FWD position powers only the cockpit evaporator blowers. FANS ALL position powers all of the evaporator blowers. COMP position powers all of the evaporator blowers and the compressor/condenser motor.

The compressor motor will be shut down automatically, should any of the following conditions occur:

1. Motor current draw 150 amps.
2. Condenser discharge freon pressure over 350 psig.
3. Condenser suction freon pressure under 10 psig.

A fan speed switch provides 28 VDC power to the evaporator blower motors in the HI position and 14 VDC in the LO position. Improved overhead airflow distribution will be provided to the aft cabin if the cockpit overhead WEMAC valves are closed.

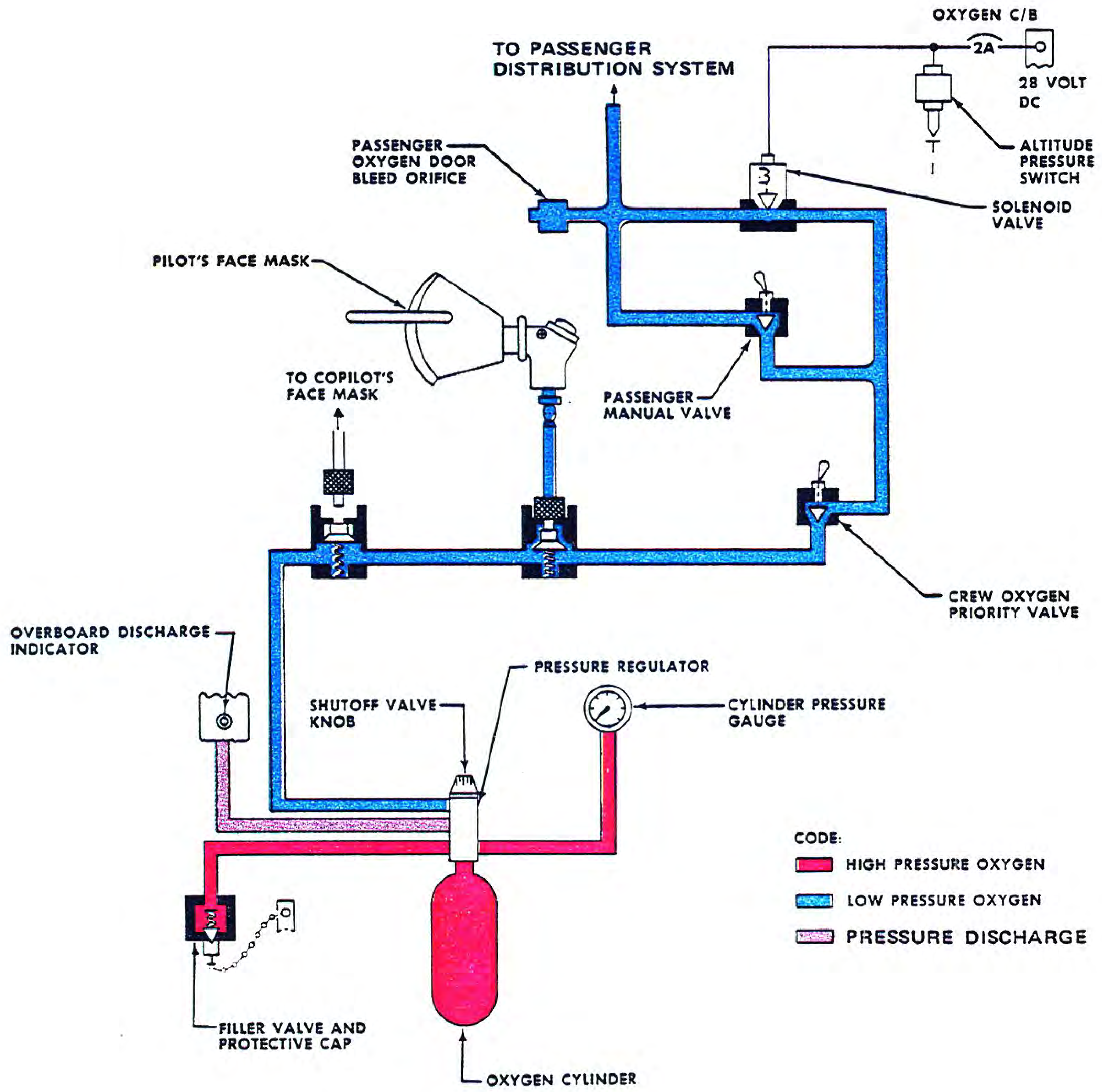
DC power to the freon air conditioner system is supplied only from the RH DC BUS. The system is isolated from both the battery and the LH DC BUS so that the battery cannot be drained by air conditioning operation.

Operation of the air conditioning system is prohibited for any one of the following conditions:

1. Pressure Altitude above 18,000 feet.
2. Right Generator inoperative.
3. Indicated OAT less than −21°C(−5°F).

OXYGEN

The oxygen system provides supplementary oxygen for the cockpit diluter demand masks and the passengers' continuous flow masks. It is not normally used since a cabin altitude of 8,000 feet can be maintained at the maximum certified aircraft altitude with normal pressurization system operation.



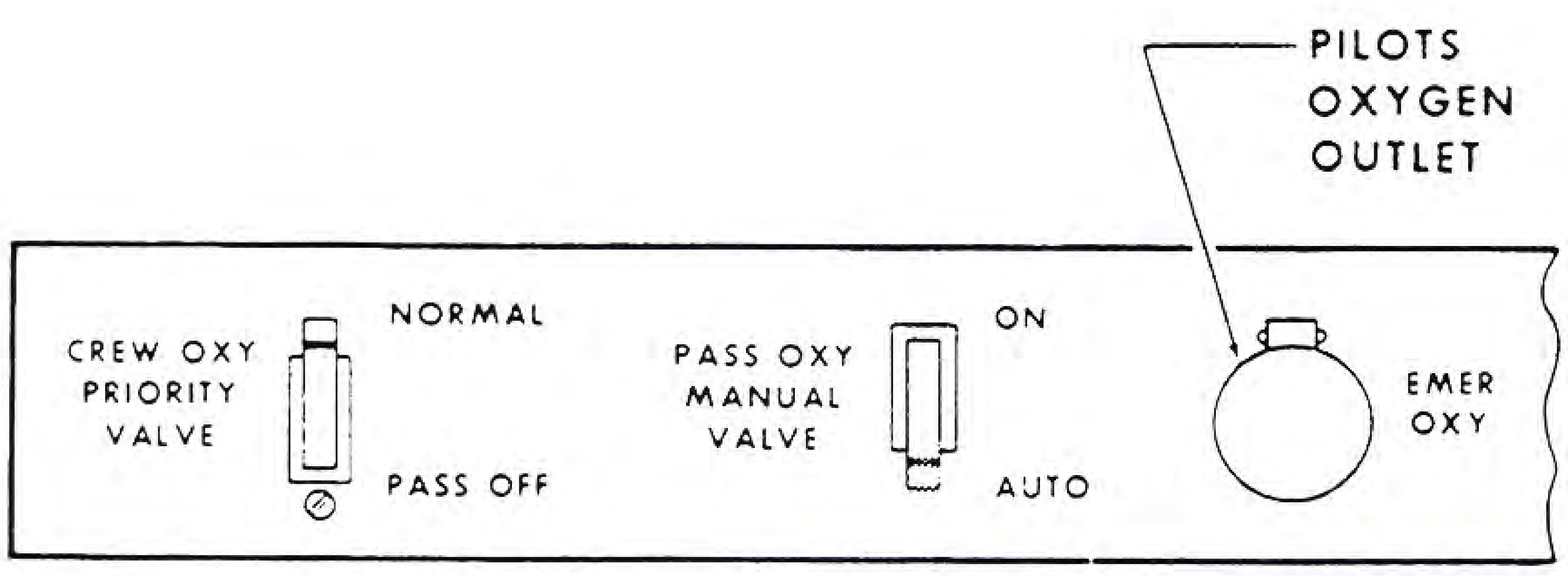
Oxygen Bottle

In the unlikely event supplementary oxygen is required, a fully-charged 22.0 cubic foot bottle located under the right nose baggage compartment floor provides approximately 15 minutes oxygen for crew and six passengers. Duration for actual personnel aboard can be computed by assuming consumption at a rate of 4 liters per minute per occupant, and a usable full bottle output of 500 liters. An optional 60 cubic foot bottle is also available. Normal pressure for the system is 1,600-1,800 p.s.i..

The bottle assembly contains a pressure reducing valve, shutoff valve and provisions for external servicing. A green disc is installed in the end of the bottle overpressure vent line which is flush mounted below the right nose baggage door. This disc, when ruptured, indicates bottle pressure has exceeded 2,500 p.s.i. and is empty. This overpressure system will actuate under only the most adverse circumstances;

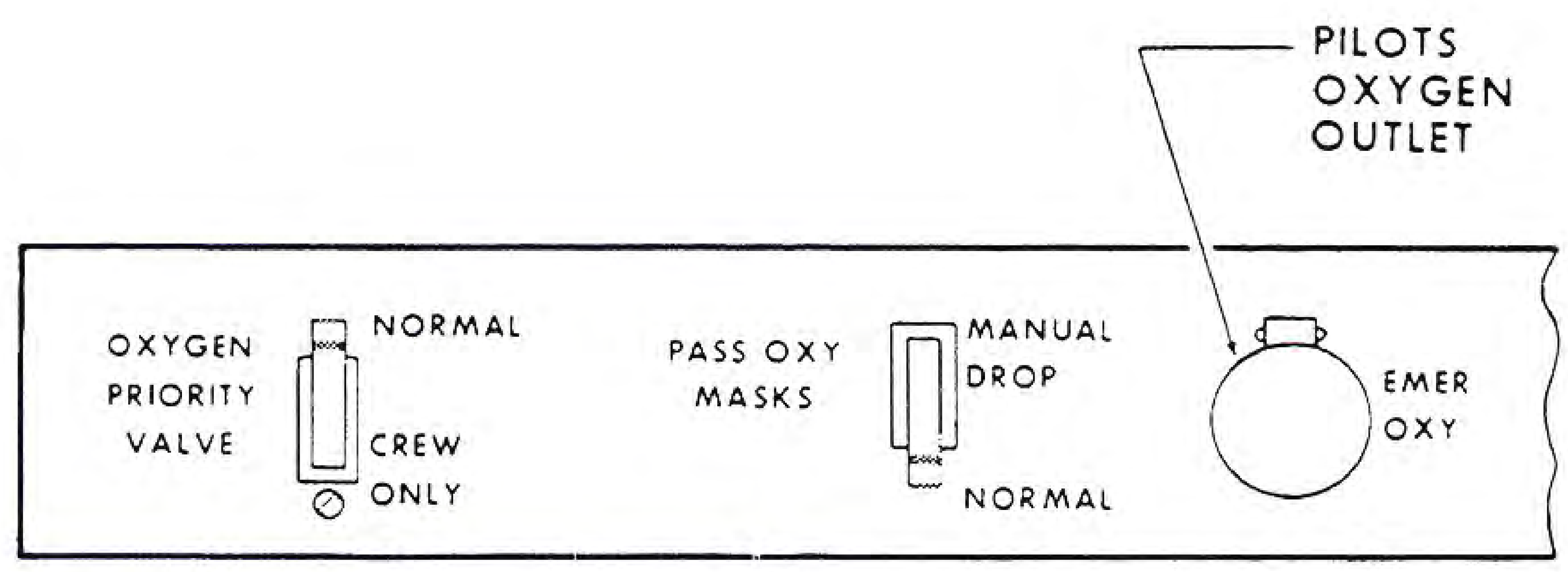
therefore, if the disc is ruptured, determine the cause of the overpressure before flight. The oxygen bottle pressure is displayed on the right instrument panel. A locking connector has been provided on the right and left flight deck consoles to supply the flight compartment occupants with 70 p.s.i. oxygen for diluter demand mask use. The diluter demand masks have an integrally-mounted microphone and oxygen regulator. Each oxygen regulator has a lever allowing manual selection of diluter demand (normal) or demand (100% oxygen) flows. The lever is normally placed in the 100% position so it is ready for emergency use at high altitudes. If oxygen is used below 20,000 feet, the lever can be repositioned to normal to conserve oxygen.

Oxygen Control Panel



PILOTS SIDE CONSOLE OXYGEN VALVES AND OXYGEN OUTLET

500-0001 thru -0061



PILOTS SIDE CONSOLE OXYGEN VALVES AND OXYGEN OUTLET

500-0062 thru -0349

The left console contains the oxygen controls regulating flow to the passenger compartment. The OXYGEN PRIORITY VALVE (labeled CREW OXY PRIORITY VALVE on 500-0061 and prior) can be closed if the situation warrants oxygen flow to the flight deck only. A switch marked PASS OXY MASKS (PASS OXY MANUAL VALVE on 500-0061 and prior) can be used to manually drop the passenger oxygen masks if therapeutic oxygen is required or if oxygen is needed during an electrical power failure. On 500-0101 thru -0349, a switch on both control panels labeled MIC OXY MASK/MIC HEADSET, selects which mike will be used. On aircraft prior to 500-0101, a switch on the stowage hook cuts off the mask mike and permits normal use of the headset mike. When stowed, the crew mask should be placed firmly in the bottom of the hook to prevent inadvertently disabling the headset mike.

OXYGEN

Should cabin altitude exceed 13,500 $\pm$ 600 feet, an altitude sensing switch will electrically actuate the passenger solenoid valve, supplying 70 p.s.i. oxygen pressure to the passenger manifold. This pressure is sufficient to operate the passenger mask actuators, deploying the doors and dropping the continuous flow masks at each passenger seat. Oxygen will not flow from these masks until the lanyard on the respective mask has been pulled removing the pintle pin. This conserves oxygen in the event all masks are not to be used. When the cabin altitude has reached approximately 8,000 feet with electrical power available, the passenger solenoid valve will close, allowing passenger manifold oxygen pressure to bleed off. If electrical power is not available the passenger manifold pressure can be shut off by closing the OXYGEN PRIORITY VALVE. As the oxygen pressure dissipates, the door actuators will retract allowing mask stowage to be accomplished. Reinstall all removed pintle pins before stowing masks.

500-0001 thru -0213

Bleed air from the engines is used to create vacuum for cabin pressurization control and the co-pilot's gyro horizon. The system has no control valves and is operational whenever the engines are running. A gauge on the co-pilot's panel reads vacuum pressure in inches of mercury, and indicates 4.5 ± 0.5 when the system is operating normally.

When either or both engines are operating, bleed air is directed through a pressure regulator and an air ejector. Air passing through the ejector creates a vacuum at an air inlet port, which is the pickoff point for the vacuum system. A filter in the system removes foreign particles from the air.

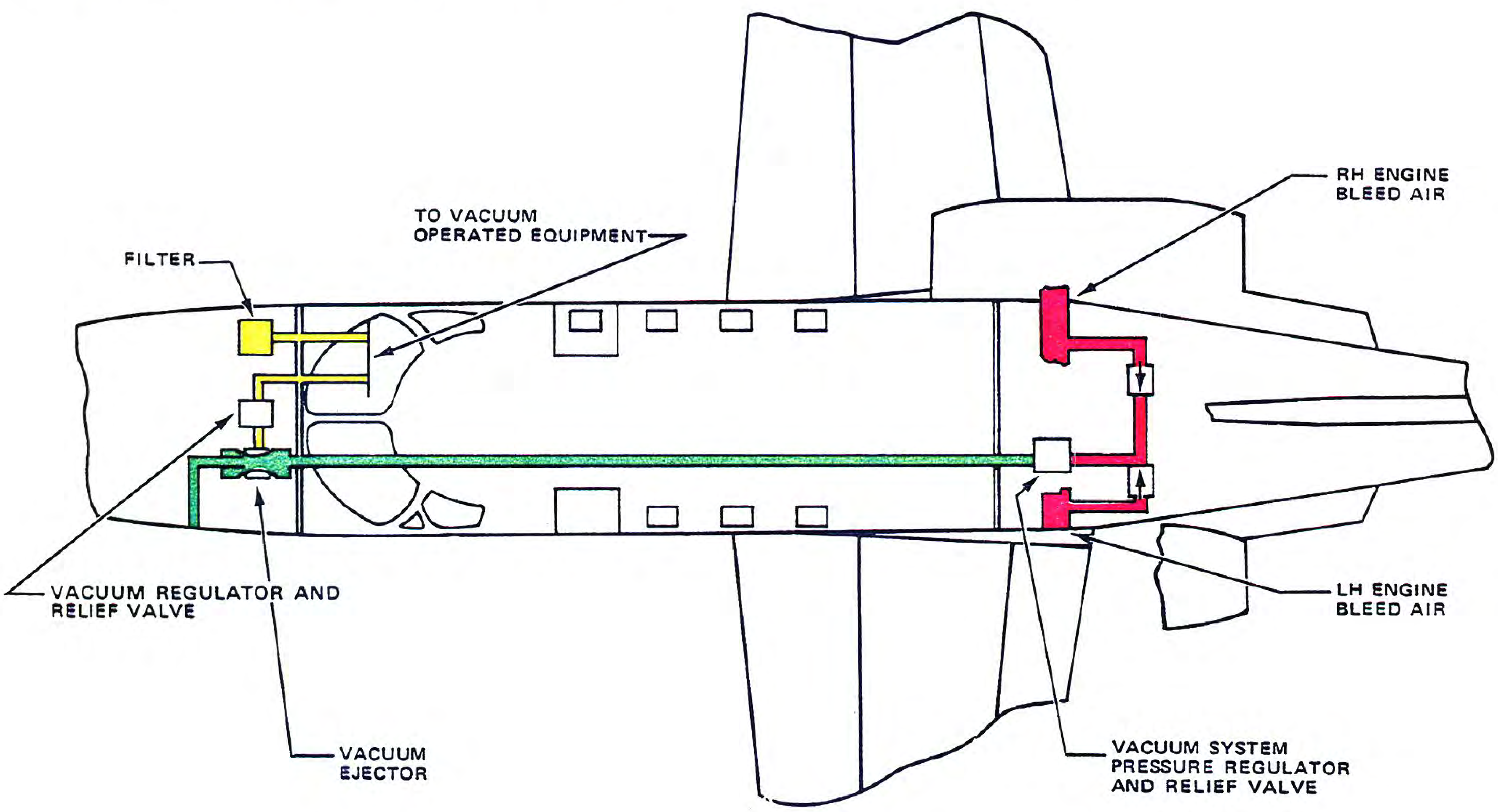
In the event of a vacuum system failure, the co-pilot's attitude gyro will be inoperative as will the emergency dump valve. Cabin pressure will go to maximum differential since control air (vacuum) is not available to the pressurization outflow valves.

500-0214 thru -0349 and Aircraft Incorporating SB21-9

Bleed air from the engines is used to create a vacuum for cabin pressurization control.

When either or both engines are operating, bleed air is directed through a pressure regulator and an air ejector. Air passing through the ejector creates a vacuum at an air inlet port, which is the pickoff point for the vacuum system. A filter in the system removes foreign particles from the air. A regulator is included which regulates the vacuum pressure between 3.75 and 4.75 inches of mercury.

In the event of a vacuum system failure, the emergency dump valve will be inoperative and cabin pressure will go to maximum differential since control air (vacuum) is not available to the pressurization outflow valves.



LIGHTING

Interior Lighting

Interior lighting is provided for the flight compartment, cabin, and tailcone area. Electroluminescent panels, instrument floodlights and white background lighting illuminate all cockpit instruments and switches. Two overhead floodlights, controlled by a single rheostat switch, are available for additional cockpit lighting. The overhead floodlights and instrument floodlights will operate off the emergency battery bus in the event of a double generator failure, providing emergency cockpit lighting. All lights except the overhead, instrument floodlights and two individually controlled map lights are controlled by a PANEL LIGHT CONTROL master switch and then adjusted by rheostats. When the instrument panel lights are on, a dimmer is activated in the annunciator panel to provide for lower warning light intensity during night flying. The starter disengage switch is also illuminated when the panel lights are on.

Two individually controlled map lights are located on the bottom of each control wheel. In 500-0144 thru -0349, this provision is deleted and replaced by map lights on a flex cable stowed under each circuit breaker panel.

Cabin lighting includes individually controlled overhead reading lights, two aft baggage compartment lights and a refreshment center light. On 500-0071 thru -0349, a switch on the forward door post turns on exit lights over the main and emergency doors and one aft baggage compartment light. On aircraft prior to 500-0071 the switch illuminates only the exit lights. These lights are powered by the hot battery bus and are available any time the battery is installed and serviceable.

A three-position Passenger Advisory Switch in the cockpit is also tied to the hot battery bus. In the SEAT BELT position, only the FASTEN SEAT BELT sign is illuminated in the cabin. In the PASS SAFETY position, the NO SMOKING, FASTEN SEAT BELT sign and EMERGENCY EXIT lights are illuminated. When the switch is OFF, all advisory and emergency lighting is extinguished.

A third provision for emergency exit lighting is through a small battery in the cabin headliner which will power the emergency exit lights any time a sensor is exposed to a force of 5Gs or more.

LIGHTING

Tailcone Lighting

A light located in the upper tailcone area provides interior lighting for tailcone inspection. Power is from the hot battery bus. The OFF/ON switch is mounted on the access door frame and is wired through the door-closed micro-switch. Closing the tailcone compartment door will extinguish the light, regardless of OFF/ON switch position.

Nose Baggage Compartment Lighting

A light located centrally in the nose baggage compartment provides interior lighting for baggage loading or unloading. An OFF/ON switch, located adjacent to the light, is wired through a microswitch in each nose baggage access door release latch. With the switch in the ON position, opening either door will illuminate the light. Closing the baggage doors will extinguish the light, regardless of switch position.

The nose baggage light which is standard on 500-0275 thru -0349 and optional on earlier aircraft, is powered by the hot battery bus and is available anytime the battery is installed and serviceable.

Exterior Lighting

Exterior lighting consists of navigation lights, anti-collision (rotating beacon) lights, a wing inspection light, landing lights, and optional strobe lights. All exterior lights are controlled by switches located on the instrument panel. The navigation lights are installed in the wing tips and on the aft fuselage below the rudder. One anti-collision light is mounted on the underside of the airplane, the other on the top of the rudder counterbalance. Both beacon assemblies consist of two bulbs, each rotating 180°. A wing inspection light, located aft of the cabin door, illuminates the forward portion of the left wing enabling the pilot to detect ice buildup during night flight. A landing light is attached to each main landing gear door and both lights are individually controlled. The landing lights are automatically shut off, regardless of switch position, when the landing gear is retracted. Strobe lights, when installed, are mounted next to the navigation lights, one in each wing tip and one on the tailcone. These lights are of very high intensity and can be disturbing to other airplanes and ground personnel if they are used during ground operations. They should be turned on just prior to takeoff roll and secured shortly after landing.

WARNING and TEST

Annunciator Panel

The annunciator panel is designed to provide the pilot with an easily interpreted display of both normal and abnormal system conditions. Two flashing master warning lights are used in conjunction with the panel to insure rapid recognition of any red annunciator light. In addition, the master warning light will flash if both amber GEN OFF lights should illuminate.

The master warning lights can be reset by correction of the abnormal condition or by pressing either light. Resetting the master warning light re-arms the system so that it will function should another failure occur.

The annunciator system is powered from the main DC buses through the WARN LTS 1 and 2 circuit breakers on the left cockpit panel.

All system lightbulbs can be tested by placing the rotary TEST selector on the left instrument panel to the ANNU position. This will illuminate all lights and cause the master warning lights to flash.

Burned out bulbs can be quickly replaced from the front of the panel by pushing in the face of the light and allowing the unit to pop out. The bulbs are accessible from the back of the released unit.

The three illustrations show typical annunciator panel layout according to airplane serial number. Individual airplanes may vary due to incorporation of Service Bulletins, but light interpretation is consistent.

500-0041 thru -0070

1 F/D AC PWR OFF	2 CAB ALT 10,000 FT	3 SPARE	4 SPARE	5 L OIL PRESS LO	6 R OIL PRESS LO
7 RAD AC PWR OFF	8 FUEL FILT BYPASS	9 L ENG ICE FAIL	10 R ENG ICE FAIL	11 L GEN OFF	12 R GEN OFF
13 L HYD PRESS LO	14 R HYD PRESS LO	15 L F/W SHUT OFF	16 R F/W SHUT OFF	17 L FUEL PRESS LO	18 R FUEL PRESS LO
19 HYD PRESS ON	20 HYD LEVEL LO	21 AIR DUCT O'HEAT	22 EMER PRESS ON	23 L FUEL BOOST ON	24 R FUEL BOOST ON
25 BLEED AIR GROUND	26 SPD BRAKE EXTENDED	27 DOOR NOT LOCKED	28 W/S AIR O'HEAT	29 SPARE	30 SURF DEICE

500-0071 thru -0274

1 F/D AC PWR OFF	2 CAB ALT 10,000 FT	3 L FUEL LEVEL LO	4 R FUEL LEVEL LO	5 L OIL PRESS LO	6 R OIL PRESS LO
7 RAD AC PWR OFF	8 FUEL FILT BYPASS	9 L ENG ICE FAIL	10 R ENG ICE FAIL	11 L GEN OFF	12 R GEN OFF
13 L HYD PRESS LO	14 R HYD PRESS LO	15 L F/W SHUT OFF	16 R F/W SHUT OFF	17 L FUEL PRESS LO	18 R FUEL PRESS LO
19 HYD PRESS ON	20 HYD LEVEL LO	21 AIR DUCT O'HEAT	22 EMER PRESS ON	23 L FUEL BOOST ON	24 R FUEL BOOST ON
25 BLEED AIR GROUND	26 SPD BRAKE EXTENDED	27 DOOR NOT LOCKED	28 W/S AIR O'HEAT	29 BATT O'HEAT	30 SURF DEICE

500-0275 thru -0349

1 AC FAIL	2 CABIN ALT 10,000 FT	3 L FUEL LEVEL LO	4 R FUEL LEVEL LO	5 L OIL PRESS LO	6 R OIL PRESS LO
7	8 FUEL FILT BYPASS	9 L ENG ICE FAIL	10 R ENG ICE FAIL	11 L GEN OFF	12 R GEN OFF
13 L HYD PRESS LO	14 R HYD PRESS LO	15 L F/W SHUT OFF	16 R F/W SHUT OFF	17 L FUEL PRESS LO	18 R FUEL PRESS LO
19 HYD PRESS ON	20 HYD LEVEL LO	21 AIR DUCT O HEAT	22 EMER PRESS ON	23 L FUEL BOOST ON	24 R FUEL BOOST ON
25 BLEED AIR GROUND	26 SPD BRAKE EXTENDED	27 DOOR NOT LOCKED	28 W/S AIR O HEAT	29 BATT O HEAT	30 SURF DEICE

WARNING and TEST

Indications

Warning Light (refer to numbers on appropriate annunciator panel)

1. **Flight Director AC Power Failure — indicates high or low voltage or loss of power to flight director bus.**
   a. Inverter switch not on — normal during start.
   b. Flight director bus voltage below 90 VAC or above 130 VAC.
   c. Indicates inverter failure (number 1 or 2 depending on XOVER switch position).

2. Cabin altitude 10,000' - cabin exceeds an altitude of 10,000'.

3. & **4. Fuel Level Low - fuel quantity in respective tank reaches a level of 170-284** pounds. Retrofit on earlier aircraft places warning lights on co-pilot's side panel. Indications remain the same.

5. & 6. Oil Pressure Low - respective engine oil pressure below 35 p.s.i.. Normal indication prior to start.

7. Radar AC Power Failure - indicates loss of power to radar bus.
   a. Switch not on - normal during start.
   b. Radar bus voltage below 90 VAC or above 130 VAC.
   c. Indicates inverter failure (number 1 or 2 depending on XOVER switch position).

8. Fuel Filter Bypass - Left, right or both filters approaching, or actually being bypassed due to fuel filter restriction.

9. & 10. Engine Ice Fail
   a. Engine inlet cowl anti-ice valve does not open or bleed air flow is insufficient to maintain a temperature above 170°F.
   b. Engine stator anti-ice valve does not open.
   c. Inboard wing leading edge temperature is below 60°F.
   d. Any one of the wing leading edge heating elements inoperative.
   e. During five second delay after actuation or until inlet temperature reaches 170°F with over 60% turbine RPM.
   f. Temperature controller has failed.

11. & 12. Generator Off -

a. Placing respective generator switch to off - normal during external power starts.

b. Generator trip caused by:

. . . reverse current

. . . fire switch (engine shutdown)

. . . overvoltage

. . . feeder (differential) fault

. . . engine shutdown

13. & 14. Hydraulic Pressure Low - indicates below normal hydraulic pressure.

15. & 16. Firewall Shutoff - fuel and hydraulic firewall shutoff valves closed after fire switch actuation. Valves can be opened by resetting fire switch.

17. & 18. Fuel Pressure Low - low fuel supply pressure to engine-driven pump. Primary pump failure will automatically initiate boost pump operation as long as FUEL BOOST switch is in the NORM position (see FUEL BOOST ON indicator light). Light remaining on indicates failure of both pumps.

19. Hydraulic Pressure On - system is pressurized to 1,500 p.s.i.. Normal during landing gear, speedbrake or thrust reverser operation.

20. Hydraulic Level Low - hydraulic reservoir fluid level below minimum operating volume.

21. Air Duct Overheat - air temperature in cabin distribution duct above 135°C (275°F).

22. Emergency Pressurization On -

a. Pressurization source selector in EMER position.

b. Air conditioning overheat with the pressurization source selector in GND, LH, BOTH or RH.

23. & 24. Fuel Boost On - normal indication during engine start, crossfeed or with FUEL BOOST switch ON. It should illuminate in conjunction with FUEL PRESS LO indicating light if FUEL BOOST switch is in NORM position.

25. Bleed Air Ground - pressurization source selector in GND position.

26. Speedbrake Extended - both sets of speedbrakes fully extended. HYD PRESS ON indicator should extinguish simultaneously.

    Door Not Locked - cabin, nose baggage compartment, or aft compartment door not fully closed and locked.

28. Windshield Air Overheat - with the W/S BLEED switch ON, indicates bleed air to windshield too hot. With switch OFF indicates windshield bleed air shutoff has failed to the open position.
29. Battery Overheat - light will flash when BATT TEMP is selected by rotary TEST switch or when battery temperature exceeds 71oC (160oF). A steady light indicates battery temperature is between 63o and 71oC (145o and 160oF).
30. Surface De-ice- illuminates twice during the 12 second surface de-ice boot cycle to indicate proper boot inflation pressure. Boot inflation can not be checked visually.

Skid Warning

The optional skid warning system enables the pilot to determine if one or both main wheels are approaching a skid condition. It consists of a skid warning transmitter located in each main gear wheel, a skid warning control, and one skid warning motor located on each of the pilot's rudder pedals.

The skid warning transmitter is a linear, permanent magnet, DC generator bolted in the main gear axle. The drive shaft for the generator is connected by a drive cap to the main wheel. As the wheel turns it rotates the generator drive shaft. The skid warning control receives the signals produced by the skid warning transmitters. The output signal from the skid warning control supplies the voltage to the skid warning motor.

Each main wheel has an individual skid warning circuit that will operate independently. The squat switch must be in the ground position to complete the skid warning motor circuit.

WARNING and TEST

An impending skid is sensed by comparing the voltage signal from the skid warning transmitter to a reference voltage. At touchdown, the transmitter voltage reaches maximum as soon as the wheel spins up. As long as no skid occurs, the transmitter voltage follows wheel speed and the reference voltage follows the voltage of the transmitters. When excessive deceleration of a wheel occurs, transmitter voltage suddenly drops. The reference voltage tries to drop to match it and in doing so energizes a relay which activates the skid warning motor on the rudder pedal. An audible warning and a vibration in the brake pedal of the effected wheel notifies the pilot of the impending skid. As soon as brake pressure is removed, the wheel regains speed, and when transmitter voltage again matches reference voltage the skid warning motor stops.

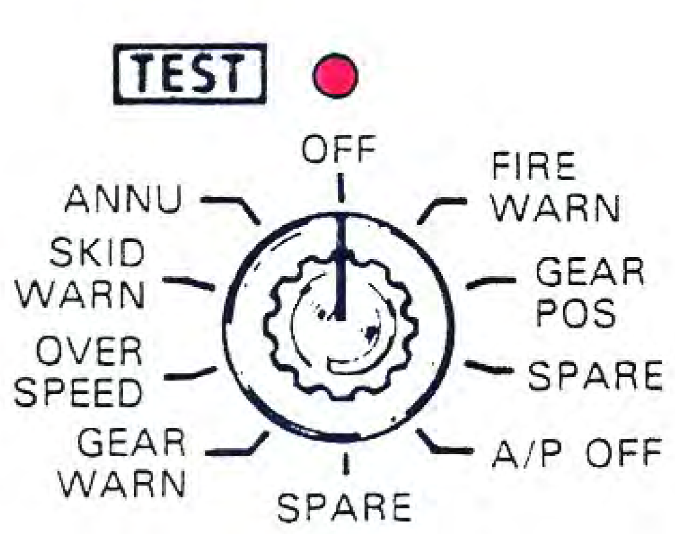
The skid warning system can be checked by selecting SKID WARN on the rotary TEST selector. This functionally checks the control and operates the skid warning motor. The skid warning motor will continue to operate for a short time after the test function has been released.

Stall Warning

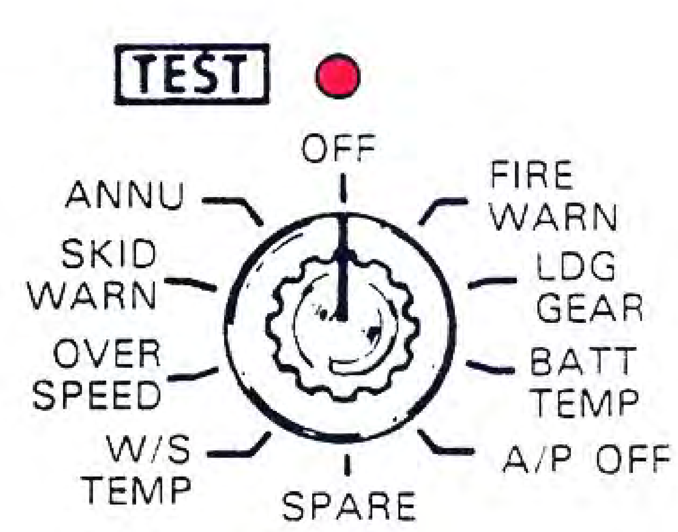
Stall warning is achieved aerodynamically, aided by stall strips on the inboard section of each wing. The strips disrupt airflow over the wing causing that area to stall first accentuating pre-stall buffet. The pilot is alerted to impending stall by aerodynamic buffeting which occurs at approximately $V_{S1} + 12$ in the clean configuration, and $V_{SO} + 5$ in the landing configuration.

Test System

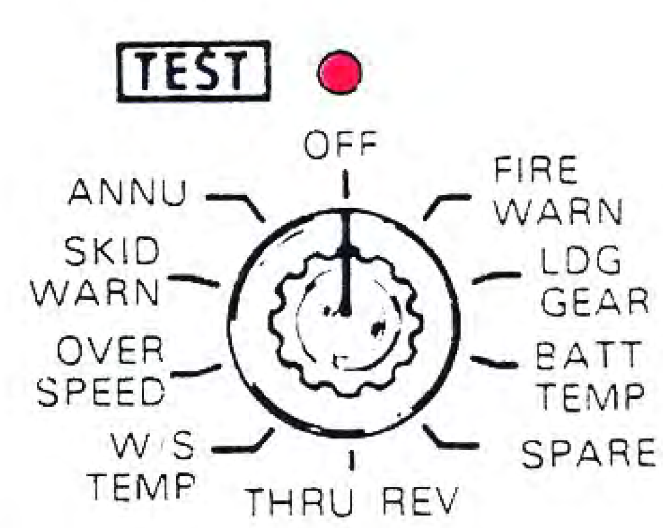
The test selector is located in the upper left corner of the instrument panel and offers several positions of test. It will function only when the BATT switch is ON. A red light above the test selector switch illuminates whenever the test selector switch is in any position but OFF.



500-0001 thru -0040
TYPICAL



500-0041 thru -0274
TYPICAL



500-0275 thru -0349
TYPICAL

WARNING and TEST

Test Selector Switch Position	Indication
OFF	The red light will be off and the test system inoperative.
FIRE WARN	The engine fire lights on the upper center instrument panel will illuminate.
GEAR POS 500-0001 thru -0040 LDG GEAR 500-0041 thru -0349	The three green safe lights and the red unlocked light on the landing gear control panel will illuminate and the warning horn will sound. Horn may be silenced by pressing horn silence button on landing gear panel.
A/P OFF 500-0001 thru -0274	The autopilot off light will illuminate and the warning tone will sound.
W/S TEMP 500-0041 thru -0349	The W/S AIR O'HEAT light will illuminate if LOW or HIGH is selected on the windshield bleed air switch.
GEAR WARN 500-0001 thru -0040	The audible landing gear warning signal will sound. Horn cannot be silenced.
OVERSPEED	The audible mach warning signal will sound.
SKID WARN (optional)	The rudder pedals will vibrate and an audible warning will sound.
ANNU	All the annunciator panel lights and the master warning light will illuminate.
ANNU 500-0275 thru -0349	In addition to the above, this position also tests the altitude alert horn and light when both avionics power switches are ON.
BATT TEMP 500 -0041 thru -0349	The BATT O'HEAT light will flash and the optional battery temperature monitor gauge will indicate 160° showing circuit integrity.
THRU REV (Optional)	The thrust reverser and master warning lights will illuminate.

SECTION III
INSTRUMENTATION and AVIONICS

500-0001 thru -0274

Page

INSTRUMENTATION

Separate airspeed indicators, vertical speed indicators, altimeters and turn and bank indicators are installed for use by the pilot and co-pilot. Two independent pitot-static systems measure total pressure and static pressure. The two pitot tubes and four static ports are electrically heated for ice protection.

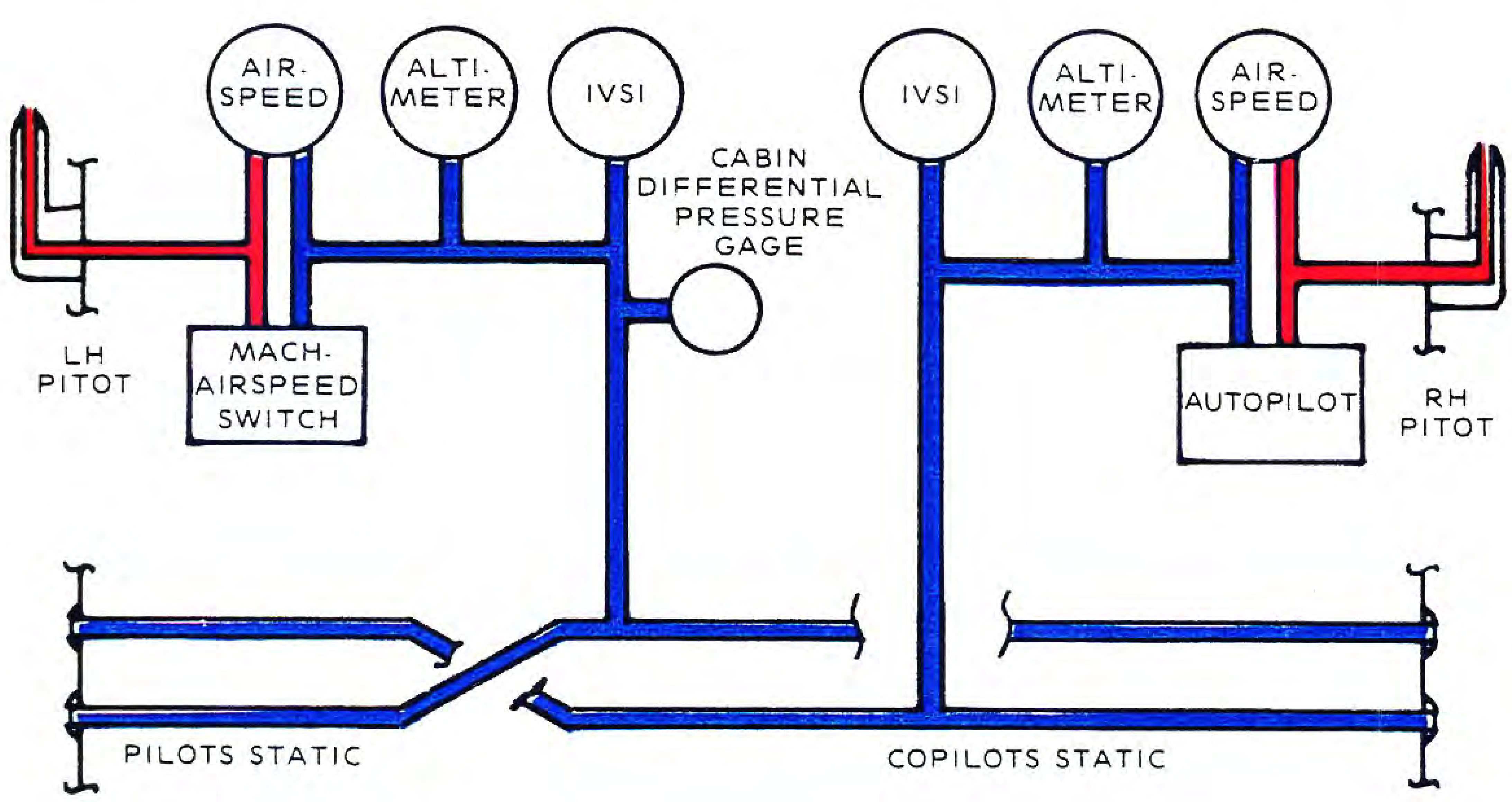
Pitot-Static

The pitot tube on the left side of the aircraft supplies pressure to the pilot's airspeed indicator and the mach-airspeed limit switch. The pitot tube on the right side of the aircraft supplies pressure to the co-pilot's airspeed indicator and the autopilot.

Two static ports are located on each side of the aircraft. One port on each side provides a static source for the pilot's airspeed indicator, altimeter, instantaneous vertical speed indicator, mach-airspeed limit switch, and the cabin diffential pressure gauge. The second port provides a static source for the co-pilot's airspeed indicator, altimeter, instantaneous vertical speed indicator and the autopilot.

PITOT AND STATIC SYSTEM

PILOTS INSTRUMENTS COPILOTS INSTRUMENTS



Altimeters

The pilot's encoding altimeter uses a counter-pointer display and is powered by 26 VAC from the Flight Director AC bus. System protection is provided through a circuit breaker on the left panel. When used in conjunction with mode C on the transponder, it provides automatic altitude reporting. A Kollsman window displays the selected barometric pressure in inches of mercury and millibars. Setting the barometric scale knob does not affect the altitude reporting feature which is always relative to

29.92 inches of mercury. A self-test feature and altitude alerting is included. (See Altitude Alert Section of this Chapter for additional information).

Any time power is interrupted to the altimeter or an error of 175 $\pm$ 25 feet or more occurs between sensed and displayed altitude, a red warning flag will appear at the zero point on the altimeter face and on the altitude alert panel. When the flags are in view, altitude reporting is discontinued.

To test the altimeter and altitude alert circuitry, set the altitude alert to the 100 foot interval nearest the altimeter reading and depress the self-test button on the altimeter face. The altimeter and alerter OFF flags will appear and the altimeter pointer will descend a minimum of 400 feet. The ALT warning light will illuminate and the aural tone will sound.

The co-pilot's altimeter is a conventional barometric type with a counter-pointer readout. Field pressure is set in a Kollsman window.

Airspeed Indicators

The pilot's and co-pilot's airspeed indicators are identical and operate off uncorrected pitot-static inputs. The instruments incorporate a single rotating needle, a fixed scale calibrated in knots and a rotating mach scale. Slots in the airspeed dial at 262 and 289 KIAS will show red below 14,000 feet and from 14,000 - 26,000 feet respectively, indicating V_{MO} limits. The mach limit of .705 above 26,000 feet is indicated by a single red radial line. A knob on the lower left corner of the instrument controls a moveable index that can be set to any airspeed as a reference.

Vertical Speed Indicators

The two instantaneous vertical speed indicators indicate vertical velocity from 0 to 6,000 feet per minute,either up or down.Their operation differs from conventional VSIs in that there is zero time lag between aircraft displacement and instrument indication. Accelerometers sense any change in normal acceleration and displace the needle before an actual pressure change occurs.

Turn and Bank

The co-pilot's turn and bank indicator is powered by 28 VDC through a circuit breaker on the left hand circuit breaker panel. An OFF flag will come into view any time power is interrupted.

INSTRUMENTATION

Vacuum Gyro — 500-0001 thru -0213

The co-pilot's attitude gyro is a vacuum powered instrument which displays aircraft attitude in pitch and roll. The vacuum is produced by a small jet pump operating off engine bleed air. The attitude gyro will be operating anytime at least one engine is running. Due to the simplicity and reliability of the system, no warning flags are provided. System vacuum may be monitored through the vacuum indicator installed in the right instrument panel.

Pressure Gyro — 500-0214 thru -0274 and Aircraft incorporating SB21-9

The co-pilot's attitude gyro is a pressure powered instrument which displays aircraft attitude in pitch and roll. The pressure is produced by engine bleed air. The attitude gryo will be operating anytime at least one engine is running. Due to the simplicity and reliability of the system, no warning flags are provided. System pressure may be monitored through the pressure indicator installed in the right instrument panel.

Engine Instruments

Each engine is equipped with the following instruments located on the center instrument panel:

- Fan RPM
- Inter-Turbine Temperature (ITT)
- Turbine RPM
- Fuel Flow
- Fuel Quantity
- Oil Temperature
- Oil Pressure

All engine instruments are of the vertical tape readout design and are powered by 28 VDC through circuit breakers on both cockpit circuit breaker panels. Small power indicators are included on the face of each instrument which will indicate "red" if power is interrupted to the respective side.

The FAN RPM and TURBINE RPM are calibrated in percent from 0 to 110%. (100% Fan RPM = 16,000; 100% Turbine RPM = 32,760). A digital display is provided below each tape for a more accurate readout. Above idle RPM, both instruments are driven by tachometer generators and will continue to operate in the event of a DC power failure.

The ITT gauge is calibrated in degrees centigrade from 200 to 1,000. A digital readout is provided below each tape for a more precise readout. The temperature displayed is a synthetic inter-turbine temperature which is computed by measuring the exhaust gas temperature and then adding to it three times the temperature rise across the bypass duct.

The FUEL FLOW gauge is equipped with a digital integrator which presents hours of fuel remaining at the displayed fuel flow and fuel quantity. Readings are very accurate at stabilized power settings, but will indicate a higher than actual flow rate during the initial portion of the start cycle.

The FUEL QUANTITY gauge is calibrated in pounds of fuel and accurately displays fuel remaining in the left and right tanks.

The OIL TEMPERATURE gauge, calibrated in degrees centigrade and the OIL PRESSURE gauge in p.s.i., show system limitations on the face of the instrument with red, yellow, and green markings.

Clock

An eight day clock with a twenty-four hour dial is mounted on the left panel. GMT and local time can be read simultaneously.

Outside Air Temperature Indicator

Below the clock on the left panel is an OAT indicator which displays air temperature uncorrected for ram rise. Two scales and a single pointer are used to indicate both Fahrenheit and Celsius readings.

Magnetic Compass

A standard liquid filled magnetic compass is mounted above the glareshield on the windshield centerpost.

Flight Hour Meter

The meter displays the total flight time on the aircraft in hours and tenths. The landing gear squat switch activates the meter when the weight is off the gear. A small indicator on the face of the instrument rotates when the hour meter is in operation.

AVIONICS

The standard avionics package in the CITATION includes dual audio control panels, dual VHF COMM transceivers, dual NAVs, dual RMIs, ADF, DME, transponder, auto flight system and weather radar. The equipment is factory installed and provides the CITATION with Category II operational capability.

VHF COMM Transceivers — 500-0001 thru -0047

Dual AVC110 transceivers are located on the center instrument panel. Each unit is a 360-channel VHF receiver, transmitter and control head. The frequency range is from 118.00 to 135.95 MHz.

Operation is straight forward, with a control knob at the bottom of the unit acting as an ON-OFF switch, a volume control, which when pushed, turns the automatic squelch ON or OFF. Two control knobs marked MHz and KHz are used to select the desired VHF frequency, which is then displayed in a window at the top of the unit.

VHF COMM Transceivers — 500-0048 thru -0274

Dual AVC110A transceivers are located on the center instrument panel. Each unit is a 720-channel VHF receiver, transmitter and control head. The frequency range is from 118.000 to 135.975 MHz. A control knob on the upper left corner of the unit serves as an ON-OFF switch and volume control. A push on, push off type switch is provided to turn the automatic squelch ON or OFF.

Frequencies are selected with the two concentric control knobs and displayed by a light bar readout. The outer knob is used to select MHz while the inner knob selects KHz. Pulling the center control knob out allows selection of frequencies in 25 KHz increments.

VHF Self-Test

An amber XMTR light located on the control head will illuminate each time the microphone button is depressed, indicating an RF carrier wave is being transmitted. The intensity of the light is proportional to the signal strength. Sidetone indicates that the voice signal is modulating the RF carrier wave. Automatic dimming of the XMTR light occurs when panel lighting is selected.

AVIONICS

COMM Preselect

An optional communications preselect head is available on either or both VHF COMMS, enabling the pilot to preselect any two VHF COMM frequencies. Both frequencies are displayed in separate windows by a light bar readout. A selector switch labeled A, B, and XFR is used to switch the transceiver between the frequencies in the top and bottom windows. The XFR position transfers the bottom frequency to the top, enabling a new frequency to be selected in the bottom window. When the set is turned off or its power supply is interrupted, the bottom frequency will automatically transfer to the top window.

HF COMM Transceivers

Two types of HF transceivers are optionally available to provide long range AM and single sideband communications.

The Sunair ASB-130 Transceiver operates on either AM or single sideband, utilizing ten preset channels between 2.0 and 18.0 MHz. Refer to Sunair handbook for specific operating instructions.

The Collins 718U-5 Transceiver operates on either AM or single sideband, utilizing 280,000 channels between 2.0 and 30.0 MHz. Refer to Collins handbook for specific operating instructions.

Audio Control Panel

Two audio control panels are installed to provide individual audio selection by each pilot. Three-position switches (SPKR-OFF-HDPH) enable all audio inputs to be selected to the speakers or headphones. A CODE/VOICE FILTER rotary selector is used in conjunction with the NAV and ADF switches to monitor either voice or code identifiers. The MASTER VOL knob controls the volume of all selected audio sources. The MIC SELECTOR switch has five selector positions. COMM 1 or COMM 2 connect the lip microphone, the hand-held microphone and the oxygen mask mircrophone to the respective VHF transmitter. COMM 3 position is used for the HF System, if installed.

A three position switch located on the control wheel is used for keying the COMM transmitters when using the lip microphone or oxygen mask microphone. The INPH position on the control wheel provides pilot-to-pilot communication from any of the three microphone sources. PASS SPKR connects any of three microphones to the speaker in the cabin for passenger announcements. The PASS SPKR VOL knob controls the speaker volume. When operating with the battery switch in the EMER position, the MIC SELECTOR switch must be placed to EMER to regain the use of COMM 1. This bypasses the audio amplifier, necessitating the use of a headset to receive and volume control is available only at the radio. Transmitting remains normal from all microphone sources.

VHF NAV

Dual AVN-220 navigation receivers provide VOR, localizer, glide path and marker beacon capability. Each receiver is a single panel mounted unit, with 200 available VHF channels (50 KHz spacing from 108.0 to 117.95), twenty frequency paired UHF glideslope channels, and automatic DME channeling. Multiple outputs drive the Flight Director HSI, RMIs, autopilot and course deviation indicator. All the basic functions have a built-in self-test.

In 500-0047 thru -0274, the AVN-220A incorporates an additional twenty glideslope channels and a light bar frequency display.

VHF NAV 1 information is displayed on the flight director HSI and both RMIs, when the RMI selector knobs are positioned to VOR 1. Course selection is accomplished on the HSI by turning the course knob to the desired setting. A TO-FROM indicator is installed within the HSI to resolve course ambiguity. A red NAV flag on the HSI indicates unreliable NAV 1 information.

VHF NAV 2 information is displayed on the co-pilot's PN-101, the repeater course deviation indicator on the left instrument panel, and both RMIs, when the RMI selector knobs are positioned to VOR 2. Course selection on the PN-101 is accomplished by turning the course knob to the desired setting. A TO-FROM indicator is included within the PN-101. A red NAV flag on the PN-101 will appear when NAV 2 information is unreliable.

NAV 1 localizer information is displayed on the pilot's HSI and by the command bars on the ADI when the flight director VOR/LOC mode is engaged. NAV 2 localizer information is presented on the PN-101 and the repeater course deviation indicator on the left instrument panel. All localizer displays have associated red warning flags which will come into view if localizer information is unreliable.

Glideslope frequencies are paired with localizer frequencies, so that the correct glideslope channel is automatically selected when the localizer is tuned. The NAV 1 glideslope is displayed on the HSI and by the command bars on the ADI when the flight director GS mode is engaged. The NAV 2 glideslope is presented on the PN-101 and the repeater course deviation indicator on the left instrument panel. A red "barber pole" will appear in the HSI glideslope indicator when the NAV 1 glideslope information is unreliable. When NAV 2 glideslope information is unreliable, the glideslope indicator in the PN-101 is masked.

NAV 1 marker beacon output is displayed by three conventional marker beacon lights above the ADI and in the "bullseye" of the ADI. NAV 2 marker beacon output is presented on a standard three-light display above the co-pilot's gyro horizon.

Marker beacon sensitivity is controlled by a two-position "MKR" switch on the face of each NAV instrument. The increased sensitivity of the HI position will provide a larger cone of marker reception. However, if the aircraft is in close proximity to the beacon, the LOW position will give more accurate marker beacon passage.

Aural marker beacon tones can be selected through the appropriate audio control panel.

VHF NAV Self-Test

VHF NAV self-test is available through the TEST button below the volume control knob. It is designed to give the pilot a simple and accurate method of checking VHF NAV system integrity. It is not a substitute for FAA required, periodic accuracy checks.

NOTE

The NAV TEST should not be performed while the autopilot is coupled to the flight guidance system.

ILS Test

1. Tune appropriate NAV receiver to an unused localizer frequency (any frequency between 108.1 and 111.9 that ends in an odd number).
2. Depress and hold the NAV receiver TEST switch.
3. HSI or PN-101 NAV and G/S flags disappear.
4. Course deviation bar moves to an approximate 3/4 scale right displacement and the G/S deviation bar moves to an approximate 3/4 scale down displacement.

5. If NAV 1 is being tested, the ADI bullseye will rotate into view and display a down and right indication with outer and middle marker rings illuminated. If NAV 2 is selected on the Flight Director mode control panel, testing NAV 2 will produce the bullseye display.
6. The marker lights on the pilot's panel will always test with NAV 1. The marker lights on the co-pilot's panel will always test with NAV 2.

VOR Test

1. Tune appropriate NAV receiver to an operable VOR frequency.
2. The HSI or PN-101 NAV flag will pull out of view.
3. Select a course of 055° on the HSI/PN-101 (in aircraft prior to 500-0048 utilizing the AVN 220 NAV, the course selection should be 060°).
4. Depress and hold the NAV receiver TEST switch.
5. The HSI or PN-101 course deviation bar should center within + 5° with a FROM flag indication.
6. If NAV 1 is being tested, the bullseye will center with the outer and middle marker rings illuminated. If NAV 2 is selected on the flight director mode control panel, testing NAV 2 will produce the bullseye display.
7. The marker lights on the pilot's panel will always test with NAV 1. The marker lights on the co-pilot's panel will always test with NAV 2.
8. Test procedures using a VOT are standard.

RMI

Dual AVI-200 radio magnetic indicators are mounted on the left and right instrument panels. Primary ADF magnetic bearing information is displayed on each compass card with a double bar pointer. VOR magnetic bearing is displayed in conjunction with the HSI and PN-101 by a single bar pointer. A selector knob labeled VOR 1 and VOR 2 is positioned to route NAV 1 or NAV 2 information to the single bar pointer. In aircraft with dual ADFs, two selector knobs labeled VOR, ADF, allow selection of

NAV 1 or 2/ADF 1 or 2 combinations on the single and double bar pointers respectively.

STANDARD

DUAL ADF INSTALLATION

The compass card for the pilot's RMI is slaved to the PN-101 compass system and driven by the PN-101 directional gyro. The compass card for the co-pilot's RMI is slaved to the CB-70 compass system and is driven by the CB-70 directional gyro. This provides independent displays for comparison by both the pilot and the co-pilot.

In the event of RMI compass card failure, the VOR pointer will remain slaved to the compass card and continue to indicate magnetic bearing to the selected station. The ADF pointer will indicate relative bearing to the selected station.

ADF

The KDF-800 automatic direction finder is a crystal controlled unit with a frequency range of 200 to 1699 KHZ. Tuning is digital and is accomplished by three concentric knobs mounted in the center of the control head. The receiver is mounted in the tailcone compartment to shorten antenna leads. ADF information is routed to the double bar pointer of each RMI.

A function selector switch labeled OFF, ADF and ANT is used to select the desired mode of operation. It is recommended that the switch be in the OFF position during aircraft start. Placing the switch to ADF sends ADF bearing information to both RMI double bar pointers. The ANT position facilitates aural identification of the selected station. The VOL knob controls receiver volume.

The LEFT-RIGHT loop switch is used to assure that the ADF function is working properly. Actuation of this switch will drive the ADF pointer away from its previous position. When released, the pointer should promptly return to its original position if the station is being received and the system is operating normally.

In some parts of the world, radio range stations use an interrupted carrier for identification purposes. A beat frequency oscillator (BFO) is provided to permit these stations to be more easily identified. The BFO switch is turned to the BFO position and a 1020 HZ tone will be heard while the transmitter carrier is on. The final effect is simply a Morse Code I.D.

Because of an automatic gain control incorporated within the system, the KDF 800 is not recommended for use with four-course A/N radio range stations.

CB—70 Compass System

The HSI, the flight director when NAV 1 is selected on the mode control panel, and the co-pilot's RMI are all driven by the CB-70 slaved gyro system. The system consists of a directional gyro, a compass coupler, a flux detector, two mode selector switches and a slaving indicator. The switches and slaving indicator are mounted on the left switch panel. The CB-70 receives AC power from the No. 1 inverter but can be operated from the No. 2 inverter by use of the inverter crossover switch.

Two LH GYRO SLAVE switches, one marked AUTO/MAN, the other RH/LH, allow selection of automatic (slaved) or manual operation of the CB-70. When the manual position is selected, the HSI compass card can be moved left or right at a minimum rate of 85° per minute by toggling the switch to the RH or LH position. Manual operation gives accurate short term heading reference when magnetic information is unreliable.

Under all normal operating conditions the CB-70 gyro slave switch will be left in the AUTO position. Fast slaving of the CB-70 in the AUTO mode occurs at a minimum rate of 60° per minute, and will continue at that rate until the gyro is slaved to the magnetic compass heading. This will normally occur within 30-60 seconds. It will then continually maintain a slow slaving rate of 1.5° - 3.5° per minute. If the synchronization indicator does not center and the gyro is not slaved to magnetic compass heading within three minutes, it indicates that the slaving system has shifted from fast slave to slow prematurely. Fast slaving may be restarted by moving the AUTO/MAN switch to MAN and then back to AUTO.

PN—101 Compass System

The right horizontal situation indicator is a PN-101 system which consists of an indicator unit, slaved directional gyro, flux detector and slaving accessory unit. The indicator unit combines a compass card, VOR/localizer course deviation indicator, glideslope indicator, warning flags and a TO-FROM indicator. The HDG knob positions a moveable heading index while the COURSE knob is used to set the course indicator. A lubber line and 45° index marks facilitate course intercept. The directional gyro, in conjunction with the flux detector and slaving accessory unit, supplies magnetic heading information to the PN-101 and the pilot's RMI and the flight director when NAV 2 is selected on the mode control panel. A RH GYRO SLAVE switch on the co-pilot's panel provides a FAST (300°/min.) and NORM (3°/min.) position for fluxgate/gyro slaving.

The PN-101 contains its own inverter and is powered off the emergency DC bus. In the event of a DC power failure, placing the battery switch to the EMER position will regain the PN-101 and provide gyro stabilized heading information.

Navigation inputs to the PN-101 are from the NAV 2 receiver. With the Flight Director mode selector in the NAV 2 position, Flight Director ADI and auto-pilot inputs come from the NAV 2 receiver and the PN-101 compass system.

A repeater course deviation and glideslope indicator is located on the pilot's instrument panel for NAV 2 reference. Warning flags are incorporated for NAV 2 failure detection.

FLIGHT GUIDANCE

The FGS-70 Flight Guidance System incorporates the pilot's Attitude Director Indicator (ADI), Horizontal Situation Indicator (HSI), mode control panel, autopilot control panel, AP/FD command computer, AP control computer, a rate gyro and servos. The system may be flown manually or automatically, and meets Category II operational requirements.

Attitude Director Indicator

The ADI displays aircraft attitude, computed roll and pitch steering commands, and ILS raw data information through the bullseye presentation. Pitch attitude is marked in 5° increments to 15° of pitch, with an additional mark at 30°. Roll attitude is marked in 10° increments to 30°, with additional marks at 60° and 90°. A green fixed reference airplane (a wing and tail symbol) displays actual aircraft position relative to the pitch and roll attitudes of the ADI sphere. Also incorporated are an inclinometer indicating skid or slip conditions, and a rate of turn indicator.

The flight director command bars are in view any time the flight director system is in operation. They are positioned by the AP/FD command computer to display pitch and roll steering commands for the mode selected on the mode control panel. Positioning the fixed reference aircraft to align it with the command bars satisfies the computed steering command and will position the aircraft to intercept, track or hold the selected mode.

A GYRO warning flag appears at the top of the ADI when attitude information is unreliable, and a Flight Director warning flag (FD) is displayed at the bottom of the ADI when command bar information is unreliable. A Rate of Turn (RT) warning flag appears when system power is off or inoperative due to system failure.

The bullseye display rotates into the center of the ADI when an ILS frequency is selected in NAV 1 and the glideslope mode of the flight director has been armed. It will also come into view with an ILS frequency in NAV 2, glideslope armed, and the NAV 2 button on the mode control panel depressed. In this situation it will present ILS information from the NAV 2 receiver but the marker lights in the bullseye will not illuminate. The bullseye presents localizer and glideslope information in the form of a three dimensional cross pointer surrounded by three concentric, illuminated rings. With an ILS frequency in NAV 1, the glideslope mode armed and NAV 1 selected on the mode control panel, the blue (inner) circle illuminates as the aircraft passes the

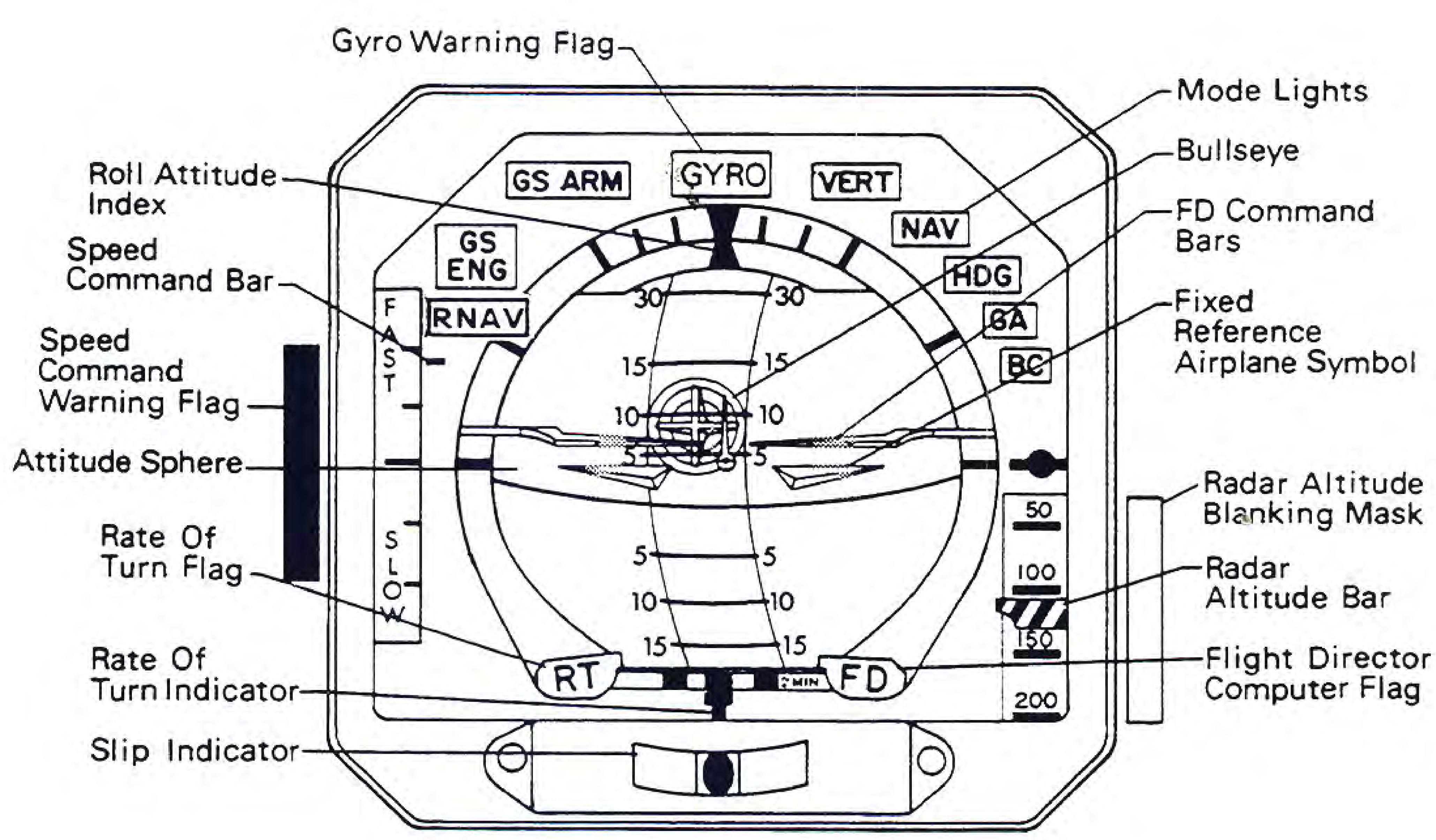
C

outer marker. As it passes the middle marker, the yellow (middle) ring illuminates. As the aircraft reaches whatever decision height is selected in the radio altimeter, the red (outer) ring will illuminate. The lighting of the red ring is solely a function of radio altimeter setting. It will always illuminate at the altitude set with the DH index on the radio altimeter. The red ring will not illuminate unless a radio altimeter is installed.

In the event of a missed approach, the bullseye will rotate out of view when the go-around button on the left throttle is pressed.

Mode annunciator lights are included on the face of the ADI and indicate the mode selected on the mode control panel as follows:

Glideslope Engage	GS ENG
Glideslope Armed	GS ARM
Altitude Hold Engaged	VERT
VOR/LOC (Engaged or Armed)	NAV
Heading Engaged	HDG
Back Course Selected	BC
Go-around	GA
Area Navigation (optional)	RNAV



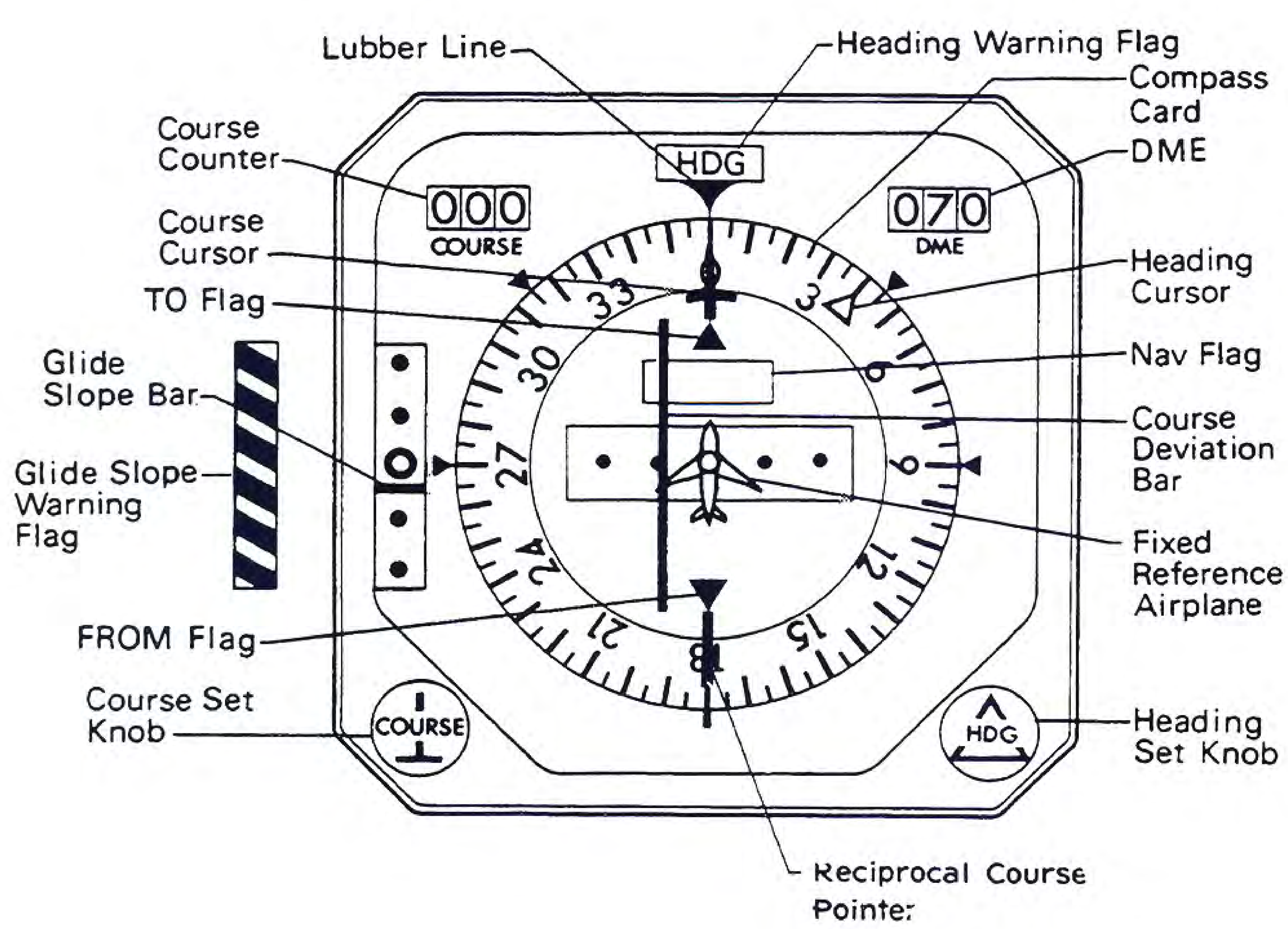
Two final items included on the ADI are a speed command and a radio altimeter repeater. The speed command will give a "fast-slow" approach speed readout when an angle of attack system is installed in the aircraft. The radio altimeter repeater will display absolute altitude from 200 feet AGL to ground level. The respective repeater display will be flagged if the angle of attack system or radio altimeter are not installed or inoperative.

Horizontal Situation Indicator

The HSI displays compass heading, glideslope and localizer deviation, DME or distance to RNAV waypoints, and aircraft position relative to VOR radials. The compass card is graduated in 5 degree increments and a lubber line is fixed at the fore and aft positions. Azimuth markings are fixed at 45°, 90°, 270° and 315° of the compass face. A fixed reference aircraft is in the center of the HSI aligned longitudinally with the lubber line markings.

The triangular heading cursor is positioned by the heading knob and displays a preselected heading. When the compass card rotates the cursor remains on the selected heading.

In addition to positioning the cursor, the heading knob sends internal signals to the command computer to position the command bars when HDG is selected on the mode control panel. A heading flag (HDG) is displayed when the compass system is off or heading indication is inoperative.



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The course knob sets both the course cursor and course counter. The course setting can be read with the green course cursor against the compass card or by the digital course counter in the upper left corner. The course knob also sets internal system reference for flight director commands in the VOR/LOC mode of operation. Like the HDG cursor, the course cursor rotates in its set position with the compass card.

A course deviation bar and course deviation dots also appear on the HSI. The bar displays angular and lateral displacement from the VOR or localizer beam, while the dots are displacement reference points for the course deviation bar. When tracking a VOR, the outer dot represents 10 degrees, while on an ILS localizer it represents 2-1/2 degrees. TO-FROM flags always point to or from a station when operating on a VOR, and a NAV warning flag comes in view when a NAV receiver is inoperable.

When receiving glideslope information during an ILS approach, a glideslope bar will appear on the left side of the HSI displaying deviation from glideslope beam. Glideslope deviation dots serve as a displacement reference for the glideslope bar. If the NAV receiver is not tuned to an ILS frequency, the glideslope indicator is retracted from view. If the ILS signal is unusable or unreliable, the glideslope bar and indicator will be covered by a red and white barber pole.

Distance to the selected VORTAC or RNAV waypoint is displayed in the DME window in the upper right corner of the HSI. The readout is repeated from the DME or area navigation unit installed in the aircraft.

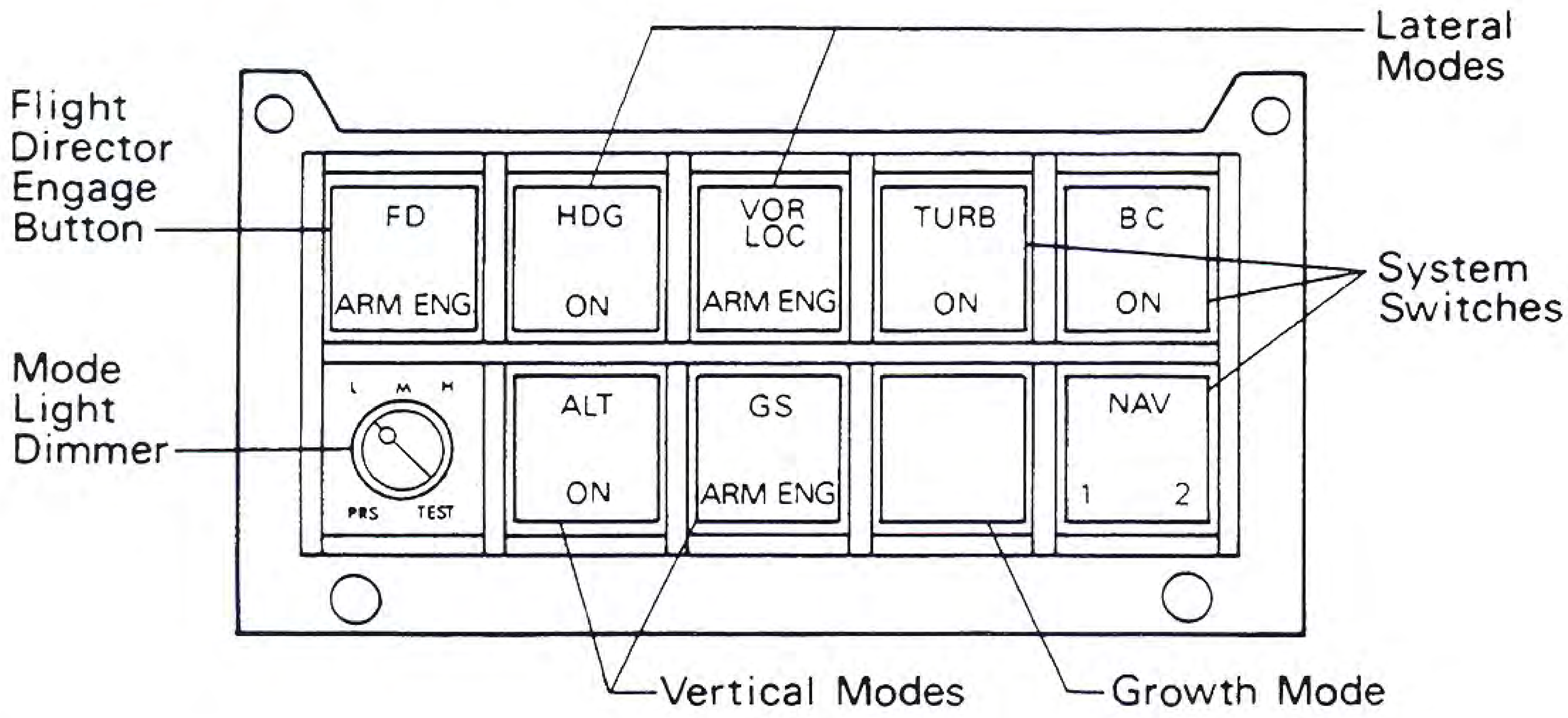
Mode Control Panel

The mode control panel consists of eight solenoid held, back lighted switches that select various flight director/autopilot modes of operation and various system configurations.

The status of the selected mode is then displayed by amber lights when armed (ARM) or green lights when on (ON) or engaged (ENG).

A PRS-TEST switch on the panel will test all lights on the mode control panel, bullseye ring lights, and mode lights on the face of the ADI. The switch also controls the intensity of these lights through high, medium and low positions. A five second time limit is imposed on this test to prevent excessive heat build-up in the lights. In

500-0062 thru -0274 and those incorporating SB34-13, the switch also controls the intensity of the altitude alert light on the pilot's altimeter.



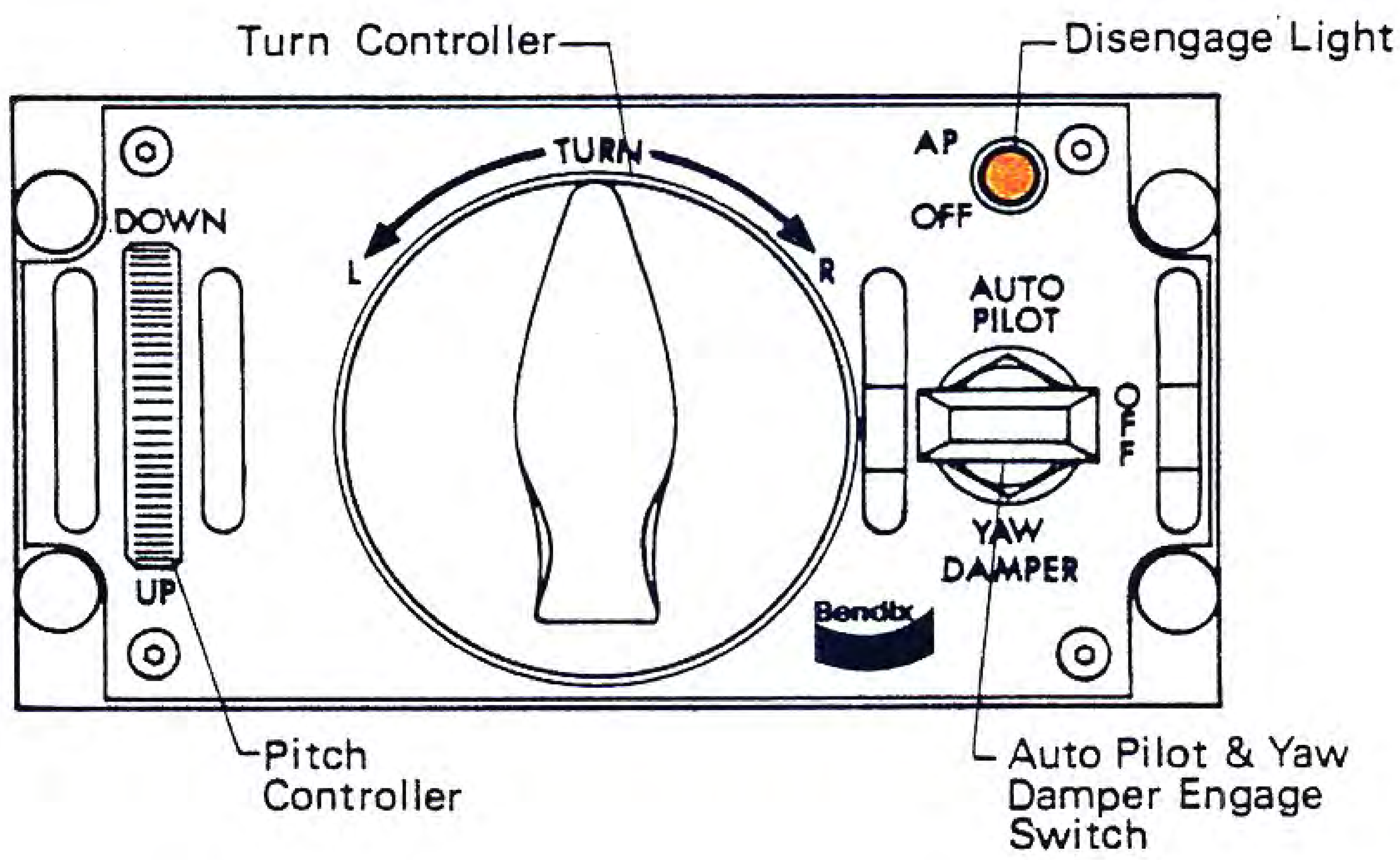
Autopilot Control Panel

The autopilot control panel mounted on the pedestal controls the operation of the autopilot. A three position, solenoid held switch engages the yaw damper independently or the complete autopilot which includes the yaw damper. The YAW DAMPER position allows the pilot to fly the aircraft manually with only the yaw channel receiving control inputs and no other function of the autopilot engaged. Use of the yaw damper aids in aircraft stability and passenger comfort while manually flying the aircraft in turbulent conditions.

The pitch wheel allows manual pitch control of the aircraft proportional to wheel displacement. Moving the pitch wheel from its detent disengages any vertical mode engaged. The turn knob allows manual bank manuevers of the aircraft by rotating the knob in the desired direction of turn. The aircraft will bank a maximum of 30^{o} of bank at 4^{o} per second. The knob is in the detent when straight up, and moving it will disengage any lateral mode engaged.

The autopilot is normally disengaged by one of four ways: 1) depressing the AP/TRIM DISC switch on either yoke; 2) electrically trimming the elevator; 3) depressing the go-around button on the left throttle; or 4) by moving the autopilot switch to OFF. The autopilot cannot be disengaged by applying an overriding force to the yoke. However, applying fore or aft pressure to the yoke will cause the autopilot to trim the aircraft in the opposite direction. If this pressure is maintained for approximately 30 seconds, the autopilot will disengage. The autopilot cannot be disengaged by the go around button unless the flight director is either armed or engaged.

If the autopilot is disengaged by either yoke disconnect switch, a warning tone will sound for one second and the amber AUTOPILOT OFF light on the instrument panel will be on for one second. If autopilot disengagement occurs through the electric trim switch or the go-around button, the tone will sound for one second, the amber AUTOPILOT OFF light will be on for one second, and the red AP OFF light on the autopilot control panel will be on steady. If the control panel switch is used for disengagement, the tone will sound for one second and the amber light will be on steady as will the red control panel light. Depressing the AP/TRIM DISC switch on either control wheel will extinguish either or both of the autopilot off warning lights. The yoke mounted disengage switch is the recommended means of disengaging the autopilot or yaw damper for normal operation as it extinguishes all lights and reduces wear on the solenoid held control panel switch.



FGS-70 System Operation

A wide variety of capabilities makes the FGS-70 a very flexible system. The flight director and autopilot can be used independently or together. There is no need to have the flight director engaged to have the various modes of operation available to the autopilot. Disengagement of the FD or AP will have no effect on the remaining AP or FD modes in operation at the moment of disengagement except when using the go-around button on the left throttle.

To use the FD either by itself or with the AP, the FD must be armed by depressing the FD button on the mode control panel. Selecting HDG will engage the FD and bring the orange command bars into view. It is possible to bypass HDG and engage the FD by selecting the VOR/LOC mode. This will only work if NAV 1 is receiving a VOR signal and the course deviation bar is centered within one dot prior to selecting VOR/LOC. The normal method of flight director engagement is to select FD followed by HDG.

With HDG selected, the command bars now give bank steering commands to fly the aircraft to and maintain the heading set on the HSI heading cursor. If the autopilot is also engaged, the autopilot will receive steering commands to turn the aircraft to and maintain the heading selected by the HSI heading cursor. VOR/LOC may be armed with the HDG mode ON. When using a VOR, the mode will switch from ARM to ENG at one dot deviation on the HSI,and the command bars will give computed steering to intercept and track the radial selected on the HSI. If the autopilot is engaged, capturing and tracking will be automatic. With a localizer frequency in NAV 1, operation is the same as when capturing and tracking a VOR radial except that the mode engages at two dots deviation on the HSI. In either case, the HDG mode will drop off as soon as the VOR/LOC mode engages. During ILS approaches the autopilot/flight director gain is progressively reduced when the GS is engaged and the aircraft is below 1,100 feet AGL. If a radio altimeter is not installed, this function is performed at GS engage and outer marker passage.

At glideslope engagement plus thirty seconds, the autopilot will be limited to a maximum bank angle of 12°. While tracking either VOR or localizer, crosswind corrections up to 25° crab angle will be maintained. While flying over a VOR station, unstable signals are suppressed to provide smooth station passage and automatic recapture of the outbound radial. The system provides fast radial recapture with flaps extended during a VOR approach.

Selecting the turbulence (TURB) mode reduces the gain of the AP and FD and prevents abrupt control deflection during turbulence. Bank angle is limited to 12°. All modes are disabled except HDG and GA, air data compensation is removed, and AP auto trim is disconnected. This mode would normally be used only with the autopilot on. It must be manually disengaged by pressing the button.

Selecting back course (BC) configures the system to give proper command bar sensing during a back course approach. With the front course of the ILS set in the HSI, the course deviation indicator will always give correct sensing regardless of whether BC is selected. The command bars, however, will give incorrect steering without BC on. The BC button must be selected prior to engaging VOR/LOC mode.

When altitude hold (ALT HOLD) is selected, the command bars will give pitch steering commands to maintain the altitude existing at the moment of engagement.

When selected with the autopilot on, the autopilot will maintain the existing altitude compensating for changes in CG, airspeed or pressure deviation. Using the autopilot, engagement can be made with rates of climb or descent up to 2,000 feet per minute and the aircraft will return to reference altitude. Normal procedure would dictate engaging ALT HOLD when the aircraft is stabilized at the desired altitude.

The glideslope mode will only function with an ILS frequency in the NAV 1 receiver and with LOC armed or engaged. When GS mode is armed, the bullseye will rotate into view on the ADI. As the aircraft intercepts the glideslope, ALT HOLD, if selected, will drop off and the command bars will provide pitch steering to fly the aircraft down the glideslope. If the autopilot is engaged, the autopilot will capture and track the glideslope. FD/AP circuitry provides correct gain scheduling for beam conveyance during the approach.

The navigation transfer (NAV) button on the mode control panel controls which NAV receiver is supplying inputs for the AP/FD system. Either NAV 1 or NAV 2 can be selected, but the system always shifts back to NAV 1 after electrical power has been interrupted. The advantage of this system can be seen in the event of a NAV 1 failure during an ILS approach. If the NAV 2 receiver is set on the ILS frequency, simply pushing the NAV button enables the autopilot to continue flying the ILS approach without any further switching. If the pilot is hand flying the approach, selecting NAV 2 switches the inputs to the command bars from NAV 1 to NAV 2, and he can continue the approach following the computed glideslope and localizer steering commands of the command bars. In this situation, the marker lights in the bullseye would not illuminate, and the localizer and glideslope information on the HSI would be inoperative. Any time NAV 2 is used, the co-pilot's PN-101 course indicator provides the HDG and COURSE inputs.

A go-around mode (GA) is available through a button on the left throttle. Depressing the button will drop off all other FD modes, the bullseye will rotate out of view, the autopilot will be disconnected and the command bars will give a wings level, 7-1/2° nose up climb command. The GA light on the ADI will illuminate as well. The GA mode is disarmed by reprogramming the flight director or engaging the autopilot. Actuation of the go-around button will not disengage the autopilot if the flight director is off.

FLIGHT GUIDANCE

When flying the aircraft manually and using the flight director, the command bars may be matched to the existing aircraft pitch attitude by pressing the PITCH SYNC button on the yoke. With a change in aircraft attitude, the command bars will stay at their last position until the SYNC button is again pressed. Pressing the SYNC button will disengage both ALT HOLD and GS if either is being used.

Basic Autopilot

The basic autopilot, without any inputs from the flight director system, can be used for pitch, roll, and heading hold. The autopilot will hold the pitch attitude existing at the moment of AP engagement, the pitch attitude existing the moment the pitch controller is returned to its detent, or the pitch attitude existing at the moment of disengagement of a vertical mode.

The compass heading hold ability of the autopilot will hold the aircraft on the heading existing at the moment of engagement, or the heading existing when the turn controller is returned to its detent if the turn was less than 6° of bank. If the bank angle is greater than 6° when the turn controller is centered, the autopilot will maintain the heading existing as the aircraft rolls down through 6° of bank. If a lateral mode of the FD (HDG or VOR/LOC) is disengaged, the heading existing at the moment of disengagement will be held.

The autopilot maintains roll attitude by rolling the aircraft wings level at engagement in conjunction with compass heading hold. Turn and pitch control are through the pitch and turn wheels as discussed in the auto-pilot control panel section.

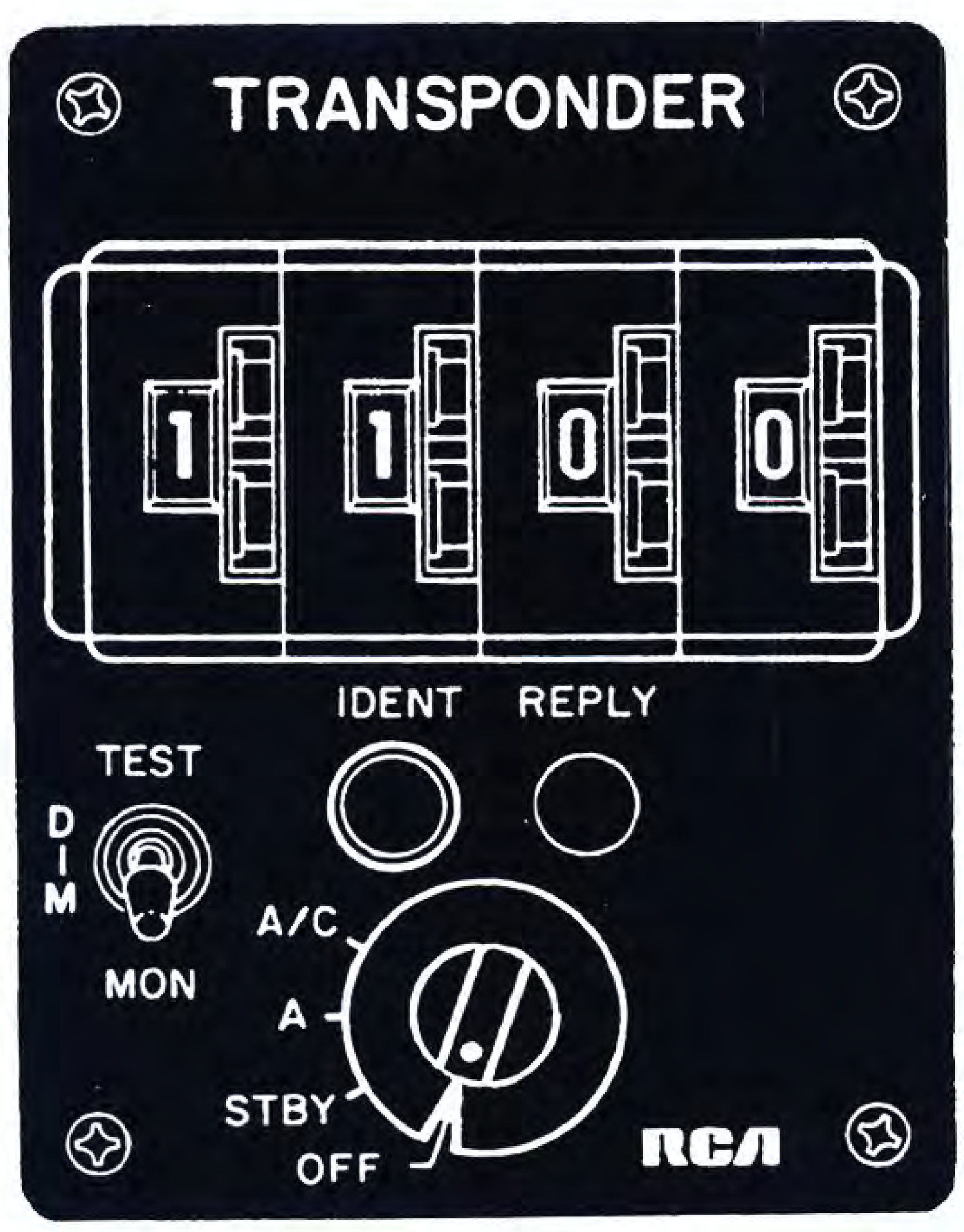
PULSE EQUIPMENT

Transponder

An AVQ-95 transponder with a 4096 Mode A code capability is located in the center instrument panel. The transponder also has a Mode C capability which will provide automatic altitude reporting regardless of selected code. A four position selector switch turns the transponder from OFF to STBY, A and A/C. Placing the switch in STBY allows the transponder to warm up. Selecting A replies in the selected mode to Mode A interrogations and A/C adds the altitude reporting capability to Mode A. With the TEST/MON switch in the MON position, the green REPLY light will illuminate each time the transponder is triggered by a surveillance radar. Placing the switch to TEST causes the transponder to self-test and indicate proper operation by lighting the REPLY light. The DIM position reduces the intensity of the REPLY light.

The desired code is selected at the top of the instrument by using the four rotary thumb wheels.

On aircraft equipped with dual transponders and a single control head, a toggle switch labeled 1-2 is used to select which of the two transponders is to be used. On aircraft equipped with two control heads, the #1 unit has priority if both are on. The #2 unit will operate only with the primary unit OFF or STBY.



Distance Measuring Equipment

An AVQ-85 DME provides the pilot with slant range distance information to the selected VORTAC, as well as time to station and groundspeed readouts. Two rotary selector switches are used to select the desired information which is then displayed by light bar readouts. Self-test is included as is a DIM knob to control the light intensity. Range is approximately 200 nautical miles.

The rotary mode selector switch has four positions:

OFF — DME is turned off independently of NAV systems.

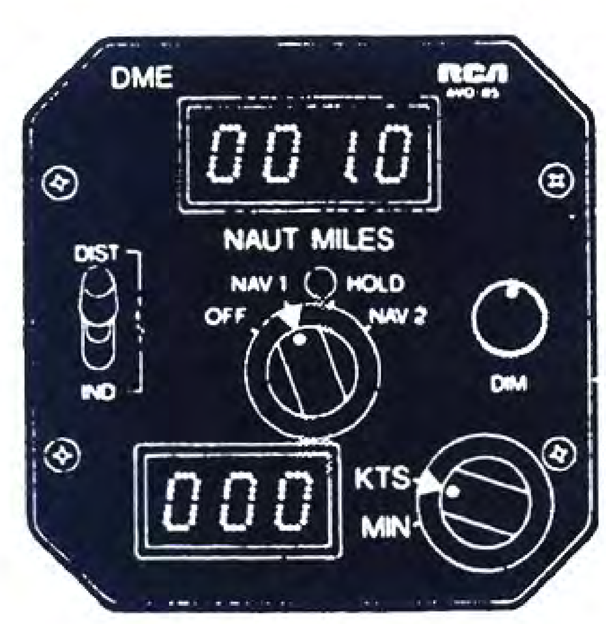
NAV 1 — Slant range distance in NM to the VORTAC (DME) selected in the NAV 1 receiver is displayed in the NAUT MILES window and pilot's HSI. NAV 1 receiver must be in ON position.

HOLD — Amber HOLD light illuminates. DME will remain tuned to the last captured frequency, regardless of subsequent NAV 1 or NAV 2 receiver frequency changes.

NAV 2 — Slant range distance in NM to the VORTAC (DME) selected in the NAV 2 receiver is displayed in the NAUT MILES window and pilot's HSI. NAV 2 receiver must be in ON position.

Placing the display selector knob to KTS gives computed groundspeed of the aircraft. Selecting MIN will give time in minutes required to cover the distance shown in the NAUT MILES window at that groundspeed. KTS and MIN displays are only accurate when tracking directly inbound to or outbound from a station. Readings are also inaccurate when the aircraft is close to the station at high altitude, causing large slant range induced error.

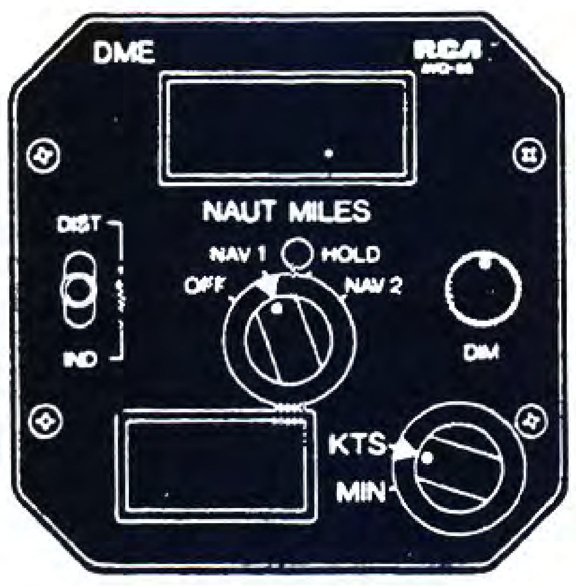
A three position TEST switch labeled DIST and IND provides for system self-test. Placing the switch from off to IND, tests all indicator light bars by illuminating all 8's in both display windows. In the DIST position, system performance is tested. A momentary display of 000.0 followed by a 001.0 $\pm$ 0.1 NAUT MILES display indicates satisfactory operation.



PULSE EQUIPMENT

A variety of presentations gives the pilot a comprehensive indication of system performance.

Power switched off or power failure - no readout.



Transmitter power low or channel selector failure.

Selected VORTAC is beyond range or is being blocked by intervening terrain.

DME has acquired the station, but signal is weak or unreliable.

Normal presentation in the distance/time-to-station mode.

Normal indication in the distance/groundspeed mode.

Illuminated amber HOLD light indicates that DME is tuned to the last selected VORTAC.

Radio Altimeter

(Bendix ALA-51A) — The radio altimeter is installed in the pilot's instrument panel and gives an absolute altitude indication from 2,500 feet AGL to ground level. An additional readout in the ADI, calibrated in 50 foot increments, displays absolute altitude from 200 feet AGL to ground level. Both displays incorporate warning flags to alert the pilot to a radio altimeter failure. A SET knob is provided to position an indexer which will trigger a visual/aural warning when the selected altitude is reached. Self-test is included for system checkout.

The system is AC operated and receives its power from the #2 AC bus. Two antennas are required and are mounted on the lower fuselage. Inputs from the radio altimeter are used to decrease the autopilot and flight director gain automatically as the aircraft passes 1,100 feet AGL with glideslope mode engaged during an ILS approach.

As the aircraft descends below 2,500 feet AGL the pointer will indicate the aircraft's absolute altitude. When the aircraft reaches an altitude 75 feet above the preselected warning altitude, a warning tone begins. This tone increases in intensity until the warning light comes on and the red outer ring in the ADI bullseye illuminates. Climbing through the selected altitude extinguishes the lights and initiates a decreasing warning tone. At 75 feet above selected altitude the tone is silenced.

Taxiing over accumulations of ice and snow may cause radio altimeter fluctuations.

Self-Test Procedures:

1. Using the SET knob, set the indexer at 150 feet.
2. Depress PUSH TO TEST switch.
3. The warning flags should appear in both indicators and the altitude pointer should indicate 250 $\pm$ 10 feet.

4. Holding the PUSH TO TEST switch depressed, rotate the SET knob clockwise. As the indexer passes through 175 feet the warning tone will begin, and increase in intensity until the indexer is on 250 feet. At this point the tone will cease and the radio altimeter and ADI warning lights will illuminate.
5. Release the functional test switch.

Radio Altimeter (Collins ALT-50) — The radio altimeter is installed in the pilot's instrument panel and gives an absolute altitude readout from 2000 feet AGL to ground level. An additional readout in the ADI will come into view at 200 feet above ground level. It is calibrated in 50 foot increments and displays absolute altitude from 200 feet AGL to ground level. Both displays incorporate warning flags to signal radio altimeter failure. A Decision Height adjust control will position the DH index to the desired setting. When the airplane descends to the selected DH a visual/aural warning is activated. A self-test switch is also incorporated.

The system is powered by 28 VDC. Transmit and receive antennas are required and are mounted on the lower fuselage. The time delay of a signal from the transmit antenna to travel to the ground and back to the receive antenna provides the input by which the radio altimeter measures absolute altitude.

Input from the radio altimeter is used to desensitize the autopilot and flight director gain automatically as the aircraft passes 1100 feet AGL with the GS engaged during an ILS approach.

For normal operation the altitude pointer will come into view as the aircraft reaches 2000 feet AGL. As the aircraft reaches the selected DH, the yellow DH light will illuminate, a tone will sound, and the red DH ring of the bullseye, if used, will illuminate. The light will remain on in the bullseye and on the altimeter but the tone will fade as the aircraft descends below DH for the runway. After landing, the DH light can be turned off by setting the DH index to -20 feet.

If the DH index is set before takeoff to a specific altitude, 400 feet for example, the DH light will remain on until the airplane climbs through 400 feet AGL. No tone will sound and the light will extinquish and remain out.

Self-Test Procedures:

The test can be accomplished on battery power if necessary.

1. Set the DH indexer at 25 feet. The DH indicator light will be on and the warning flag out of view.
2. Press the TEST button. As the altitude indicator passes the DH indexer the DH light will go out, and the indicator should stop at 50 $\pm$ 5 feet.
3. Release the TEST button. As the indicator passes the indexer, the DH light will come on and the warning tone will sound. The light will remain on, the tone will fade out and the altitude indication should read zero.

While taxiing over ice or snow, it is common for the altitude indicator to deflect momentarily as much as 50 feet.

Weather Radar

WARNING:

The area within the scan arc and within 15 feet of an operating weather radar system constitutes a hazardous area. Do not operate the radar system within 15 feet of personnel or flammable or explosive material or during fueling operations. For ground operation of a radar system, position the airplane facing away from buildings or large metal structures that are likely to reflect radar energy back to the airplane.

The AVQ-21 weather radar is an X band radar with a 200 nautical mile range and three modes of operation. A 12" flat plate antenna takes fifteen scans per minute and gives a presentation up to 60° either side of the aircraft centerline. Six push button switches control the operation and mode selection of the radar.

With the OFF button depressed, power to the system is cut off. In STBY, the set is in standby, warming up but not operating. Warm-up time is approximately ninety seconds. If the pilot bypasses the STBY mode, the radar will still go through the ninety second warm-up period. In the NORM position, the set is in normal operation for weather detection. Selecting contour (CTR) causes the circuitry to reject all signals of sufficient strength to indicate heavy precipitation, causing such areas to appear dark within the surrounding cloud return. A thin rim of rainfall appearing between the cloud return and the dark area indicates a sharp shear zone where maximum turbulence can be anticipated.

The MAP position will allow the radar to be used for terrain mapping, and the TEST position will self-test the radar circuits. Depressing TEST will cause the FAULT Light to illuminate momentarily to indicate the light is functioning normally. A malfunction, or combination of malfunctions will cause the FAULT light to remain on. The transmitter does operate in TEST, therefore, this mode should not be selected until the aircraft has cleared the flight line. If TEST is selected during the ninety second warm-up period, the FAULT light will remain on until the ninety second period is up. The TILT control adjusts the amount of antenna tilt from 15° up to 15° down, relative to the longitudinal axis of the aircraft.

The RANGE control selects the operating range of the set, either 25, 100 or 200 nautical miles. The range marks on the scope indicate a distance readout and are set at 50 mile increments when in 200 mile range, 25 mile increments in 100 mile range, and 5 mile increments in 25 mile range. The RANGE MARKS control adjusts the intensity of these range marks.

The numbers 0, 30 and 60 printed around the face of the scope indicate relative bearings in degrees from the nose of the aircraft and can be used as azimuth references.

The TRACE control adjusts the brightness of the returns on the scope by raising or lowering the sensitivity of the Display Storage Tube (DST) indicator.

The GAIN control is preset for optimum operation. When it is rotated out of the PRE SET position, a VAR GAIN light illuminates next to the gain control. Now gain control is in the hands of the operator. As gain is reduced, returns begin to disappear beginning with the weakest return. Thus manual gain can be used to select and maintain only very prominent targets on the scope.

For night operation the scope can be dimmed by means of a polaroid filter which covers the scope and is moved into place by a knob on the front of the radar console.

PULSE EQUIPMENT

The radar is powered by the #2 AC inverter, but antenna stabilization is provided by pitch and roll references from the vertical gyro in the nose. This gyro also provides signals to the Flight Director; therefore, the antenna will not be stabilized in the event of a loss of the #1 inverter.

The radar should always be selected to OFF when the radar is not receiving AC power, i.e., not powered by either the #1 or #2 inverter. The DC components will continue to operate but no cooling will be provided and heat damage will occur.

ALTITUDE ALERTING AND REPORTING

500-0001 thru -0062 without SB34-13

Altitude alerting and reporting operates in conjunction with the pilot's encoding altimeter and the A/C mode of the transponder. If two transponders are installed, altitude reporting is available only from the #1 unit. When mode A/C is selected, altitude reporting in response to ground interrogation is automatic.

The altitude alerting portion of the system must be set by the flight crew for the desired altitude. As the aircraft reaches 1,000 feet from the desired altitude a yellow light on the altitude alert unit will illuminate and remain on. 500′ prior to the set altitude, a tone will sound momentarily, followed by the light going out. Any deviation from the set altitude by more than 500 feet will cause the tone to sound momentarily and the light to illuminate. Once the aircraft has deviated 1,000 feet from the set altitude, the light will extinguish and remain out.

500-0063 thru -0274 and aircraft incorporating SB34-13

Altitude alerting and reporting operates through the pilot's electrically driven encoding altimeter and the A/C mode of the transponder. The pilot's altimeter is servo-powered and operates off the #1 AC inverter. In the event of a #1 inverter failure, the altimeter can be powered from the #2 inverter through the inverter crossover switch. A red OFF flag will appear in the top of the altimeter with a loss of AC power, and both the altitude reporting function and the altimeter itself will be inoperative. Altitude reporting is automatic with mode A/C selected on the transponder. With a two transponder installation, either the #1 or #2 unit is capable of providing altitude reporting.

The altitude alert unit must be manually set by the flight crew to the desired altitude. 1,000 feet prior to the set altitude a yellow light on the pilot's altimeter will illuminate and the alert tone will sound momentarily. The light will be extinguished at 300 feet from the set altitude. Any deviation from the set altitude by 300 feet or more will cause the light to illuminate and the tone to sound momentarily. The light will remain on until the aircraft is returned to the original set altitude or until a new altitude is selected in the altitude alert unit.

Dimming of the altitude alert light is accomplished through the flight director mode control panel dimming switch.

Locator Beacon

The optional emergency locator beacon (ELT) system is an emergency transmitter designed to assist in locating a downed airplane. The transmitter has a self-contained battery pack but is powered through the airplance DC bus if available. The system is activated, automatically, by an impact of 5.0 +2, −0 G along the flight axis of the airplane or manually by a remote EMER switch on the instrument panel. When the transmitter is activated, a modulated omni-directional signal is transmitted simultaneously on emergency frequencies 121.50 and 243.00 MHz. The modulated signal is a downward sweep tone signal starting at approximately 1600-1000 Hz and sweeps down every two to four seconds continuously and automatically.

The transmitter has an ARM-ON-OFF switch which is normally left in ARM. ON position is used to test the system from the ground and OFF position turns the system off.

A guarded EMER-NORM switch on the instrument panel provides manual activation of the system as well as a means of testing the operation. In NORM position, the system is available to be activated by the impact switch. In EMER the impact switch is bypassed and the emergency signal is transmitted. EMER position can be used to test the system; however, prior approval from control tower and flight service must be obtained. An ON-OFF switch on the dorsal fin serves as a means of testing the system from outside on the ground.

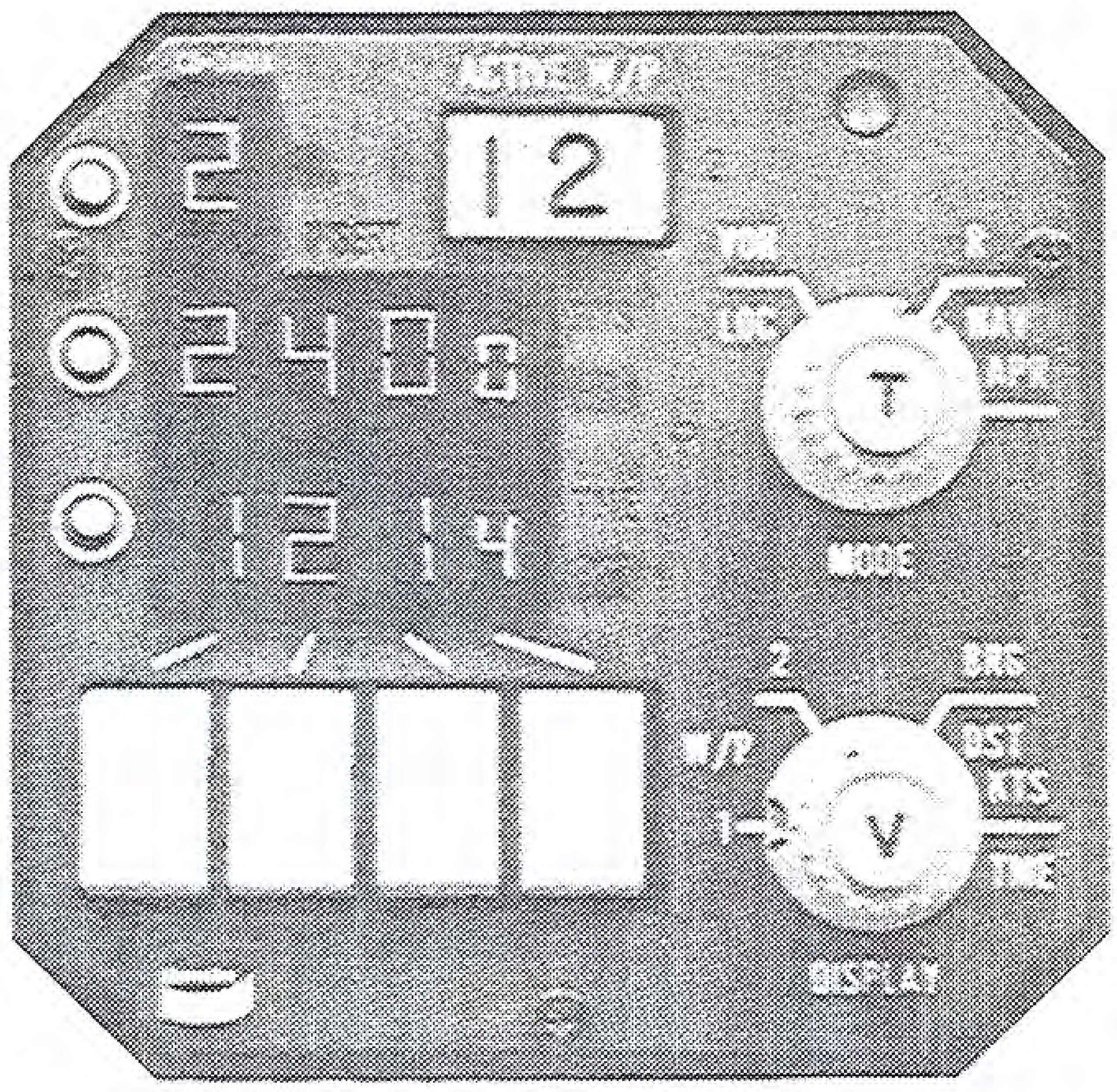
If the impact switch is inadvertently set, activating the transmitter, it may be reset by pushing either of the RESET buttons. One is on the instrument panel next to the guarded EMER-NORM switch; the other is next to the ON-OFF switch on the dorsal fin. The RESET button must be depressed and held for a minimum of three seconds.

AREA NAVIGATION

The optional RNS-3400 Area Navigation System is an airborne system which gives the pilot the capability of navigating "point to point" within 150 n.m. of any co-located VOR/DME (VORTAC) station selected on the #1 VHF navigation receiver.

System components include a CD-3401A control display unit and an IU-3404A system interface unit.

The CD-3401A control unit is panel mounted and contains all the switches and indicators required to program, monitor, operate and test the area navigation system.



The IU-3404A interface unit receives inputs from the encoding altimeter, NAV 1 receiver (VOR bearing and DME) and the CD-3401A control unit. It produces conventional navigational displays to the selected waypoint on the ADI, HSI and both RMIs.

Mode Control Switch

The mode control switch is a four position switch labeled OFF, VOR/LOC, RNAV and APR. A pushbotton labeled T is located in the center of the Mode Control switch and is used for system self-test. The function of each switch position is as follows:

OFF

Removes electrical power from the system.

VOR/LOC

Supplies power to the unit and permits it to be programmed. Normal VHF navigation is not affected.

RNAV

Provides computed area navigation information to the selected waypoint. This information is displayed on the pilot's HSI in the form of course deviation and distance. The No.1 VOR position on the pilot's and co-pilot's RMIs will show magnetic bearing to the waypoint. Flight director command steering as well as the autopilot can be used to track the selected course.

In the RNAV position, full scale deflection of the HSI course deviation indicator is equal to a five mile off-course error and no longer represents angular deviation from the selected course. Selection of RNAV will illuminate the RNAV annunciator light in the pilot's ADI.

APR

This position provides exactly the same functions as RNAV, except that full scale deflection of the HSI course deviation indicator is now equal to a 1.25 n.m. off course error.

Selection of APR will illuminate the RNAV annunciator light in the pilot's ADI.

Display Control Switch

The Display Control switch is a four-position rotary switch labeled W/P1, W/P2, BRG/DIST, and KTS/TME. The four positions allow the pilot to select what information is to be displayed in the windows, or to program a new waypoint. The function of each switch position is as follows:

W/P1

Illuminates the EL (elevation), BRG (bearing) and DST (distance) identification lights adjacent to each display window, as well as the elevation, bearing and distance parameters of waypoint 1.

W/P2

Same as described for waypoint 1 above.

BRG/DST

BRG/DST identification lights are illuminated adjacent to the display windows and the magnetic bearing and distance to the active waypoint are presented. The EL display will not be lighted.

If the mode control switch is in the VOR/LOC position, the bearing and distance to the station selected in the No. 1 NAV receiver, and not the waypoint, will be presented.

KTS/TME

The KTS/TME identification lights are illuminated adjacent to the display windows and the groundspeed and time-to-waypoint are presented. The EL display will not be lighted.

If the mode control switch is in the VOR/LOC position, the groundspeed and time will be relative to the station selected in the No. 1 NAV receiver. Since a slant range correction has been made, these values are considered more accurate than the associated DME readings. Like the ground speed on the DME, it requires a few moments to stabilize after selection.

"V"

Depressing the "V" pushbutton in the center of the display control switch will present bearing/distance information to the station selected in the No. 1 NAV receiver on the RMIs and the DME readout in the pilot's HSI. Releasing the button returns the displays to RNAV computed information. This feature allows the pilot to monitor his position relative to the ground station without interrupting RNAV guidance.

An ACTIVE W/P select switch is located at the top of the control head. Selecting position 1, will illuminate the number one to the left of the switch and provide the pilot with navigation information to waypoint 1. Selecting position 2, will illuminate the number 2 to the right of the switch and provide the pilot with navigation information to waypoint 2.

An address pushbutton is located to the left of each of the three display windows. Depressing a button will set the adjacent display window to zero. The appropriate EL, BRG, or DST identification lights as well as the INSERT light will flash indicating a new parameter may be programmed by utilizing the rocker switches located directly beneath the display windows. The address pushbuttons will have no effect if the displayed information is being used for navigation (i. e., selected by the ACTIVE W/P switch).

Turning the mode selector OFF, or any interruption of power will erase the control display. There is no method of storing waypoints with power removed.

The intensity of all the lights on the control head is automatically controlled by an externally incorporated light sensor.

Programming the Waypoints

To insert the waypoint parameters, first insure that the No. 1 NAV receiver is turned on and that the MODE switch is in the VOR/LOC position. Set the DISPLAY knob to the W/P 1 position. Depress the appropriate address pushbutton and operate the rocker switches until the desired information is presented in the display window. Continue in this manner until all three parameters are programmed.

Rotate the DISPLAY knob to W/P 2 and program the parameters for W/P 2 as described for W/P 1 above.

The ACTIVE W/P switch will have no effect with the MODE switch in the VOR/LOC position.

No. 1 NAV must be receiving azimuth and distance information in order for the computed RNAV information to be presented. DME must be selected to the NAV 1 position.

Self-Test

The RNAV system can be tested at any time by simply turning on the No. 1 NAV receiver, turning the MODE selector to VOR/LOC, programming a waypoint in W/P 1 or W/P 2 (distance should be 10 n.m. or greater) and depressing the test switch "T", for eight seconds or more. The following sequence of events will occur:

Lighting Test — Control segment lamps will be lighted to 8's for two seconds.

Flag Test — Control segment lamps will indicate dashes for two seconds.

Distance Test — The lower window will display the inserted waypoint distance and the DST legend will be lighted. The center window will display the computed waypoint distance so that the two can be visually compared. This will hold for two seconds.

Bearing Test — the center window will display the inserted waypoint bearing and the BRG light will be lighted. The lower window will display the computed waypoint bearing so that the two can be visually compared. This will hold for as long as the test button is depressed.

With a valid VOR signal, computed distance should be within ± .3 n.m. of inserted distance and computed bearing within ± 2° of inserted bearings.

If the system is not receiving a valid VOR signal when the test is performed, the results will be somewhat degraded, but still adequate to determine that the system is functioning properly.

Without a valid VOR signal, computed distance should be within ± .5 n.m. of inserted distance and computed bearing within ± 3° of inserted bearing.

ANGLE OF ATTACK

The optional angle of attack system is powered by 28 VDC from the left main DC bus and is comprised of three units.

The angle of attack transmitter is the basic sensor which detects the direction of airflow at the side of the fuselage by means of a probe extending into the airstream. The transmitter has a conical probe with slots in it, and rotates to achieve uniform airflow. The probe is heated for anti-icing by selection of PITOT & STATIC anti-ice.

The flap position sensor provides a signal to the interface unit so it is able to compensate for any flap position. The interface unit computes angle of attack from the transmitter signals and flap sensor and compensates for all configurations and weights so as to give a standard readout on the angle of attack gauge.

A full range indicator is the primary type used in the CITATION. The gauge is calibrated from 0 to 1.0 and marked with red, yellow and green arcs. The indicator displays lift information with 0 representing zero lift and 1.0 representing stall. Lift is presented as a percentage, and with flap position information, the display is valid for all aircraft configurations and weights. Therefore, at 1.0 on the gauge where full stall occurs, 100% of the available lift is being produced. At 0, zero lift is being produced. The red bank on the indicator is a warning area and represents the beginning of low speed buffet to full stall. The yellow range is a caution area where the aircraft is approaching a critical angle of attack. The green arc is the normal operating range of the aircraft. The angle of attack gauge has reference indices at .8 where low speed buffet begins, and at .6 which is optimum approach speed (1.3 V_{SO}). The index at .6 also represents the maximum value of Lift/Drag (L/D max.), which equates to maximum endurance and maximum angle of climb.

A moveable bug may be set by the factory at .35, the angle of attack at which the greatest ratio of velocity to drag occurs in the CITATION. This represents maximum range in still air.

A secondary angle of attack display is provided on the ADI as a vertical readout of the optimum approach angle of attack. This information is repeated from the primary indicator.

C

SECTION IIIA
INSTRUMENTATION and AVIONICS

500-0275 thru -0349

INSTRUMENTATION

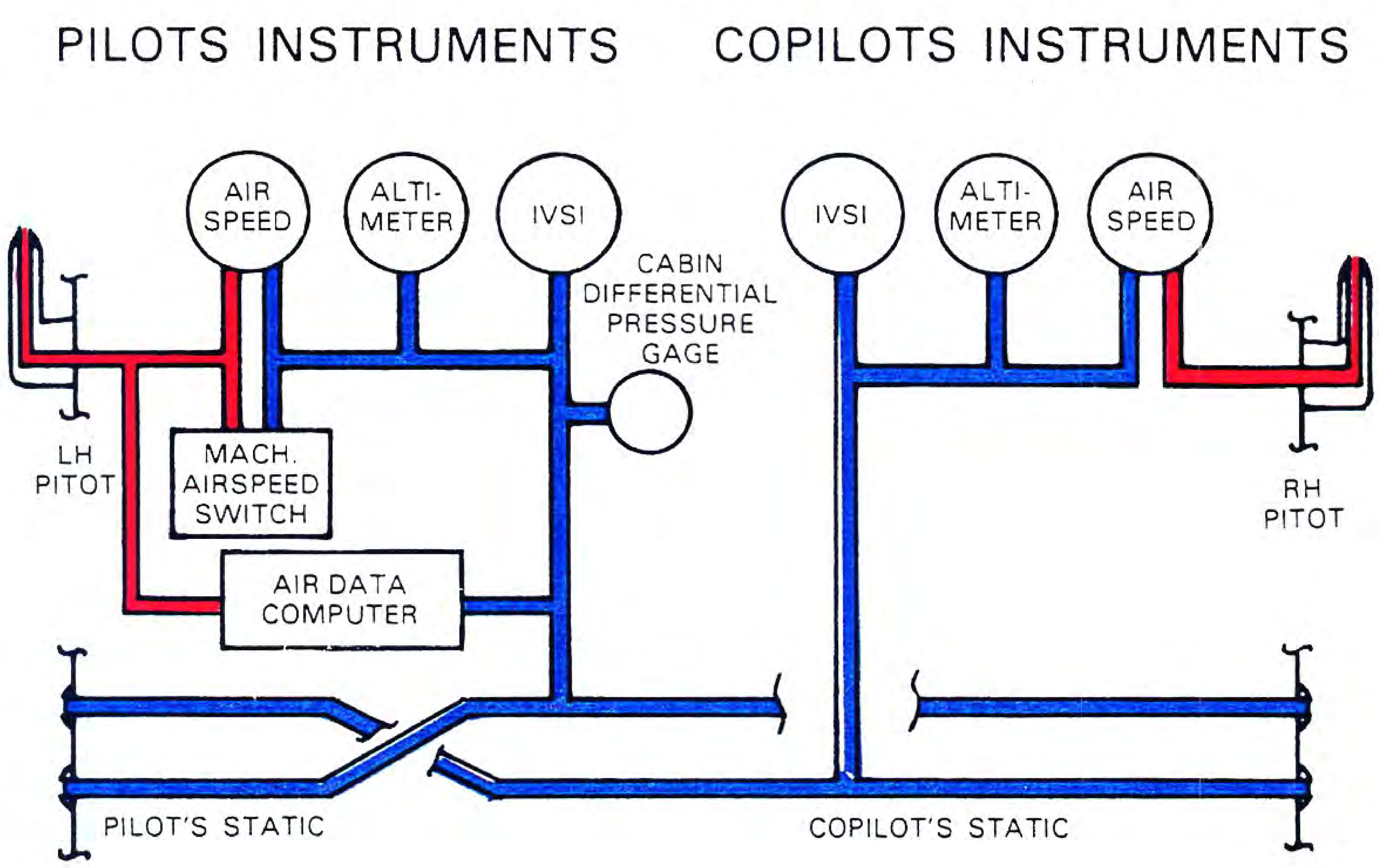
Separate airspeed indicators, vertical speed indicators, altimeters and turn and bank indicators are installed for use by the pilot and copilot. Two independent pitot-static systems measure total pressure and static pressure. The two pitot tubes and four static ports are electrically heated for ice protection.

Pitot-Static

The pitot tube on the left side of the aircraft supplies pressure to the pilot's airspeed indicator, the mach-airspeed limit switch and the air data computer. The pitot tube on the right side of the aircraft supplies pressure to the copilot's airspeed.

Two static ports are located on each side of the aircraft. One port on each side provides a static source for the pilot's airspeed indicator, altimeter, instantaneous vertical speed indicator, mach-airspeed limit switch, the cabin differential pressure gauge and the air data computer. The second port provides a static source for the copilot's airspeed indicator, altimeter and instantaneous vertical speed indicator.

PITOT AND STATIC SYSTEM



Altimeters

The pilot's encoding altimeter system is driven from an air data computer. It is a servoed counter/pointer display of barometrically corrected altitude. A description of the operation of the altimeter and altitude alert system is covered in detail in the SPZ-500 Flight Guidance System.

The copilot's altimeter is a conventional barometric type with a counter-pointer readout.

C

Airspeed Indicators

The pilot's and co-pilot's airspeed indicators are identical and operate off uncorrected pitot-static inputs. The instruments incorporate a single rotating needle, a fixed scale calibrated in knots and a rotating mach scale. Slots in the airspeed dial at 262 and 289 KIAS will show red below 14,000 feet and from 14,000 - 26,000 feet respectively, indicating V_{MO} limits. The mach limit of .705 above 26,000 feet is indicated by a single red radial line. A knob on the lower left corner of the instrument controls a moveable index that can be set to any airspeed as a reference. For airplanes equipped with the 9500 lb. zero fuel weight option the slots in the airspeed dial are at 262 and 277 KIAS and show red below 14,000 feet and from 14,000 - 28,000 feet respectively. For airplanes equipped with the 10,500 lb. zero fuel weight option, a single slot is at 262 KIAS and shows red from low altitude to 30,500 feet.

Vertical Speed Indicators

The two instantaneous vertical speed indicators indicate vertical velocity from 0 to 6,000 feet per minute, either up or down. Their operation differs from conventional VSIs in that there is zero time lag between aircraft displacement and instrument indication. Accelerometers sense any change in normal acceleration and displace the needle before an actual pressure change occurs.

Turn and Bank

Turn and Bank (500-0275 thru -0349 with optional five-inch ADI):

The pilot's turn and bank is incorporated in the ADI. The co-pilot's turn and bank indicator is powered by 28 VDC through a circuit breaker on the left hand circuit breaker panel. An OFF flag will come into view any time power is interrupted. If an optional second flight director system is installed, the co-pilot's turn and bank indicator is replaced by a third attitude gyro which is driven by bleed air, and a slip indicator on the co-pilot's HSI.

Pressure Gyro

The co-pilot's attitude gyro is a pressure driven instrument which displays aircraft attitude in pitch and roll. The pressure is produced by engine bleed air. The attitude gyro will be operating anytime at least one engine is running. Due to the simplicity and reliability of the system, no warning flags are provided. System pressure may be monitored through the pressure indicator installed in the right instrument panel.

Engine Instruments

Each engine is equipped with the following instruments located on the center instrument panel:

- Fan RPM
- Inter-Turbine Temperature (ITT)
- Turbine RPM
- Fuel Flow
- Fuel Quantity
- Oil Temperature
- Oil Pressure

All engine instruments are of the vertical tape readout design and are powered by 28 VDC through circuit breakers on both cockpit circuit breaker panels. Small power indicators are included on the face of each instrument which will indicate "red" if power is interrupted to the respective side.

The FAN RPM and TURBINE RPM are calibrated in percent from 0 to 110%. (100% Fan RPM = 16,000; 100% Turbine RPM = 32,760). A digital display is provided below each tape for a more accurate readout. Above idle RPM, both instruments are driven by tachometer generators and will continue to operate in the event of a DC power failure.

The ITT gauge is calibrated in degrees centigrade from 200 to 1000. A digital readout is provided below each tape for a more precise readout. The temperature displayed is a synthetic inter-turbine temperature which is computed by measuring the exhaust gas temperature and then adding to it three times the temperature rise across the bypass duct.

The FUEL FLOW gauge is equipped with a digital integrator which presents hours of fuel remaining at the displayed fuel flow and fuel quantity. Readings are very accurate at stabilized power settings.

The FUEL QUANTITY gauge is calibrated in pounds of fuel and accurately displays fuel remaining in the left and right tanks.

The OIL TEMPERATURE gauge, in degrees centigrade and the OIL PRESSURE gauge in p.s.i., show system limitations on the face of the instrument with red, yellow, and green markings.

Clock

An eight day clock with a twenty-four hour dial is mounted on the left panel. GMT and local time can be set simultaneously.

Outside Air Temperature Indicator

Below the clock on the left panel is an OAT indicator which displays air temperature uncorrected for ram rise. Two scales and a single pointer are used to indicate both Fahrenheit and Celsius readings.

Magnetic Compass

A standard liquid filled magnetic compass is mounted above the glareshield.

Flight Hour Meter

The meter displays the total flight time on the aircraft in hours and tenths. The landing gear squat switch activates the meter when the weight is off the gear. A small indicator on the face of the instrument rotates when the hour meter is in operation.

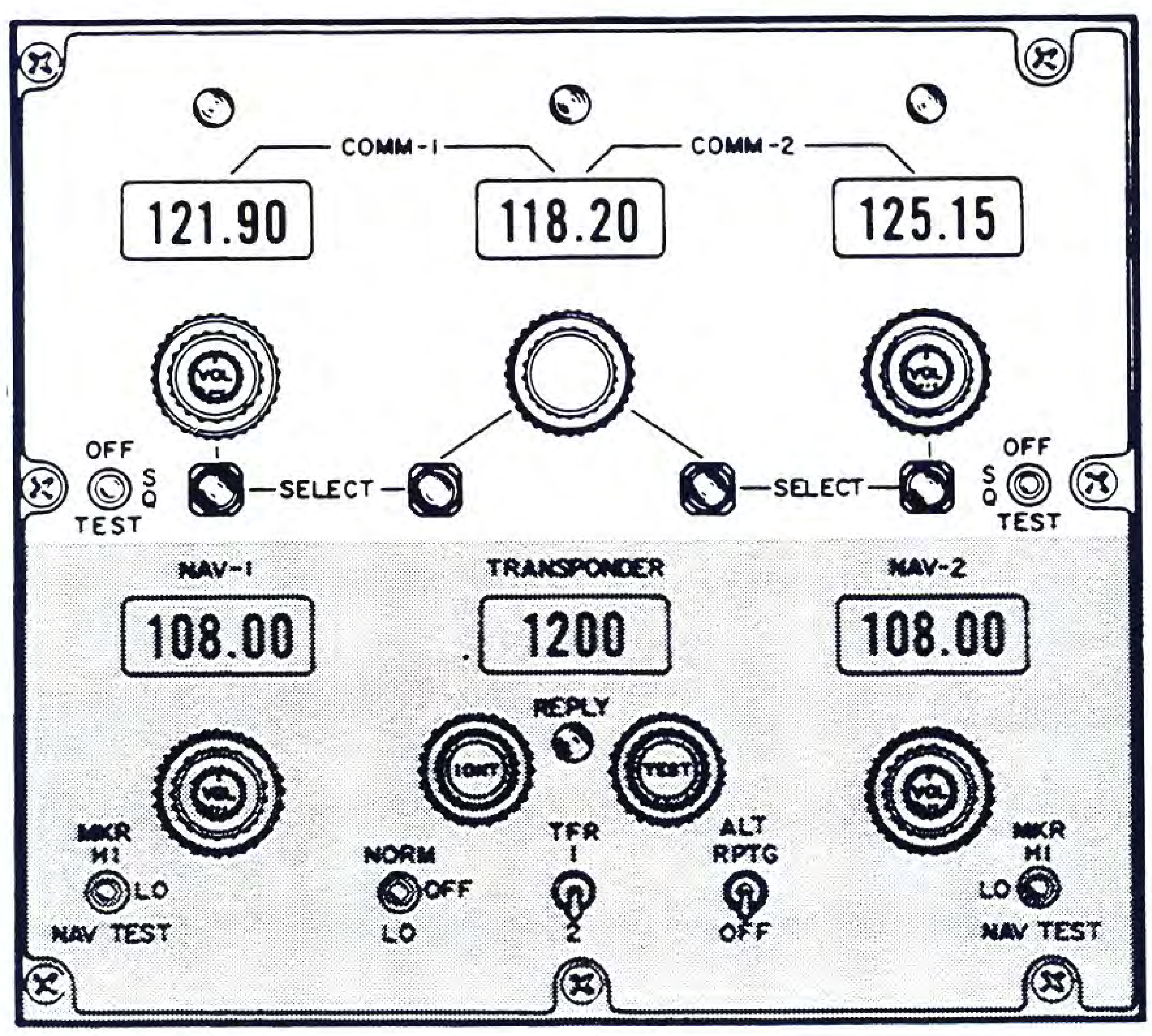
AVIONICS

The standard avionics package in the CITATION includes dual audio control panels, dual VHF COMM transceivers, dual NAVS, dual RMIs, ADF, DME, transponder, auto flight system and weather radar. Included as part of the auto flight system is altitude preselect, altitude alerting, altitude reporting and vertical navigation. The equipment is factory installed and provides Category II equipment capability.

VHF COMM Transceivers

Dual VHF-20A transceivers are located in the avionics bay with the control heads located in the consolidated control unit in the center instrument panel. Each unit is a 720-channel VHF receiver-transmitter with a frequency range from 118.000 to 135.975 MHz. Three concentric control knobs are used for system operation. The inner knob serves as the ON-OFF switch and volume control. Frequency selection is by the two outer controls. Frequency display is a drum type display with internal lighting.

A green light located above each frequency window is illuminated during transmission.



Squelch Test

A three position toggle switch labeled OFF/SQ/TEST is provided for each COMM system. In the OFF position, squelch is removed. In the SQ position, automatic squelch is provided. The switch is spring loaded to return to the squelch position from the TEST position. Selecting TEST causes noise in the airplane audio system showing proper operation of the squelch disabling circuits.

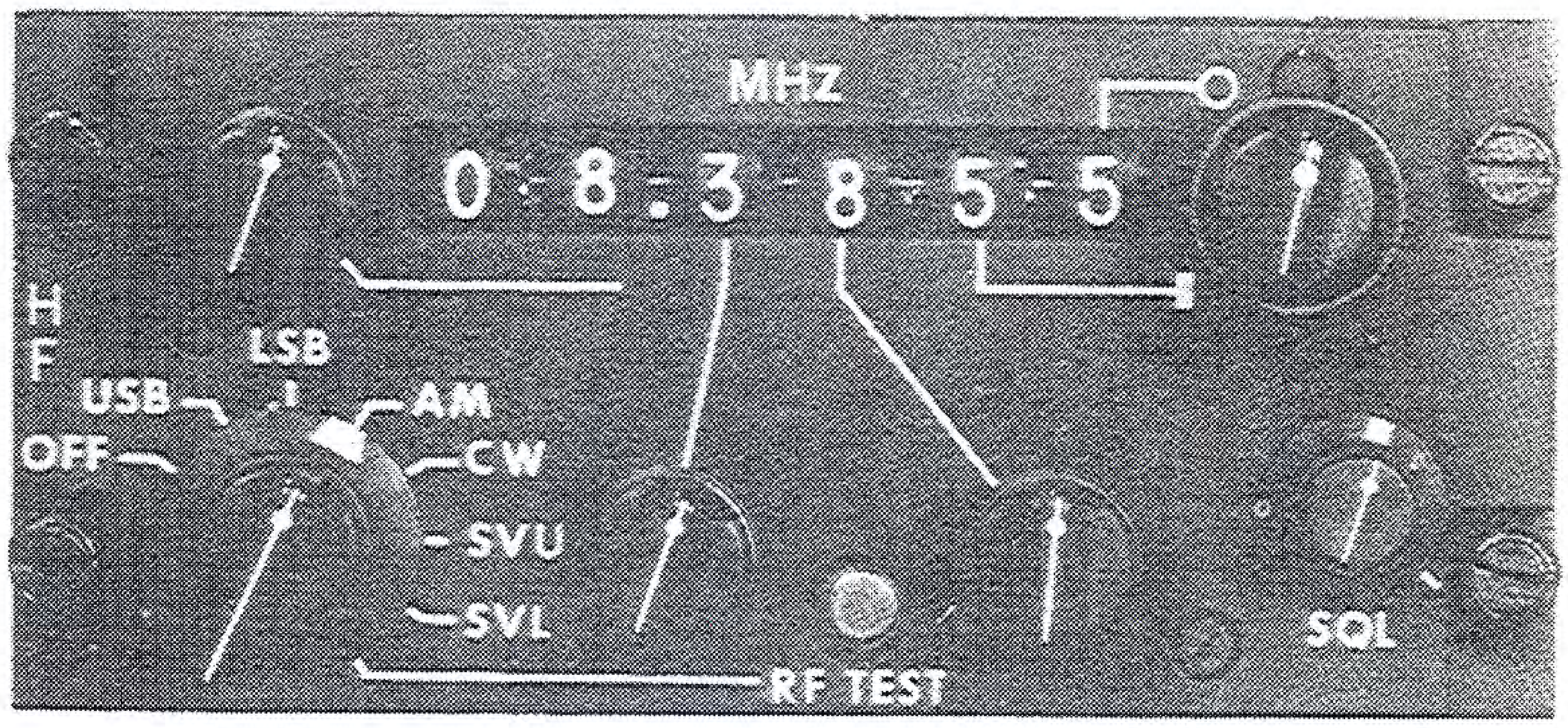
COMM Preselect

The control unit contains the capability of COMM preselection on either system. A frequency readout is located between the COMM 1 and COMM 2 frequency windows. Two concentric knobs are located below the window for frequency selection. Two push type selector switches are located adjacent to the control knobs for switching the preselected frequency to COMM 1 or COMM 2.

The push buttons are lighted at night whenever they are in the selected position.

HF COMM Transceiver (Optional)

The 718U-5 is a 100 watt transceiver that provides 280,000 communication channels in the HF band (2.0000 to 29.9999 MHz). It operates in either AM or single sideband.



Controls and Indicators

All controls and indicators are located on the Radio Set Control.

There are five rotary knobs for frequency selection. A single rotary knob is used for mode selection; OFF, USB, LSB, AM or TEST. A rotary step knob for squelch operation is in the lower right hand corner. An RF TEST lamp is used to indicate the operational status of the system in transmit.

Voice operation is available in the USB, LSB or AM modes. For voice operation set the mode selector to the desired operating voice mode. Set frequency selector knobs to desired frequency. If squelch is desired, adjust squelch control to the maximum counterclockwise position, with no receive signal present. Wait for the background noise to disappear, then turn the squelch control clockwise until the background noise is heard in the receiver output, then move the control one position counterclockwise to set the squelch threshold.

To tune the HF system to the frequency selected, key the transmitter, (handmic or transmit button on control wheel). The system will tune automatically. A constant tone will be heard in the earphones or speaker during the cycle. The average tune cycle is approximately 3 seconds. After completion of the tune cycle, the constant tone will disappear.

RF Test Lamp Check

Turn mode selector to the test position. The RF test lamp may blink for up to 1 minute but should come on steady after that time. Lamp should burn steady for normal operation.

Audio Control Panel

Two audio control panels are installed to provide individual audio selection by each pilot. Three-position switches (SPKR-OFF-HDPH) enable all audio inputs to be selected to the speakers or headphones. A CODE/VOICE FILTER rotary selector is used in conjunction with the NAV and ADF switches to monitor either voice or code identifiers. The MASTER VOL knob controls the volume of all selected audio sources. The MIC SELECTOR switch has five selector positions. COMM 1 or COMM 2 connect the lip microphone, the hand-held microphone and the oxygen mask mircrophone to the respective VHF transmitter. COMM 3 position is used for the HF System, if installed. A three position switch located on the control wheel is used for keying the COMM transmitters when using the lip microphone or oxygen mask microphone. The INPH position on the control wheel provides pilot-to-pilot communication from any of the three microphone sources. PASS SPKR connects any of three microphones to the speaker in the cabin for passenger announcements. The PASS SPKR VOL knob controls the speaker volume. When operating with the battery switch in the EMER position, the MIC SELECTOR switch must be placed to EMER to regain the use of COMM 1. This bypasses the audio amplifier, necessitating the use of a headset to receive and volume control is available only at the radio. Transmitting remains normal from all microphone sources.

VHF NAV

Dual VIR-30A navigation receivers provide VOR, localizer, glideslope and marker beacon capability. The receivers are remotely mounted in the avionics nose bay with the control heads located in the consolidated control unit. Each system has three concentric control knobs for system operation. The inner knob is the ON-OFF switch and volume control. The two outer knobs are for frequency selection. A three-position toggle switch for marker beacon sensitivity selection and system test is also located on the control unit.

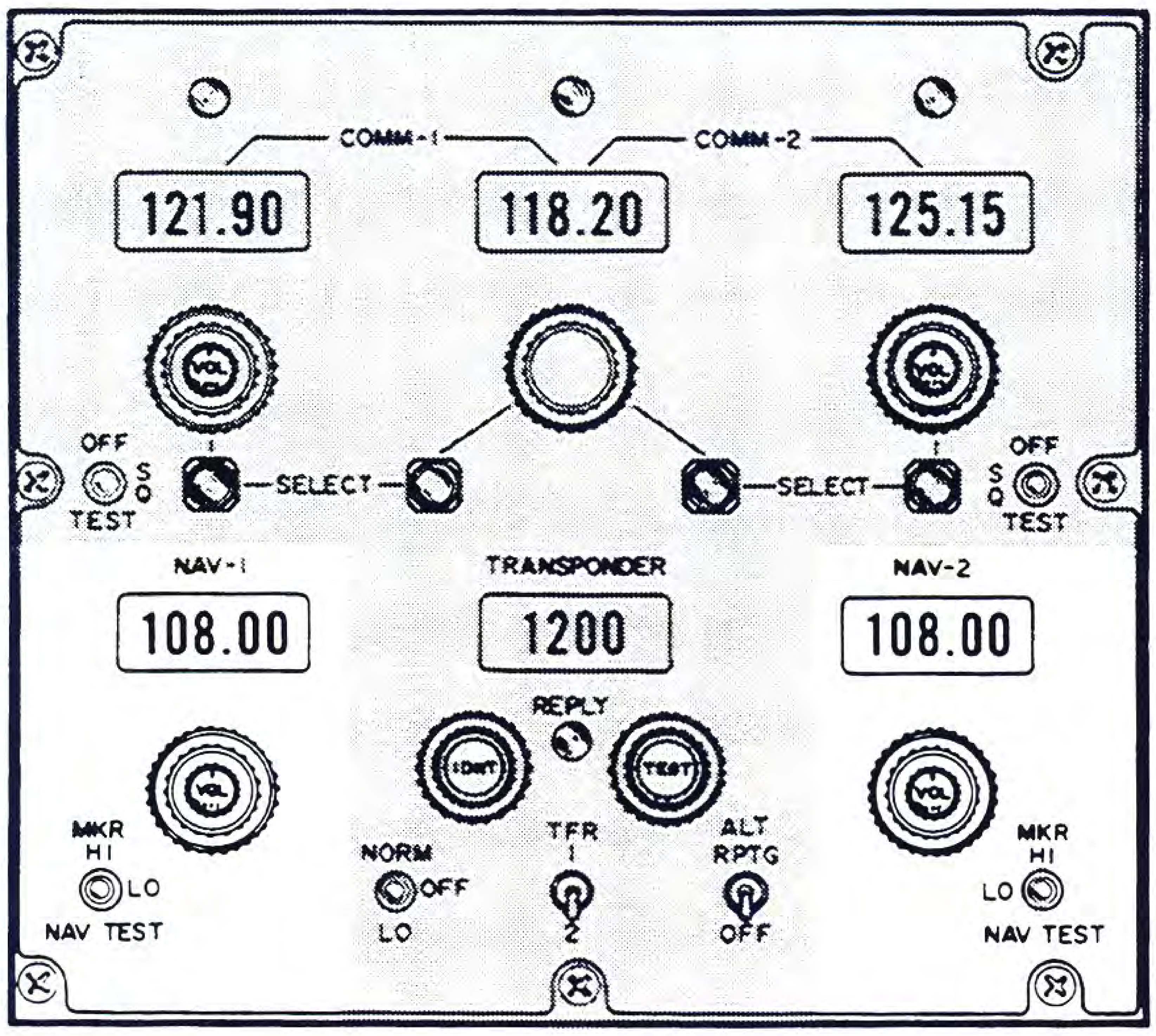
Each system has 200 VOR/LOC operating channels and 40 glideslope channels and automatic DME channeling. Multiple outputs drive the Flight Director HSI, RMIs, autopilot, course deviation indicator and R-NAV if installed. All the basic functions have a built-in self test.

VHF NAV 1 information is displayed on the flight director HSI and both RMIs when the RMI VOR/ADF selector switches are positioned to the VOR position. The No. 1 VOR bearing information is shown on the single bar pointer. Course selection is accomplished on the pilot's HSI by turning the course knob to the desired setting. A TO-FROM indicator is installed within the HSI to resolve course ambiguity. Red and yellow stripes appearing in the TO-FROM windows indicate that the NAV 1 information is unreliable.

VHF NAV 2 information is displayed on the co-pilot's RD-44 HSI, the repeater course deviation indicator on the left instrument panel and both RMIs when the RMI VOR/ADF selector switches are in the VOR position. The VOR bearing information is shown on the double bar pointer. Course selection on the co-pilot's HSI is accomplished by turning the course knob to the desired setting. A TO-FROM indicator is included within the co-pilot's HSI. A red and white stripped flag on the HSI will appear when the NAV 2 information is unreliable.

NAV 1 localizer information is displayed on the pilot's HSI and the expanded localizer in the ADI when the NAV mode is engaged with a localizer frequency selected. NAV 2 localizer information is presented on the co-pilot's HSI and the repeater course deviation indicator (CDI) on the left instrument panel. The localizer displays have associated warnings flags that will come into view if localizer information is unreliable.

Glideslope frequencies are paired with localizer frequencies, so that the correct glidesclope channel is automatically selected when the localizer is tuned. The NAV 1 glideslope is displayed on the HSI and GS deviation indicator on the ADI when the flight director GS mode is engaged. The NAV 2 glideslope is presented on the co-pilot's HSI, the repeater CDI on the left instrument panel, and the pilot's ADI if NAV 2/HSI 2 is selected on the mode control panel. A red flag will appear in the HSI and ADI glideslope indicator when the NAV 1 glideslope information is unreliable. When NAV 2 glideslope information is unreliable, the glideslope indicator in the co-pilot's HSI is masked by a red and yellow flag and the pilot's ADI glideslope indicator is covered by a red flag if NAV 2/HSI 2 is selected.



VHF NAV Self-Test

VHF NAV self-test is available through the NAV TEST button located adjacent to each NAV control knobs on the consolidated control unit. It is designed to give the pilot a simple and accurate method of checking VHF NAV system integrity. It is not a substitute for FAA required periodic accuracy checks.

NOTE

The NAV TEST should not be performed while the autopilot is coupled to the flight guidance system.

ILS Test

1. Tune appropriate NAV receiver to an unused localizer frequency (any frequency between 108.1 and 111.9 that ends in an odd number).
2. Depress and hold the NAV receiver TEST switch.
3. ADI, pilot's and co-pilot's HSIs, NAV and GS flags disappear.
4. Course deviation bar moves to an approximate 3/4 scale right displacement, the expanded localizer bar stows to right and the GS deviation bars in the HSI and ADI move to an approximate 3/4 scale down displacement.
5. The marker lights on the pilot's panel will illuminate with NAV 1 test. The marker lights on the co-pilot's panel will illuminate with NAV 2 test.

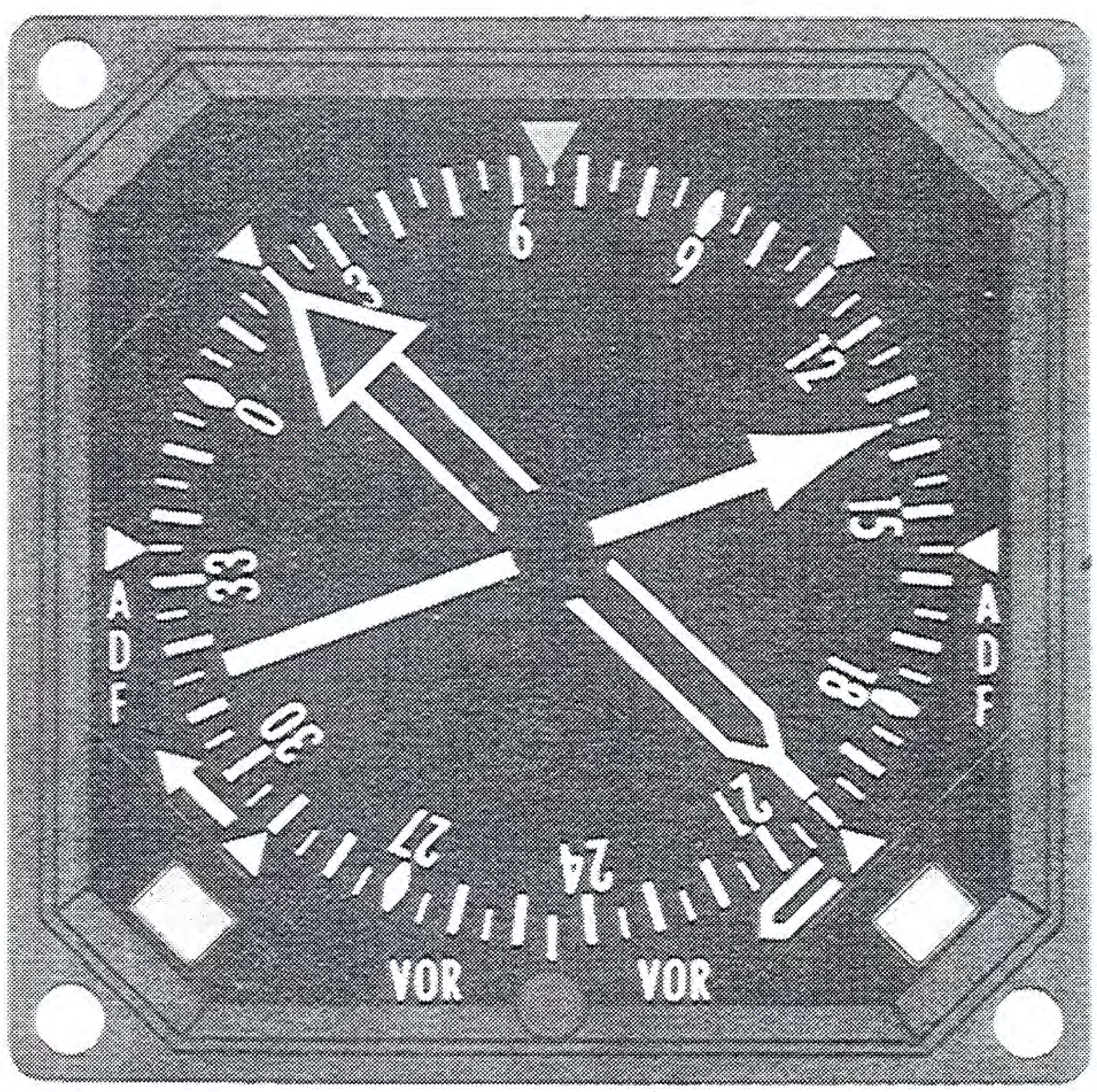
VOR Test

1. Tune appropriate NAV receiver to an operable VOR frequency.
2. The pilot's HSI or co-pilot's HSI NAV flag will pull out of view.
3. Select a course approximately 5° on the pilot's or co-pilot's HSI.
4. Depress and hold the NAV receiver TEST switch.
5. The appropriate course deviation bar approximately centers with a FROM flag indication.
6. The marker lights on the pilot's panel will illuminate with NAV 1 test. The marker lights on the co-pilot's panel will illuminate with NAV 2 test.
7. Test procedures using a VOT are standard. With the NAV receiver tuned to the published frequency of the test facility, the HSI will indicate 0° when centered with a "FROM" flag, and 180° centered with a "TO" flag.

RMI

Dual 332C-10 radio magnetic indicators are mounted on the left and right instrument panels. ADF and VOR magnetic bearing information are displayed on each RMI.

The single bar pointer presents VOR 1 or ADF 1 information. The double bar pointer presents VOR 2 or ADF 2 information. In those aircraft with single ADF installations (standard) ADF 1 information is provided to both pointers. Push type selector switches are used for selecting desired information.



The compass card for the pilot's RMI is slaved to the co-pilot's compass system and driven by the co-pilot's C-14 directional gyro. The compass card for the co-pilot's RMI is slaved to the pilot's compass system and driven by the pilot's C-14 directional gyro.

In the event of RMI compass card failure, the VOR pointer will remain slaved to the compass card and continue to indicate magnetic bearing to the selected station. The ADF pointer will indicate relative bearing to the selected station.

ADF

The ARC 846A is an automatic directional finder system operating in the frequency range of 200 to 1699 KHz. Tuning is digital and is accomplished by concentric knobs mounted on the control head. The receiver and receiver accessory unit are mounted in the tailcone compartment to shorten antenna leads. ADF information is routed to each RMI for display and the pilot's HSI.

A function selector switch labeled BFO, REC and ADF is used to select the desired mode of operation. If the BFO mode is selected, a 1000 Hz tone is produced which is used for the identification of keyed CW signals. The REC position facilitates aural identification of the selected station. Placing the switch to the ADF position sends ADF information to both RMIs and the pilot's HSI. The VOL controls receiver volume and is also the ON-OFF switch.

The TEST switch is used to assure that the ADF function is working properly. Momentary actuation of this switch will drive the ADF pointer away from its previous position. When released, the pointer should promptly return to its original position if the station is being received and the system is operating normally.

C-14 Compass System (Pilot's)

The pilot's HSI, the flight director when NAV 1 is selected on the mode control panel and the co-pilot's RMI are all driven by the pilot's C-14 slaved gyro system. The system consists of a directional gyro, a flux detector, two mode selector switches, a remote compensator and a slaving indicator. The switches and the slaving indicator located on the left switch panel. The directional gyro operates from 28 volts DC. Two LH GYRO SLAVE switches, one marked AUTO/MAN, the other RH/LH, allow selection of automatic (slaved) or manual operation of the pilot's C-14. When the manual position is selected, the HSI compass card can be moved left or right at a rate of 30° per minute by toggling the switch to the RH or LH position. Manual operation gives accurate short term heading reference when magnetic information is unreliable.

Under normal operating conditions the pilot's C-14 gyro slave switch will be left in the AUTO position. Fast slaving of the pilot's C-14 in the AUTO mode occurs at a minimum rate of 30° per minute and will continue at that rate until the gyro is slaved to the magnetic compass heading. It will then continually maintain a slow slaving rate of 2.5° - 5.0° per minute. The RH/LH switch must be activated to start the fast slaving action in the AUTO mode after the gyros have obtained operating speed.

C-14 Compass System (Co-pilot's)

The copilot's C-14 compass system is the same as the pilot's C-14 except for the HSI display. The copilot's HSI houses the slaving meter. The copilot's C-14 system drives the copilot's HSI, the pilot's RMI, and when NAV 2/HSI 2 is selected on the mode control panel, the flight director.

The co-pilot's C-14 is powered off the emergency DC bus. In the event of a DC power failure, placing the battery switch to the EMER position will regain the co-pilot's C-14 and provide gyro stabilized heading information.

Two GYRO SLAVE switches, marked AUTO/MAN and LH/RH, are located on the co-pilot's RH panel. Operation of the switches is the same as that described for the pilot's C-14 system.

FLIGHT GUIDANCE

The SPZ-500 Autopilot/Flight Director Instrument System is a complete automatic flight control system which includes flight director, automatic pilot, pilot's attitude director indicator (ADI), pilot's horizontal situation indicator (HSI), air data computer with associated outputs, autopilot controller, vertical navigation system including altitude alerter, touch control steering, a rate gyro and autopilot servos. The air data system provides pressure altitude, altitude reporting, altitude pre-select, IAS hold and vertical speed hold. The system may be flown manually or automatically and meets Category II equipment requirements.

Attitude Director Indicator

The ADI displays aircraft attitude, computed roll and pitch steering commands and ILS raw data through the expanded localizer and glideslope needles. Pitch attitude is marked in 5° increments to 40° of pitch, with additional marks at 60°. Roll attitude is marked in 10° increments to 30°, with additional marks at 45°, 60°, and 90°. A fixed reference airplane displays actual aircraft position relative to the pitch and roll attitudes of the ADI sphere. Also incorporated are an inclinometer indicating skid or slip conditions, a rate of turn indicator and system mode annunciator.

The flight director command bars are in view any time the flight director system is in operation. They are positioned by the FD computer to display pitch and roll steering commands for the mode selected on the mode control panel. Positioning the fixed reference aircraft to align it with the command bars gives computed steering to intercept and track a radial, glideslope, or whatever mode may be selected.

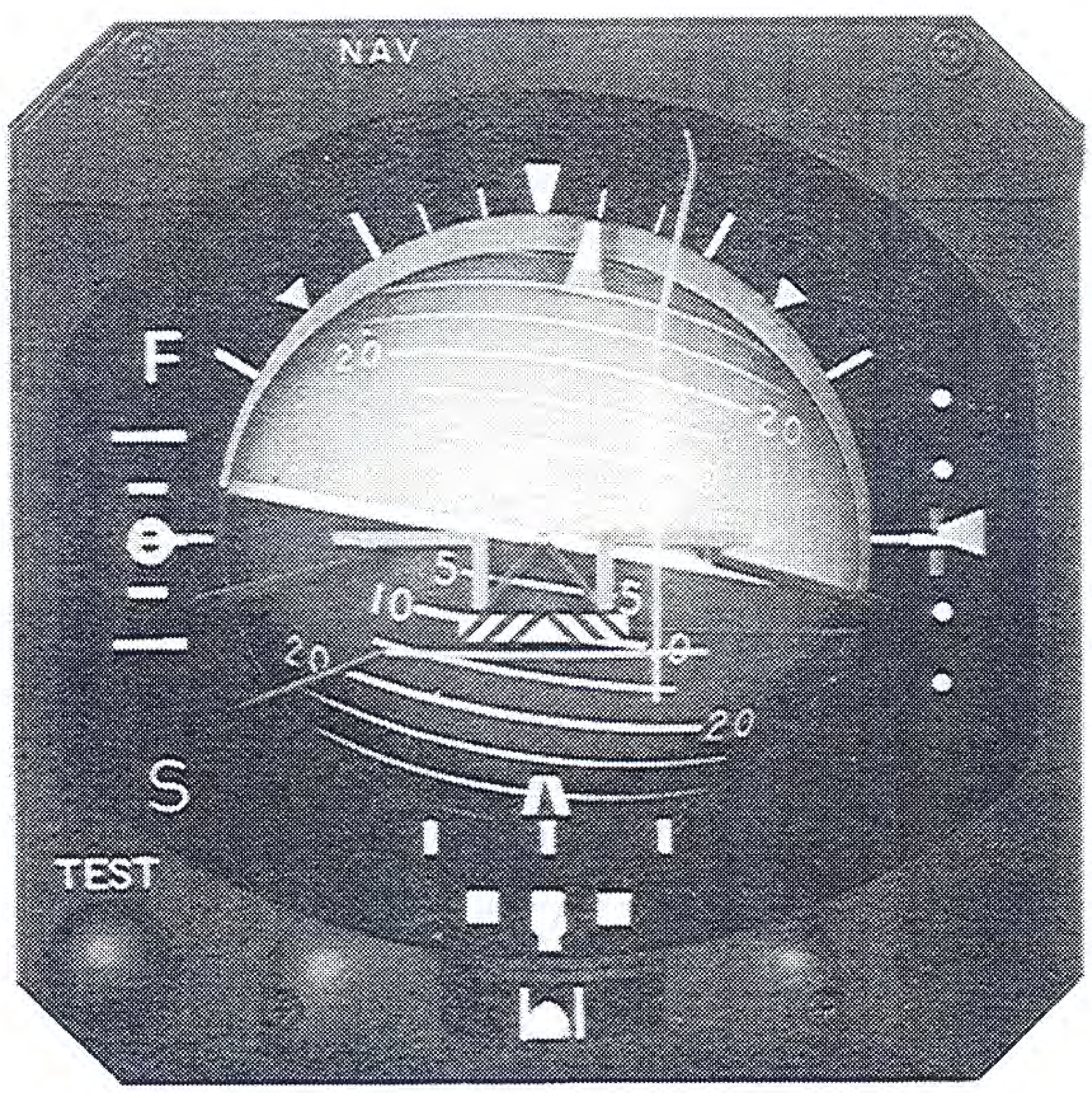
An ATT warning flag appears at the top left side of the ADI when attitude information is unreliable and a Flight Director warning flag (DF) is displayed at the top right side of the ADI when command bar information is unreliable. A Rate of Turn (RT) warning flag, LOC warning flag, and GS warning flag appears when system power is off or the function is inoperative due to system failure.

Depressing the attitude test switch causes the sphere to rotate, approximately 20° left and pitch up approximately 10°. The ATT warning flag will appear and all system annunciator lights will illuminate except the DH.

FLIGHT GUIDANCE

Mode annunciator lights are included on the face of the ADI and indicate the mode of operation as follows:

VOR Engaged	NAV
VOR Approach Armed	APR
VOR Approach Engaged	NAV APR
Glideslope Engage	GS
Glideslope Armed	APR
LOC Engaged	LOC
Altitude Hold Engaged	ALT
Heading Engaged	HDG
Back Course Engaged	BC
Go-Around	GA
Altitude Preselect Engage	VRT
IAS Hold Engage	VRT
Vertical Speed Hold Engage	VRT



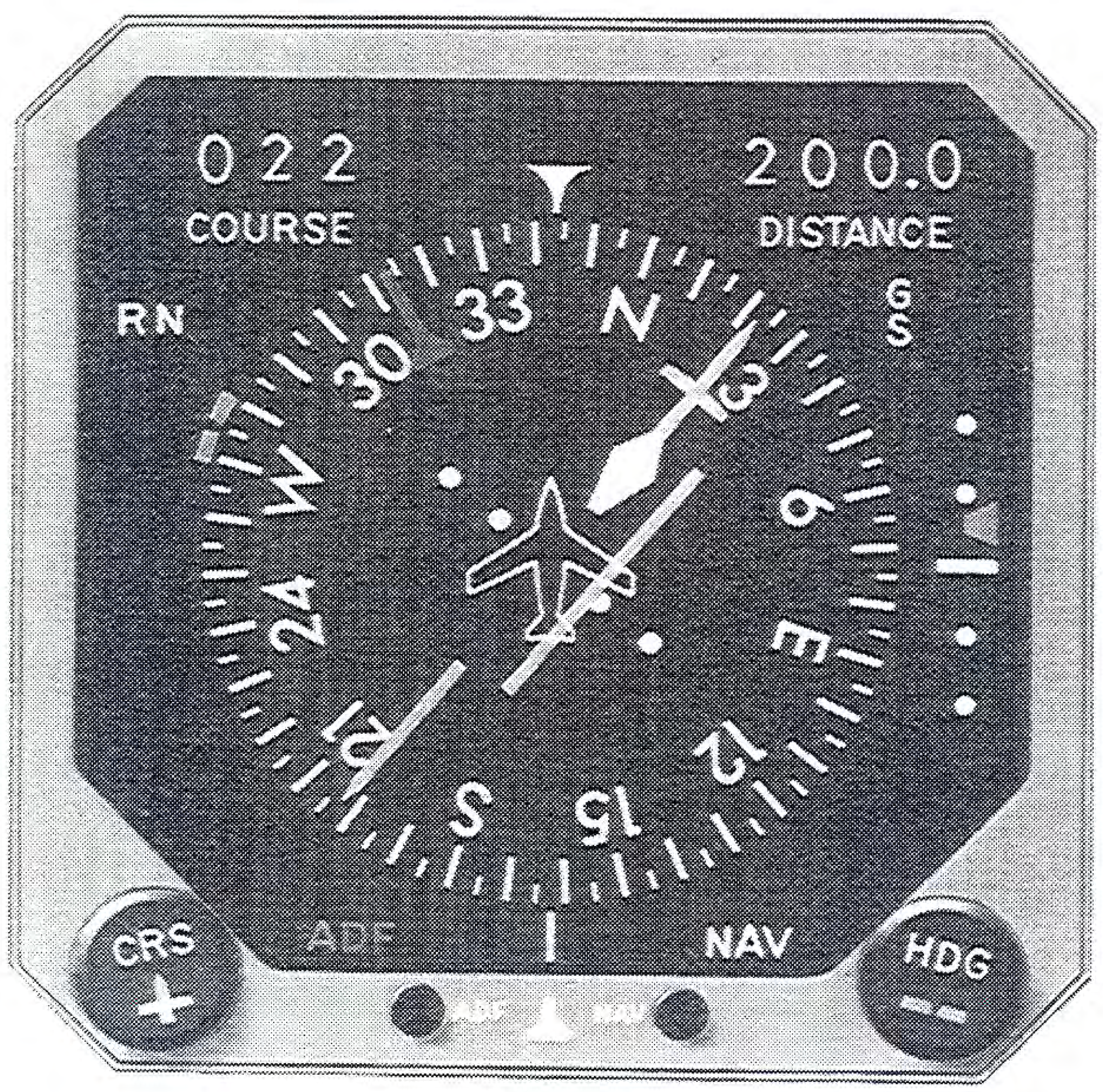
The ADI also includes a speed command and a radio altimeter repeater (rising runway). The speed command will give a "fast-slow" approach speed readout when the optional angle of attack system is installed in the aircraft. The rising runway will display absolute altitude from 200 feet AGL to ground level when the optional radio altimeter is installed. A SPD warning flag appears when system power is off or inoperative due to system failure.

Horizontal Situation Indicator

The pilot's HSI displays compass heading, glideslope and localizer deviation, DME or distance to RNAV way points, and aircraft position relative to VOR or RNAV radials. The compass card is graduated in 5 degree increments and a lubber line is fixed at the fore and aft positions. Azimuth markings are fixed at 45° and 315° of the compass face. A fixed reference aircraft is in the center of the HSI aligned longitudinally with the lubber line markings.

The heading cursor is positioned by the heading knob on the instrument or remotely from the pedestal and displays a preselected heading. When the compass card rotates the cursor remains on the selected heading.

In addition to positioning the cursor, the heading knob sends internal signals to the command computer to position the command bars when HDG is selected on the mode control panel. A heading flag (HDG) is displayed when the compass system is off or heading indication is inoperative.



The course knob sets both the course cursor and course counter. The course setting can be read with the yellow course cursor against the compass card or by the digital course counter in the upper left corner. The course knob also sets internal system reference for flight director commands in the VOR, LOC and RNAV modes of operation. Like the HDG cursor, the course cursor rotates in its set position with the compass card.

A course deviation bar and course deviation dots are on the HSI. The bar displays angular and lateral displacement from the VOR or localizer beam, while the dots are displacement reference points for the course deviation bar. When tracking a VOR, the outer dot represents 10 degrees, while on an ILS localizer it represents 2-1/2 degrees. TO-FROM flags always point to or from a station when operating on a VOR and a NAV warning flag comes in view when NAV information is unreliable.

The vertical deviation pointer displays V-NAV or glideslope deviation. When receiving glideslope information during an ILS approach, the deviation pointer will appear on the right side of the HSI displaying deviation from the glideslope beam. When receiving V-NAV information the deviation pointer will display deviation from the computed vertical path with each dot of deviation representing 750 ft. of vertical path deviation. The vertical mode annunciator will display GS except when the deviation pointer is displaying V-NAV information or when power is removed from the HSI. Under these conditions VN will be displayed. If the NAV receiver is not tuned to an ILS frequency or receiving V-NAV information the pointer will be retracted from view. If either signal is unusable or unreliable, the deviation pointer will be covered by a red warning flag.

Distance to the selected VORTAC or RNAV waypoint is displayed in the DME window in the upper right corner of the HSI. The readout is repeated from the DME or area navigation unit installed in the aircraft.

When operating on R-NAV, an alert light on the left side of the HSI comes on when the waypoint is approximately 3-1/2 miles away.

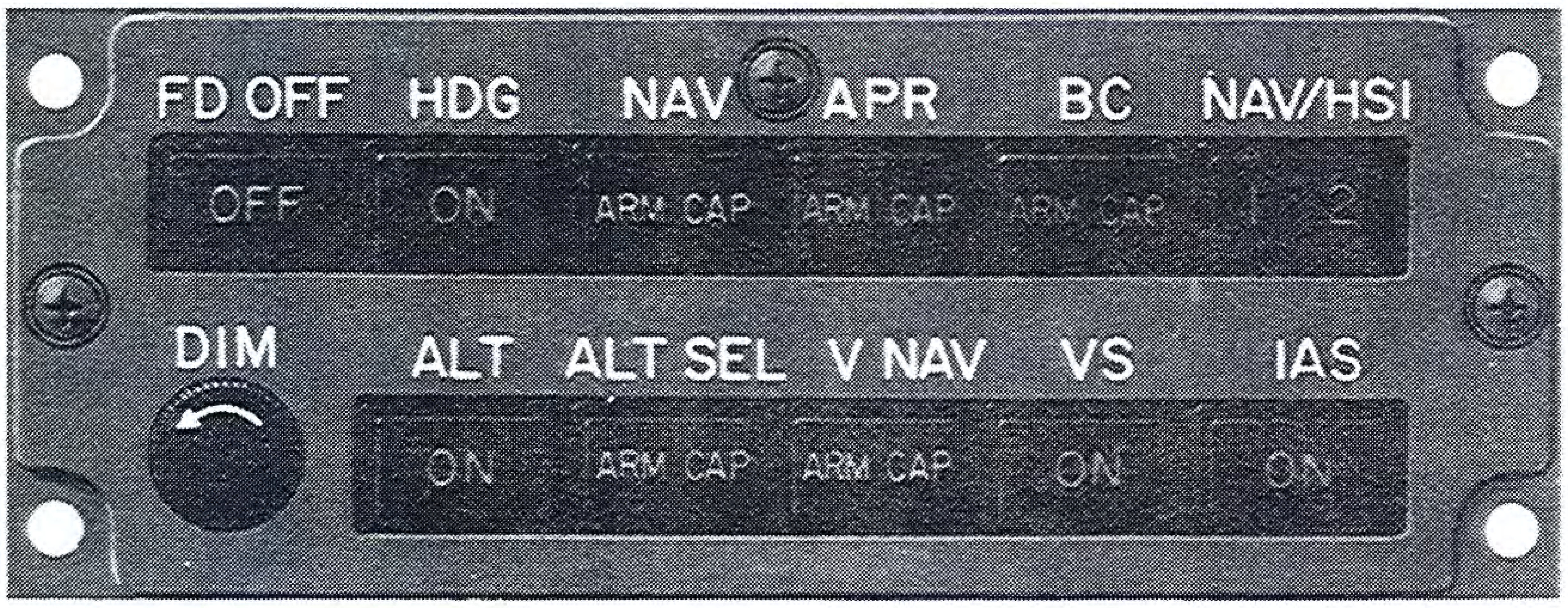
A pink bearing pointer is also provided in the HSI which indicates magnetic bearing to an ADF or VOR station and the selected station is annunciated as ADF or NAV. The bearing pointer is controlled by two source buttons along the bottom of the HSI.

Mode Control Panel

The mode control panel consists of eleven push on, push off back lighted switches that select various flight director/autopilot modes of operation.

The status of the selected mode is then displayed by amber lights when armed (ARM) or green lights when on (ON) or engaged (CAP).

A test switch on the ADI will test all lights on the mode control panel and annunciator lights on the face of the ADI.



The flight director off switch biases the command bars out of view to allow operation of the autopilot, using any of the nine available modes, without displaying the flight director command bars.

Autopilot Control Panel

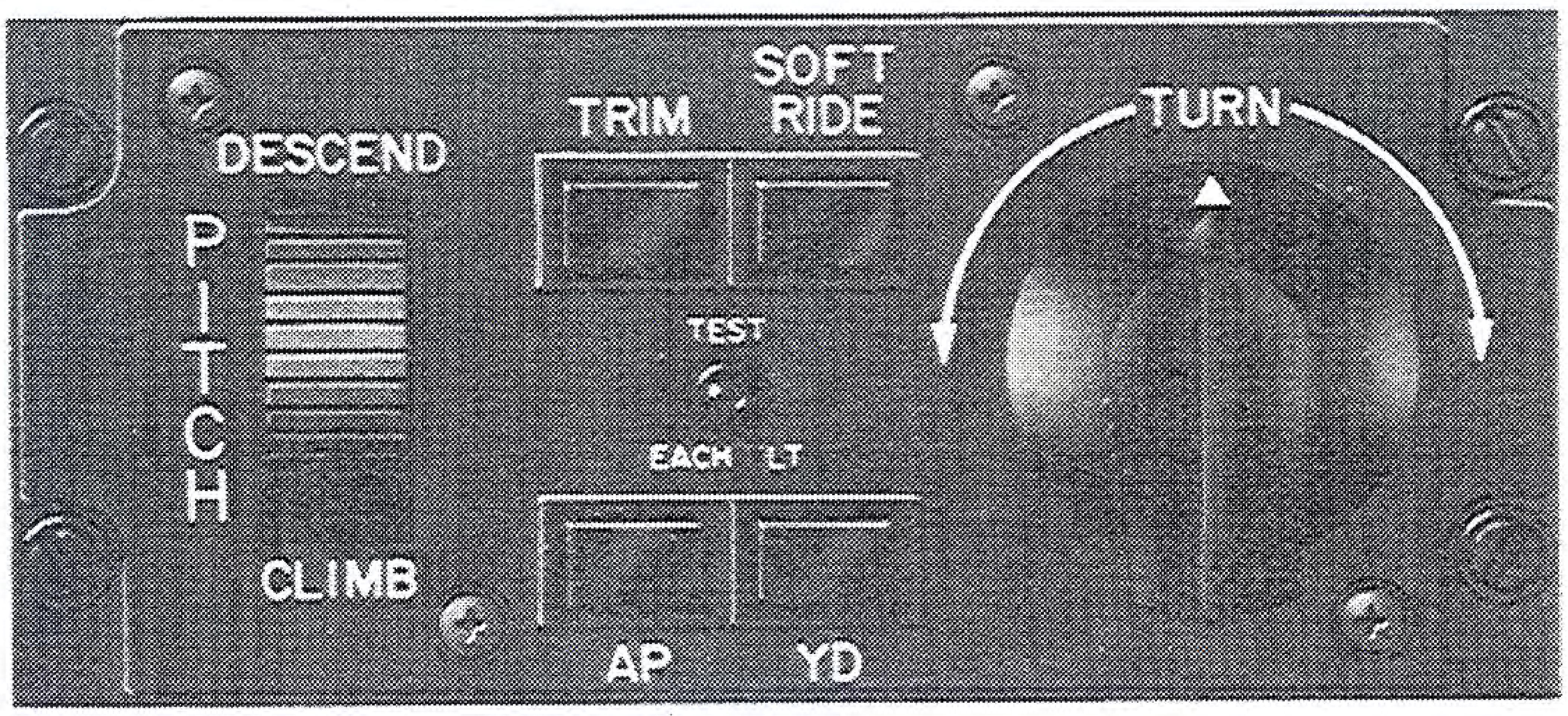
The autopilot control panel mounted on the pedestal provides the means of engaging the autopilot and yaw damper, as well as manually controlling the autopilot through the turn knob and pitch wheel.

The AP engage switch is used to engage the autopilot and yaw damper. The YD switch is used to engage the yaw damper without the autopilot. Use of the yaw damper while manually controlling the aircraft aids in aircraft stability and passenger comfort.

The pitch wheel allows manual pitch control of the aircraft proportional to the rotation of the wheel and in the direction of wheel movement. Movement of the wheel also cancels any other previously selected vertical mode. The turn knob allows manual bank control of the aircraft proportional to and in the direction of wheel movement. The aircraft will bank a maximum of 30° bank angle. The turn knob must be in the center detent position before the autopilot can be engaged. Rotation of the turn knob cancels any other previously selected lateral mode.

The soft ride mode is controlled with a push-on-push-off switch. The switch is the annunciator showing that soft ride has been selected. Soft ride reduces autopilot gains while still maintaining stability in rough air. The mode may be used with any mode selected.

The elevator trim indicator shows an out of trim condition by displaying UP or DN when a sustained signal is being applied to the elevator servo. The indicator should be OFF before engaging the autopilot.



The test button provides a test for the torque limit and the autopilot disconnect warning horn. After engaging the autopilot, pressing the TEST button will cause the autopilot to disengage by simulating a failure in the torque limiters. The AUTOPILOT OFF light on the instrument panel will illuminate and the autopilot off warning horn will sound. This test should be performed prior to each flight. If the autopilot does not disconnect, the system should be checked before using the autopilot inflight.

The autopilot is normally disengaged by one of three ways: 1) depressing the AP/-TRIM DISC switch on either yoke; 2) electrically trimming the elevator trim system; or 3) depressing the go-around button on the left throttle (either throttle if dual flight directors are installed). The autopilot cannot be disengaged by applying an overriding force to the yoke, however, actuation of the touch control steering button on the yoke will interrupt the pitch and roll servos until the switch is released. If the autopilot is disengaged by any of the above three ways, a warning tone will sound for one second and the amber AUTOPILOT OFF light will illuminate for one second. Any other disconnect will cause the warning horn to sound for one second and the amber AUTOPILOT OFF light to stay illuminated. The amber light can be turned off by pressing the AP/TRIM DISC switch, the electric trim switch, or the go-around switch.

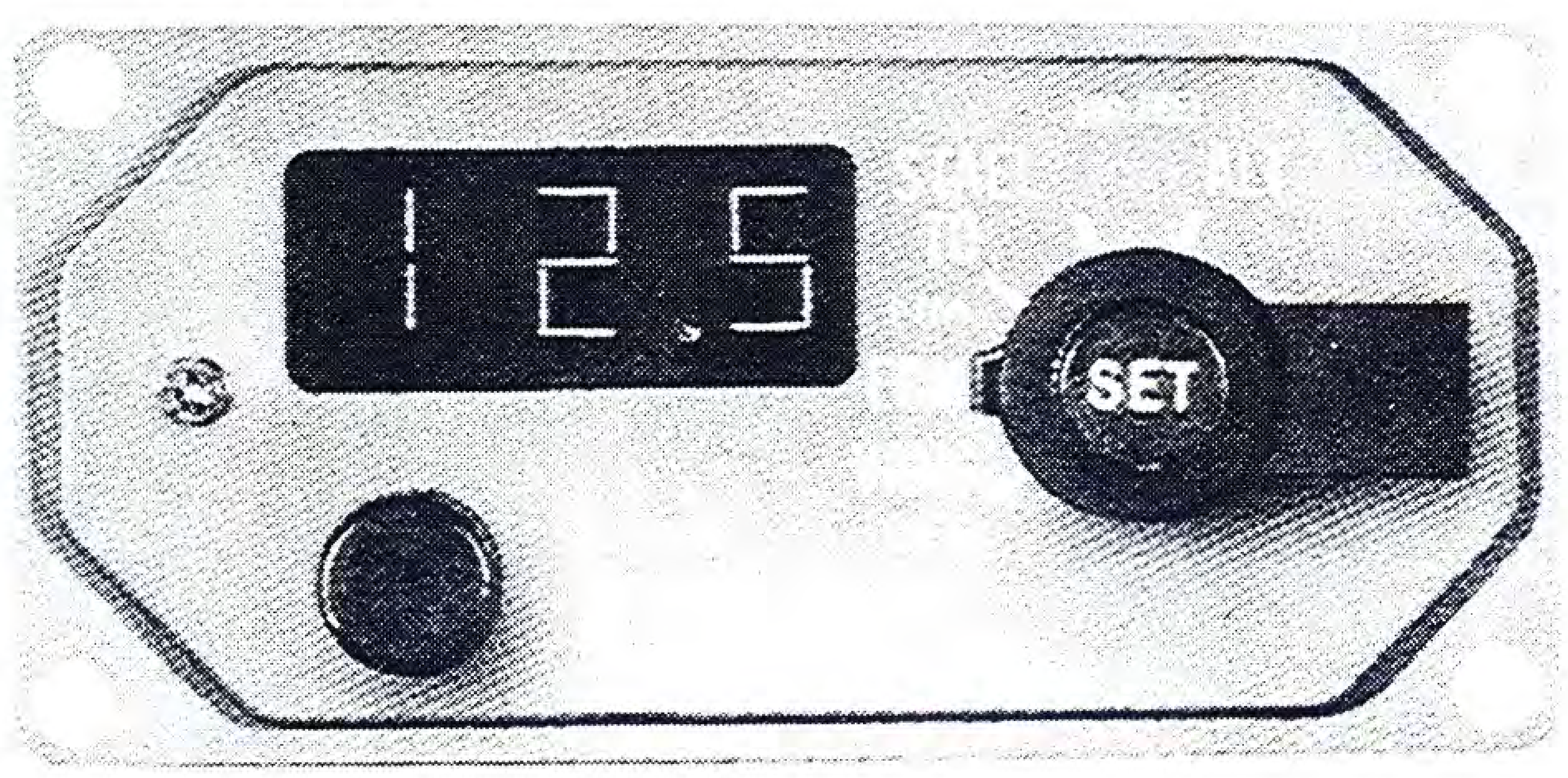
Pilot's Altimeter

The altimeter provides a servoed drum/pointer display of barometrically corrected pressure altitude. AC power is required for operation of the altimeter. The barometric pressure is set manually with the BARO knob and is displayed in inches of mercury and millibars on the baro counters. The altimeter is driven from an air data computer that provides sensors and electronic output for altitude.

An altitude alert light illuminates to provide a visual indication when the aircraft is within 1000 ft. of the preselected altitude and extinguishes when the aircraft is within 250 ft. of the preselected altitude. After capture, the light will illuminate if the aircraft departs more than 250 ft. from the selected altitude.

V-NAV Computer/Controller

The V-Nav computer/controller (VNCC) provides data inputs for altitude alerting, altitude preselect, and V-NAV modes. The display is 3-digit 7-segment lights. Data is entered by turning the display selector switch to the desired position with the set knob.



Altitude preselect is used by placing the selector switch to ALT and selecting the desired value. This value assumes two zeros, i.e., 350 represents 35,000 ft. No further action is required for altitude preselect.

Data must be entered in ALT and station elevation (STAEL) before a V-NAV angle will be displayed in the VANG position. If a bias is required to or from the station, data is entered in the To or FRM position on the controller.

An operating DME is required for computing V-NAV functions.

The dim control is for intensity of the 3-digit display and does not affect intensity of back lighted nomenclature.

System Operation

The SPZ-500 System incorporates a wide variety of capabilities that produces one of the most flexible and easy to use systems in aircraft today. The flight director and autopilot can be used independently or together. When engaged and coupled to the flight director, the autopilot will control the aircraft using the commands generated by the flight director computer. With the flight director turned off, the autopilot will still couple to the same modes without displaying the flight director command bars. Disengagement of the FD or AP will have no effect on the remaining AP or FD modes in operation at the moment of disengagement, except when using the go-around button. When the autopilot is engaged without any mode selected, manual pitch and roll commands may be made or soft ride selected. Touch Control Steering (TCS) can be used to maneuver the aircraft or to modify the commands to the FD and AP or, if the autopilot is not engaged, TCS works as a sync system for the FD.

The SPZ-500 is offered with either a crosspointer or single cue flight director presentation. Operation of the two are similar; however, the command bars of the single cue system are brought into view by selecting any lateral mode. Selection of a vertical mode will not bring the command bars into view. With the cross-pointer display, selecting a lateral mode brings both steering bars into view while selecting a vertical mode will bring the vertical steering bar into view.

Basic Autopilot

The basic autopilot, without any inputs from the flight director system, can be used for pitch, roll and heading hold. The autopilot will hold the pitch attitude existing at the moment of AP engagement or the pitch attitude existing at the moment of disengagement of a vertical mode.

The compass heading hold ability of the autopilot will hold the aircraft on the heading existing at the moment of engagement or the heading existing when the turn controller is returned to its detent if the turn was less than 6° of bank. If the bank angle is greater than 6° when the turn controller is centered, the autopilot will maintain the heading existing as the aircraft rolls down through 6° of bank. If a lateral mode is disengaged, the autopilot will hold the heading existing at the moment of disengagement. The autopilot cannot be engaged with the turn controller out of the center detent position.

The autopilot maintains roll attitude by rolling the aircraft wings level at engagement in conjunction with compass heading hold. Turn and pitch control are through the pitch and turn wheels as discussed in the autopilot control panel section.

A touch control steering (TCS) pushbutton located on the pilot control wheel allows manual changes of aircraft pitch and roll attitude without disengaging the autopilot. After completing the manual maneuver, the TCS pushbutton is released and the autopilot automatically synchronizes to the pitch attitude established when released. The roll attitude will roll to wings level if bank angle is 6° or less or will hold the established bank angle if above 6° up to the 30° bank angle limit.

The optional dual flight director system provides switching so the autopilot can be driven from the No. 1 FD system or the No. 2 FD system.

Heading Mode

The heading mode can be used only with the FD or in conjunction with the autopilot. When the heading mode is selected, the command bars will come into view and display a steering command that is controlled by the HDG pointer on the HSI. The command bars will sync vertically to the pitch attitude at the time of HDG selection. It is possible to bypass HDG and engage the FD by selecting NAV, APR, or BC as appropriate. Selecting these modes will automatically engage heading if out of the capture band of the mode selected or, if the NAV receiver is tuned and the aircraft is within the capture requirements of the selected mode, the selected mode will engage directly. If the AP is also engaged, the AP will receive steering commands to turn the aircraft to and maintain the selected mode. NAV, APR, and BC can be armed with the HDG mode ON. When intercepting a VOR radial with the NAV mode selected, the system will switch from ARM to ENG when within the capture band, the NAV annunciator will illuminate and the HDG annunciator will extinguish.

NAV Mode

Two methods of capture and tracking a VOR signal are used in the SPZ-500 system. One method is used for normal enroute navigation and another for the VOR approach.

For enroute navigation, the desired VOR frequency is selected on the NAV 1 receiver, NAV/HSI 1 is selected on the mode control panel and the NAV mode is selected on the control panel. If outside the capture limits, the system will show ARM on the NAV mode selector. HDG will also illuminate on the mode control panel and annunciator panel when NAV is selected if it has not previously been selected and annunciated. HDG will extinguish and NAV will illuminate on the annunciator panel and CAP will show on the NAV portion of the mode control panel as the aircraft is manuevered within the capture limits. If the airplane is within the capture limits when NAV is selected, NAV will be illuminated on the annunciator panel and CAP will show in the mode selector under NAV. The system will acquire and track the VOR radial. For a VOR approach, the desired VOR frequency is selected on NAV 1 receiver and the APR mode is selected. If outside the capture limits the system will show ARM on the NAV mode selector and APR will illuminate on the annunciator panel. HDG will illuminate when APR is selected if it has not previously been selected and annunciated. At capture, the NAV mode selector will switch to CAP and NAV APR will be displayed on the annunciator panel. The HDG annunciator will extinguish.

In both NAV modes a station passage feature is provided that incorporates 12^{o} bank angle limits and a heading hold (plus wind drift) mode. The station passage mode for enroute tracking is of long enough duration to provide smooth transition of a VOR station at any altitude. The station passage mode for approach is of short duration (approximately 4 seconds) to provide approach accuracy. This does not provide the degree of ride smoothing that is present in the enroute case.

ILS Approach

With a localizer frequency selected in NAV 1, operation is similar to capturing and tracking a VOR radial. Selecting APR on the mode control panel arms both the LOC and GS modes and captures HDG if not previously selected. HDG and APR will be displayed on the annunciator panel, LOC arm is displayed as NAV ARM and GS arm is displayed as APR ARM. When inside the LOC capture limits NAV CAP will illuminate on the mode control panel, HDG will extinguish on the annunciator panel and LOC

APR will be illuminated on the annunciator panel. At GS capture ($\pm$ 1/2 dot) APR CAP will illuminate on the mode control panel and GS will be annunciated on the annunciator panel. During ILS approaches, the AP/FD gain is progressively reduced during the approach using GS capture and the radio altimeter as the signal for initiating gain programming. If a radio altimeter is not installed, this function is performed at GS engage and middle marker passage.

The capture limits for VOR and LOC captures are variable depending on intercept angle and rate of movement of the course deviation needle. During VOR or LOC tracking, bank angles are limited to 12° and crosswind corrections up to 30° crab angle can be maintained.

Back Course Localizer Approach

A back course localizer approach capability is provided using either flight director or autopilot or both.

With a localizer frequency set in NAV 1, selecting BC arms or engages the system for a back course localizer approach. The front course of the ILS should be set into the HSI to give the proper indication on the course deviation needle and to give correct sensing for course correction. The command bars and autopilot will give incorrect steering commands if BC has not been selected or the back course is set on the HSI. When BC is captured, BC CAP will be displayed on the mode control panel and BC will illuminate on the annunciator panel. HDG will extinguish on the annunciator panel.

NAV/HSI Transfer

The navigation transfer switch on the mode control panel (NAV/HSI) controls which NAV and HSI is supplying inputs to the AP/FD system. Either NAV/HSI 1 or NAV/HSI 2 can be selected. In the NAV/HSI 1 position, NAV information must be set on the pilot's HSI. In the NAV/HSI 2 position, NAV information is from NAV 2 and heading and course information must be set on the co-pilot's HSI. Since the DME is used for gain scheduling in the NAV and NAV APR modes, the DME should be set to the same NAV that is being used by the AP or FD.

Altitude Hold and Altitude Preselect

The vertical modes will operate the same using the autopilot whether the ADI is single cue or crosspointer. If single cue, selection of a vertical mode without a lateral mode will provide autopilot tracking of the mode but the FD command bars will not be in view. If crosspointer, selection of a vertical mode without a lateral mode provides autopilot tracking of the mode and the appropriate command bar will be in view.

Selecting altitude hold provides steering commands to maintain the altitude at the moment of engagement. An altitude preselect mode is also incorporated which provides a preprogramming capability. To use altitude preselect, the desired altitude is set in the V-NAV controller and the altitude preselect mode on the mode control panel is armed. The aircraft may be maneuvered toward the desired altitude using any of several methods: the autopilot pitch wheel, touch control steering, FD pitch sync, IAS hold or vertical speed hold. As the aircraft approaches the desired altitude the altitude preselect will capture at an altitude corresponding to 1/4 the rate-of-climb/descent; i.e. at 2000 ft/min climb rate the system will capture 500 ft. prior to the selected altitude. At capture the mode control panel will display CAP and VRT will illuminate on the annunciator panel. The FD will command and the autopilot will steer to a smooth level out at the desired altitude. When the airplane is within 40 ft. of the desired altitude, the mode will switch to altitude hold displaying ALT ON on the mode control panel and ALT on the annunciator panel. Once altitude hold is captured, the touch control steering button (TCS) on the control wheel can be used to change or trim the selected altitude. TCS operates either the FD, AP, or both. Once altitude hold is captured, resetting the BARO set on the altimeter will cause the airplane to climb or descend to recapture the same indicated altitude. Moving the autopilot pitch wheel will cancel altitude preselect and altitude hold when either is captured.

Airspeed Hold and Vertical Speed Hold

Indicated airspeed hold and vertical speed hold are engaged by selecting the appropriate mode on the mode selector panel. The FD, AP or both will hold the airspeed or vertical speed established at the time of engagement. ON will illuminate at the appropriate mode on the mode selector panel and VRT will illuminate on the annunciator panel. Using the AP pitch wheel will cancel either mode. Changing the commanded airspeed or vertical speed is done by holding TCS and maneuvering the airplane manually to the new speed. The airplane will hold the airspeed or vertical speed established at the time TCS is released.

Vertical NAV

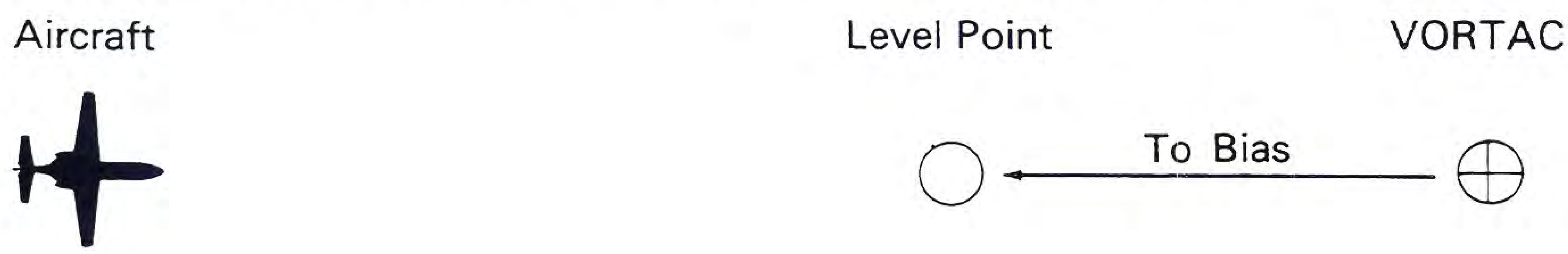
The vertical navigation system provides vertical guidance along a computed angle. This angle can be used for climb or descent and can be varied from 0° to 6° in either direction. The computed angle is used very much like a glideslope path in that, once established, the airplane climbs or descends at a specific angle.

The V-NAV will only operate when using NAV 1 with the DME set to NAV 1. The DME must be locked on a DME station for V-NAV computation. The desired altitude, station elevation, and TO/FROM bias (if desired) should be set into the V-NAV controller.

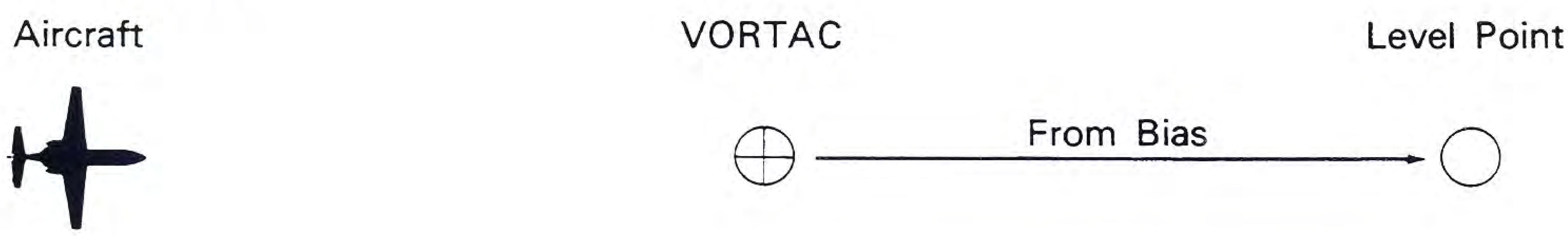
The desired altitude — The altitude at which the airplane will level at the completion of the climb or descent.

Station elevation - The elevation above sea level of the VORTAC station that the VOR and DME are receiving.

TO/FROM bias - Bias is a distance set into the V-NAV that moves the point for completion of the problem away from the VORTAC/WAYPOINT being used. TO bias moves the point closer to the airplane than the VORTAC/WAYPOINT.



FROM bias moves the point farther from the airplane than the VORTAC/WAYPOINT.



A VOR or RNAV (optional) station should be selected and the course deviation indicator on the HSI rotated to produce a TO flag toward the station. The V-NAV controller will then display the computed angle to the VOR station (± bias) or waypoint (± bias) when the display selector switch is in the V ANG position. The V-NAV can be used for either climb or descent at angles up to 6°. Once an angle is displayed on the V-NAV controller, a larger angle (up to 6°) can be preset by the set knob. With a computed angle displayed in the V ANG position of the V-NAV controller, selecting V-NAV on the mode control panel causes the AP or FD to capture and track the angle. The command will steer the FD, AP or both along the computed angle and level the aircraft at the desired altitude. As the aircraft passes the selected point, the vertical angle will be cancelled by replacing the displayed angle with dashes and switching automatically to altitude hold. If a larger angle than the displayed angle is set, selecting V-NAV on the mode control panel will arm the mode and the airplane will continue along in level flight until approaching the preset angle. Upon intercepting the preset angle, the mode will capture and climb or descend at that angle. Any time the V-NAV is armed or captured the vertical displacement bar in the HSI will display the computed angle and an annunciator above the vertical displacement bar will show VN. Upon completion of the problem this annunciator will display GS. At capture the mode control panel will display CAP and VRT will illuminate on the annunciator panel. Operation of the V-NAV below 500 ft. above ground level is prohibited. During descent from high altitude, changing the BARO SET for altimeter will cause a deviation in vertical angle. The V-NAV will not operate on the No. 2 FD if installed.

Go-Around Mode

A go-around mode (GA) is available through a button on the left throttle (both throttles if optional dual flight director system installed). Depressing the button will drop all other FD modes and disconnect the autopilot. The FD command bars will command a wings level and 7-1/2° nose up climb attitude. The GA light on the annunciator panel will illuminate. Go-around is cancelled by engaging the autopilot or selecting a lateral and vertical mode. If dual FD's are installed pressing either go-around will cause both ADI's to display go-around.

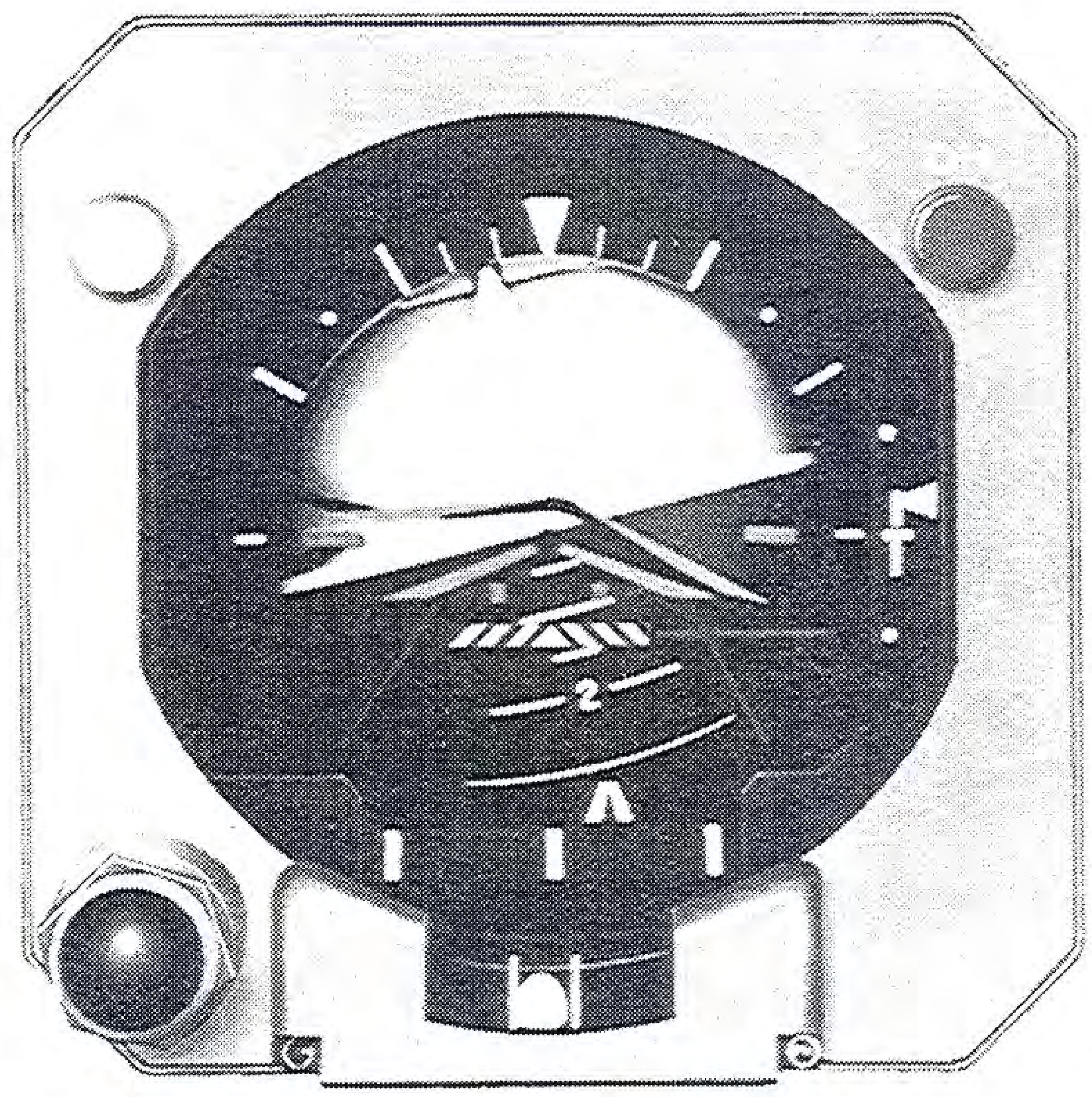
Pitch Sync

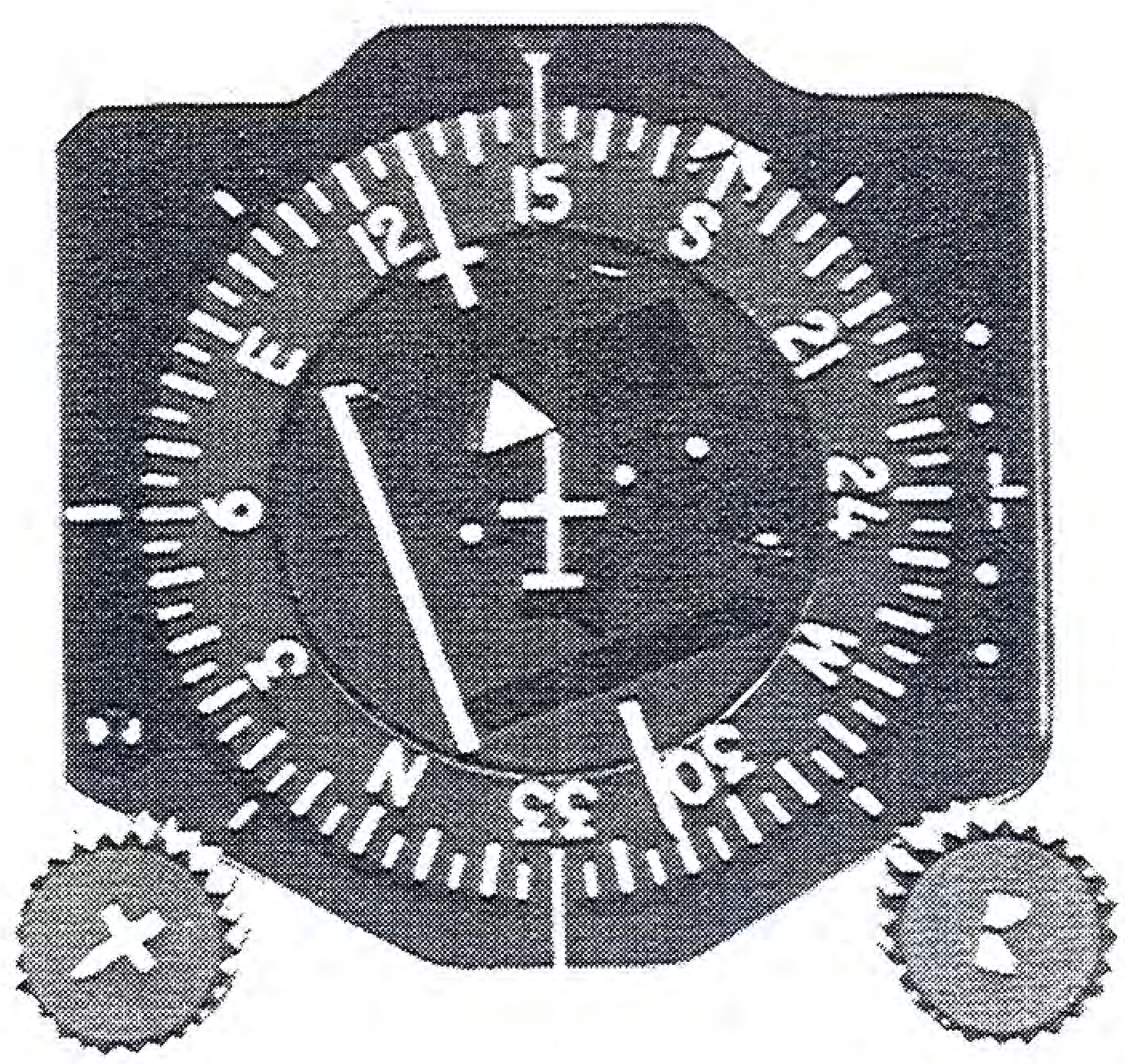
When flying the airplane manually and using the flight director, the command bars may be matched to the existing pitch attitude or the vertical modes may be reset by using the touch control steering (TCS) mode.

Optional Dual Flight Director System

An optional dual flight director system is available that provides the same operational capabilities to the co-pilot as the standard system does to the pilot with the exception of V-NAV. The ADI and HSI are 4-inch instruments for the dual offering (as opposed to 5 inch for the pilot instruments) and the co-pilot ADI does not incorporate an annunciator panel. Single cue and crosspointer flight director presentations are available. The flight director computer and mode selector panel are identical to those used in the standard system. The single cue ADI and HSI (which is the same RD 44 unit included in the standard package) are shown below.

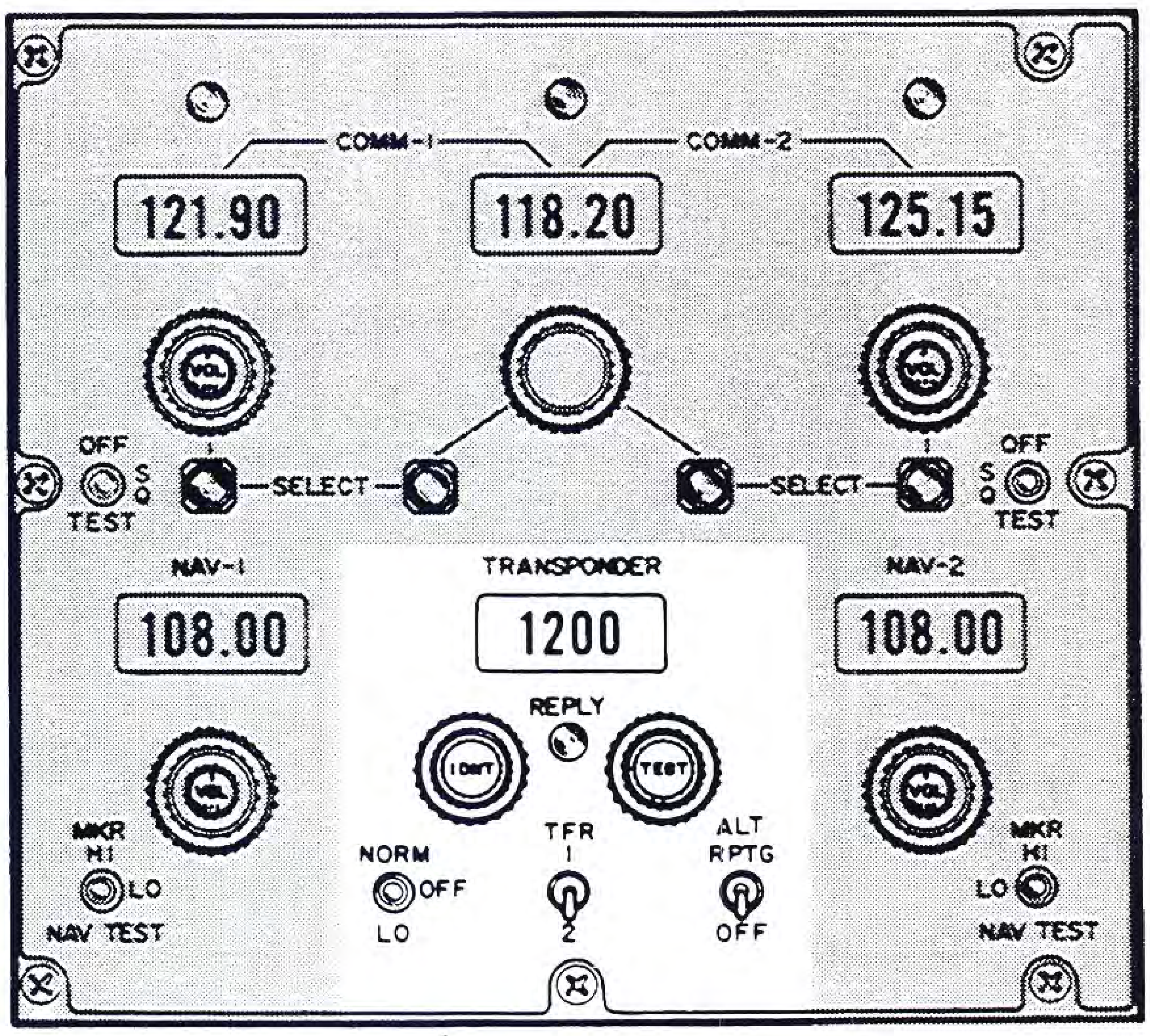
The third attitude gyro must be installed and operating and remain on throughout the flight.





Transponder

A Collins TDR-90 transponder with a 4096 Mode A code capability is located in the center instrument panel as part of the consolidated control unit. The transponder also has Mode C capability which will provide automatic altitude reporting. Three toggle switches provide means for selecting the modes of operation. The NORM/OFF/LO switch provides power to the system whenever NORM or LO is selected. The system is normally used in the NORM sensitivity mode. LO sensitivity is used only when requested by the ATC ground controller. There is a 60 second delay from the time the switch is placed in the NORM or LO position until operation is obtained.



The TFR switch is used with dual installations to select which of the two transponders is to be used.

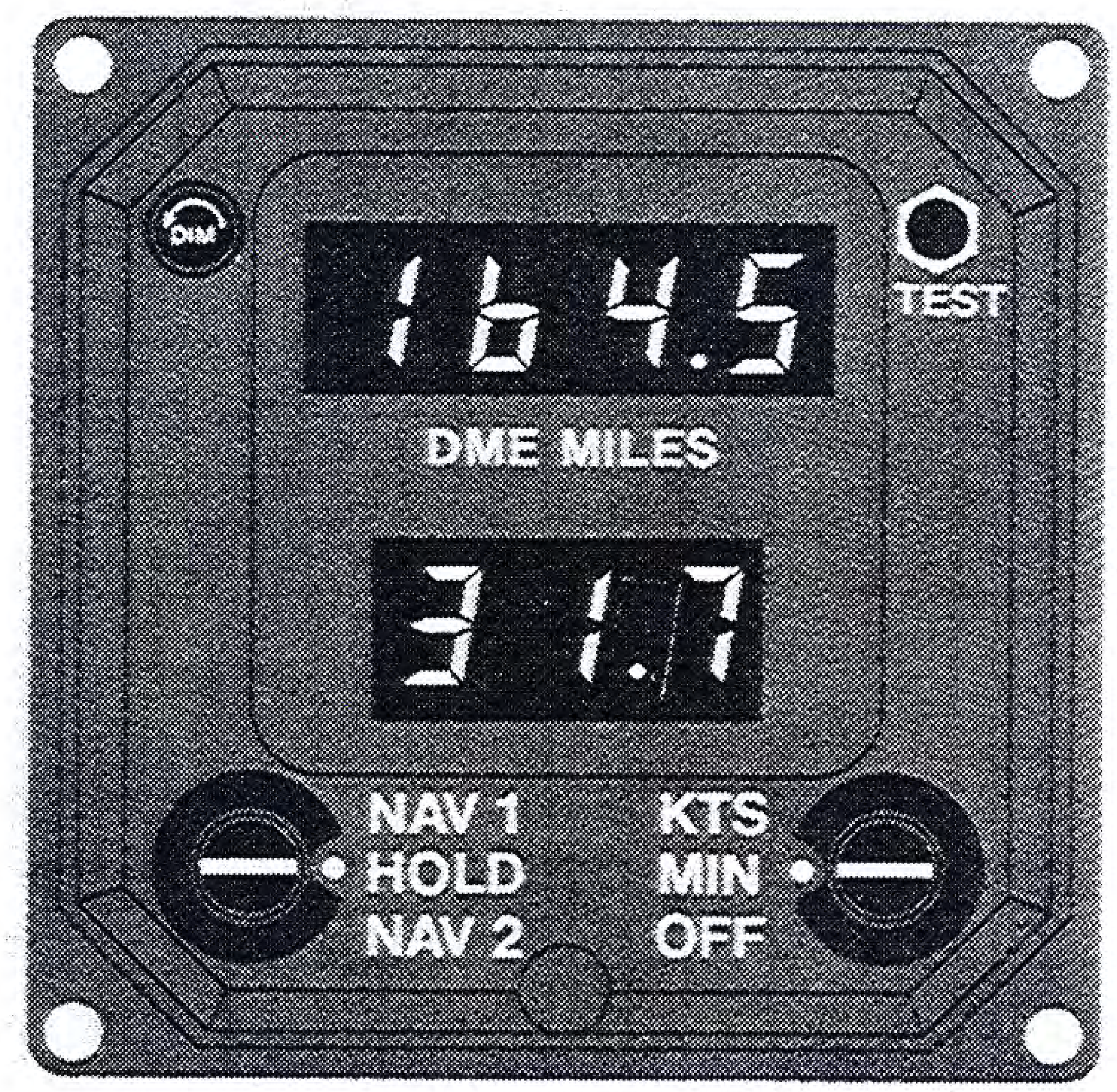
The transponder will transmit coded altitude information on Mode C when the ALT RPTG/OFF switch is placed in the ALT RPTG position. In the OFF position the transponder will respond with a normal Mode A reply.

The code selector knobs are used for selecting the reply code which is displayed in the code window. The left-hand code selector knob contains the IDENT switch. A remote IDENT button is located on each control wheel. The right-hand code selector knob contains the TEST function. When the TEST button is depressed, a simulated interrogation is generated on Mode A. Mode C is tested when the ALT RPTG/OFF switch is in the ALT RPTG position. The RPLY light illuminates to indicate proper operation of the system.

PULSE EQUIPMENT

Distance Measuring Equipment

The Collins DME-40 provides the pilot with slant range distance information to the selected VORTAC as well as time to station and ground speed readouts. Two rotary selector switches are used to select the desired information which is displayed by light bar readouts. Self test is included as is a DIM knob to control light intensity. The DIM control is also a press-to-test switch for activating the lamp test.



The KTS/MIN/OFF control provides power to the system whenever the KTS or MIN position is selected. Placing the control to KTS gives computed groundspeed of the aircraft displayed in the lower window. Selecting MIN will give time in minutes required to cover the distance shown in the DME MILES window at that groundspeed. The MIN and KTS indications require approximately 3 minutes after station acquisition for final accuracy. Groundspeed and time to/from station are only accurate when tracking directly inbound to or outbound from a station.

The NAV 1/HOLD/NAV 2 control is used to select the VORTAC (DME) station to which either NAV 1 or NAV 2 is tuned. Slant range to the selected station is displayed in the upper window (DME MILES) and the pilot's HSI. When the HOLD position is selected the DME will remain tuned to the last captured frequency, regardless of subsequent NAV 1 or NAV 2 receiver frequency changes. The HOLD window illuminates when the hold position is selected.

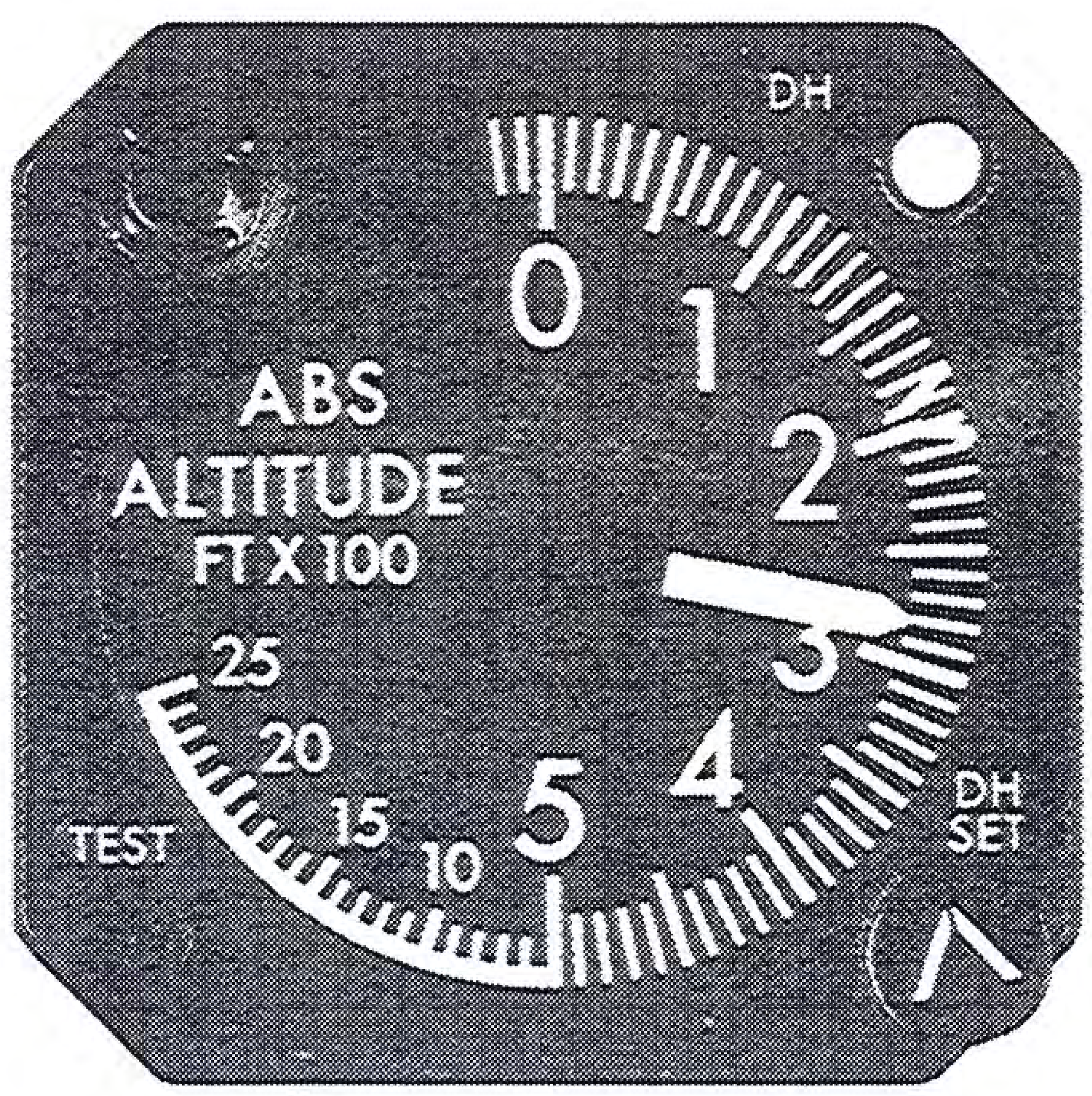
The test button provides for system self-test. Pressing and holding the button causes the upper window to display 0.0 or 0.1; the lower indication decreases toward zero if aircraft is in flight or displays dashes if aircraft is on the ground. After releasing the button, the upper window readout will drift 8-10 seconds. Lower window indication will continue toward zero or remain dashes. After the 8-10 second delay, normal DME operation is resumed.

The DIM control varies the brightness of both the distance and knots/minutes displays.

Radio Altimeter

The optional Sperry AA-215 radio altimeter is installed in the pilot's instrument panel and gives an absolute altitude readout from 2500 feet AGL to ground level. In addition to the altitude display, auxiliary outputs are available to drive rising runway bars in both the pilot's and co-pilot's attitude director indicator (ADI). Trip points are used to initiate the gain desensitization of the autopilot and flight director during ILS approaches. The system TEST capability permits the pilot to check his radio altimeter at any time. A decision height (DH) adjust control will position the DH index to any desired setting.

For normal operation the altitude pointer will come into view as the aircraft decends below 2500 feet AGL. As the aircraft reaches the selected DH, the yellow DH light will illuminate (the DH light is repeated on the pilot's and co-pilot's ADIs) and a tone will sound. The light will remain on but the tone will fade as the aircraft descends below the DH setting. At an altitude of 200 feet, a barber pole radio altitude bar is displayed at the bottom of the pilot's ADI (co-pilot's ADI also if dual flight director installation). The bar(s) moves toward the minature aircraft as the aircraft descends toward the runway, contacting the bottom of the symbolic aircraft at touchdown.



Self-Test Procedures:

1. Set the DH indexer to 50 feet. The DH indicator light will be on and the warning flag out of view.
2. Press the TEST button. As the altitude indicator passes the DH indexer the DH light will go out and the indicator will stop at 100 $\pm$ 20 feet. The red warning flag will appear.
3. Release the TEST button. As the indicator passes the indexer, the DH light will come on and the warning tone will sound. The light will remain on, the tone will fade out and the altitude indication will read zero. The warning flag will retract.

NOTE: The test function is disabled after the glideslope has been captured during an ILS approach by the autopilot or flight director.

Taxiing over accumulations of ice and snow may cause radio altimeter fluctuations.

Radio Altimeter (Collins ALT-50) - The radio altimeter is installed in the pilot's instrument panel and gives an absolute altitude readout from 2000 feet AGL to ground level. An additional readout in the ADI will come into view at 200 feet above ground level. It is calibrated in 50 foot increments and displays absolute altitude from 200 feet AGL to ground level. Both displays incorporate warning flags to signal radio altimeter failure. A Decision Height adjust control will position the DH index to the desired setting. When the airplane descends to the selected DH a visual/aural warning is activated. A self-test switch is also incorporated.

The system is powered by 28 VDC. Transmit and a receive antennas are required and are mounted on the lower fuselage. The time delay of a signal from the transmit antenna to travel to the ground and back to the receive antenna provides the input by which the radio altimeter measures absolute altitude.

Input from the radio altimeter is used to desensitize the autopilot and flight director gain automatically as the airplane passed 1100 feet AGL with the GS engaged during and ILS approach.

For normal operation the altitude pointer will come into view as the airplane reaches 2000 feet AGL. As the airplane reaches the selected DH, the yellow DH light will illuminate and a tone will sound. The DH light is repeated on the ADIs. The light will remain on but the tone will fade as the aircraft descend below DH for the runway. After landing, the DH light can be turned off by setting the DH index to -20 feet.

If the DH index is set before takeoff to a specific altitude, 400 feet for example, the DH light will remain on until the airplane climbs through 400 feet AGL. No tone will sound and the light will extinguish and remain out.

Self-Test Procedures:

The test can be accomplished on battery power if necessary.

1. Set the DH indexer at 25 feet. The DH indicator light will be on and the warning flag out of view.
2. Press the TEST button. As the altitude indicator passes the DH indexer the DH light will go out, and the indicator should stop at 50 ±5 feet.
3. Release the TEST button. As the indicator passes the indexer, the DH light will come on and the warning tone will sound. The light will remain on, the tone will fade out and the altitude indication should read zero.

While taxiing over ice or snow, it is common for the altitude indicator to deflect momentarily as much as 50 feet.

Weather Radar

WARNING:

The area within the scan arc and within 15 feet of an operating weather radar system constitutes a hazardous area. Do not operate the radar system within 15 feet of personnel or flammable or explosive material or during fueling operations. For ground operation of a radar system, position the airplane facing away from buildings or large metal structures that are likely to reflect radar energy back to the airplane.

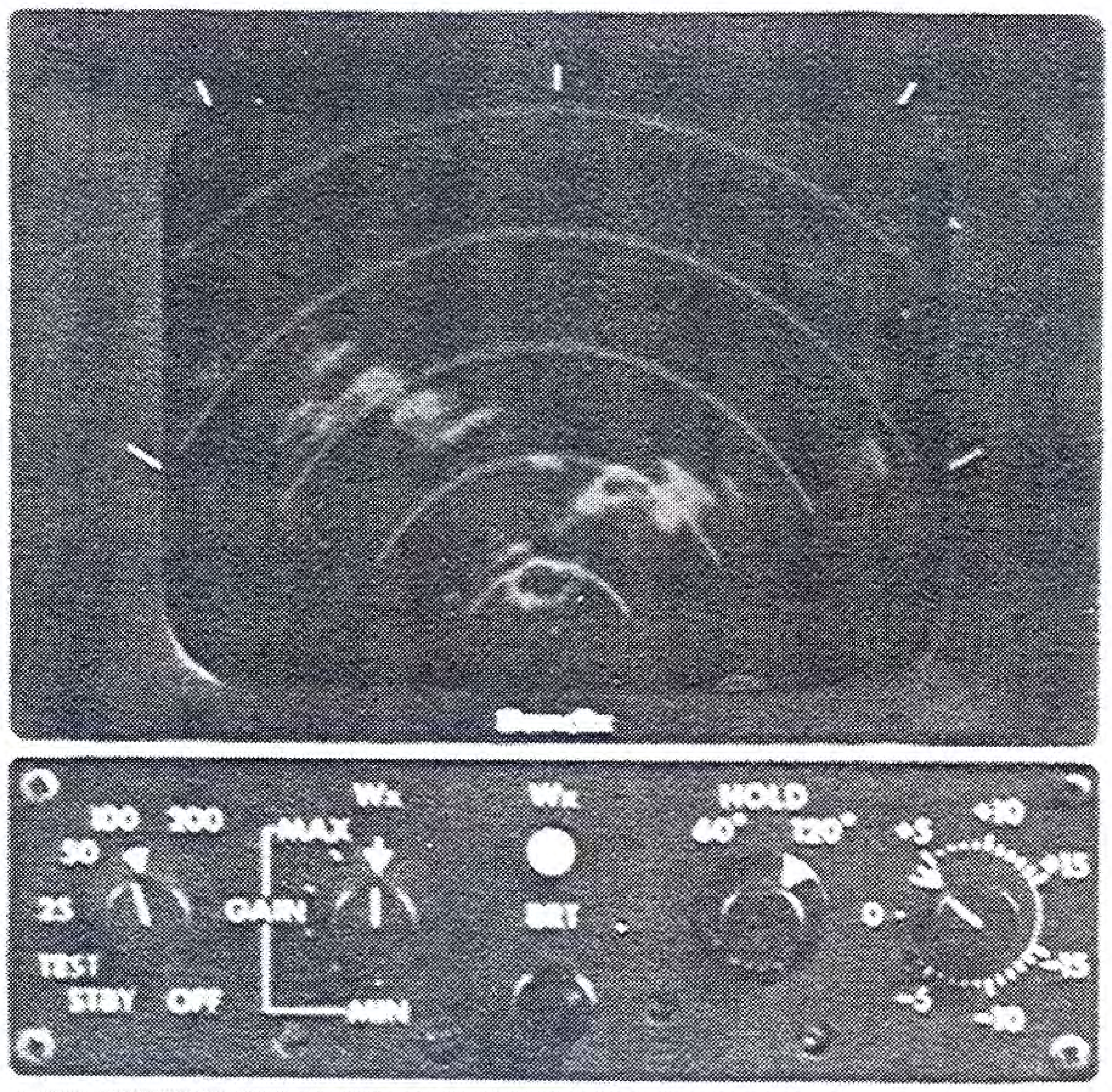
The Bendix RDR-1200 weather radar is an X band radar with a 200 nautical mile range. The RDR-1200 consists of a receiver-transmitter, indicator and antenna. The primary use of this radar is to aid the pilot in avoiding thunderstorms and associated turbulence.

The receiver-transmitter generates 10 KW pulses of X-band energy and routes them to the antenna. It amplifies the echoes received by the antenna and routes them to the indicator for display.

The indicator provides a constant nonfading display of any targets within the selected range and antenna scan angle. All controls for system operation are located on the lower section of the front panel.

The antenna is stabilized to line-of-sight (approximately ±30°) in response to aircraft pitch, roll and tilt information.

PULSE EQUIPMENT



OPERATIONAL CONTROLS

All operational controls are located on the front panel of the indicator. They are:

Function Switch:

OFF — Power removed from system

STBY — Power applied to system but transmitter, antenna scan and indicator display are inhibited. (Warm-up time is approximately 70 seconds).

TEST — Applies power to system and activates test circuits. After approximately 70 seconds, test pattern should appear and fault lamp should be illuminated.

25, 50, 100, 200 — Energizes transmitter, selects indicated range with 5 range marks. Each range mark will represent 1/5 of the range selected.

Mode Selector

Wx — Places indicator in automatic contour mode. Contoured storm cells will be outlined by lighter shades automatically.

Gain — Places indicator in MAP mode and activitates manual gain control. All targets will be presented on the indicator in one of 3 different shades, dependent on the radar echo strength and the particular gain setting used.

WX — Pushbutton

When the mode selector is in the weather position, the Wx pushbutton may be used to verify that a dark hole is a contour or storm cell area. If the dark hole is a storm cell, it will become the brightest of the three shades displayed on the indicator when the button is depressed. If the dark hole remains when the Wx pushbutton is depressed, this area does not represent a contour or storm cell.

Brightness Control

Controls the brightness of the indicator display.

SCAN/STAB Selector

120° - Stab "ON"	Places the antenna in a 120° stabilized scan.
120° - Stab "OFF"	Places the antenna in a 120° stabilized scan and the stabilization circuitry is disabled.

HOLD — Freezes the display on the indicator.

60° Stab "ON"	Places the antenna in a 60° stabilized scan mode.
60° Stab "OFF"	Places the antenna in a 60° scan mode and the stabilization circuitry is disabled.

Tilt Control

Adjusts the antenna tilt to obtain the best indicator presentation.

Fault Lamp

Amber lamp that will light when a fault occurs as a result of low power or weak receiver. The fault lamp will light in the TEST function as a cross check of the fault monitor circuit.

Access Roll - Trim Pot

Adjustment pot for calibration of roll stabilization circuitry to aircraft gyro.

The RDR-1200 is designed such that full operation is possible approximately one minute after turn-on. During the first five seconds after system turn-on, noise and/or vibration may occur in the antenna. This is the normal sound of the stepping drive motor waiting for the strobe line to catch up so that they are synchronized.

During take-off or during prolonged aircraft maneuvering, gyro precession may occur. Antenna stabilization may suffer a 3°-5° error for as long as five minutes, depending upon the aircraft gyro. The result is a "lopsided" antenna scan causing a wedge shaped return on one side of the scope. Tilt the antenna up enough to clear the indicator if this occurs.

The radar is powered by 28 VDC. Antenna stabilization requires AC from the aircraft inverter.

ALTITUDE ALERTING and REPORTING

Altitude alerting and reporting information is obtained from the Sperry Air Data Computer (ADC) and is supplied to the V-NAV Computer/Controller (VNCC) for altitude alerting and to the transponder(s) for altitude reporting.

For altitude alerting operation, the desired altitude must be set into the VNCC. The altitude is selected by placing the switch to ALT and slewing to the desired value. As the aircraft reaches a point 1000 feet from the selected altitude, the warning light on the altimeter illuminates and a warning horn sounds for one second. The warning light remains on until the aircraft is 250 feet from the selected altitude. If the aircraft then deviates by ± 250 feet or more from the selected altitude, the light is illuminated and the horn is sounded. The light remains on until the aircraft returns to within 250 feet of the selected altitude or a new altitude is set, which resets the alert horn and light for the selected altitude.

Altitude reporting is automatic when ALT RPTG is selected on the transponder controller. With a dual transponder installation, either the No. 1 or No. 2 unit is capable of providing altitude reporting.

Locator Beacon

The optional emergency locator beacon (ELT) system is an emergency transmitter designed to assist in locating a downed airplane. The transmitter has a self-contained battery pack but is powered through the airplance DC bus if available. The system is activated, automatically, by an impact of 5.0 +2, −0 G along the flight axis of the airplane or manually by a remote EMER switch on the instrument panel. When the transmitter is activated, a modulated omni-directional signal is transmitted simultaneously on emergency frequencies 121.5 and 243.00 MHz. The modulated signal is a downward sweep tone signal starting at approximately 1600-1000 Hz and sweeps down every two to four seconds continuously and automatically.

The transmitter has an ARM-ON-OFF switch which is normally left in ARM. ON position is used to test the system from the ground and OFF position turns the system off.

A guarded EMER-NORM switch on the instrument panel provides manual activation of the system as well as a means of testing the operation. In NORM position, the system is available to be activated by the impact switch. In EMER the impact switch is bypassed and the emergency signal is transmitted. EMER position can be used to test the system; however, prior approval from control tower and flight service must be obtained. An ON-OFF switch on the dorsal fin serves as a means of testing the system from outside on the ground.

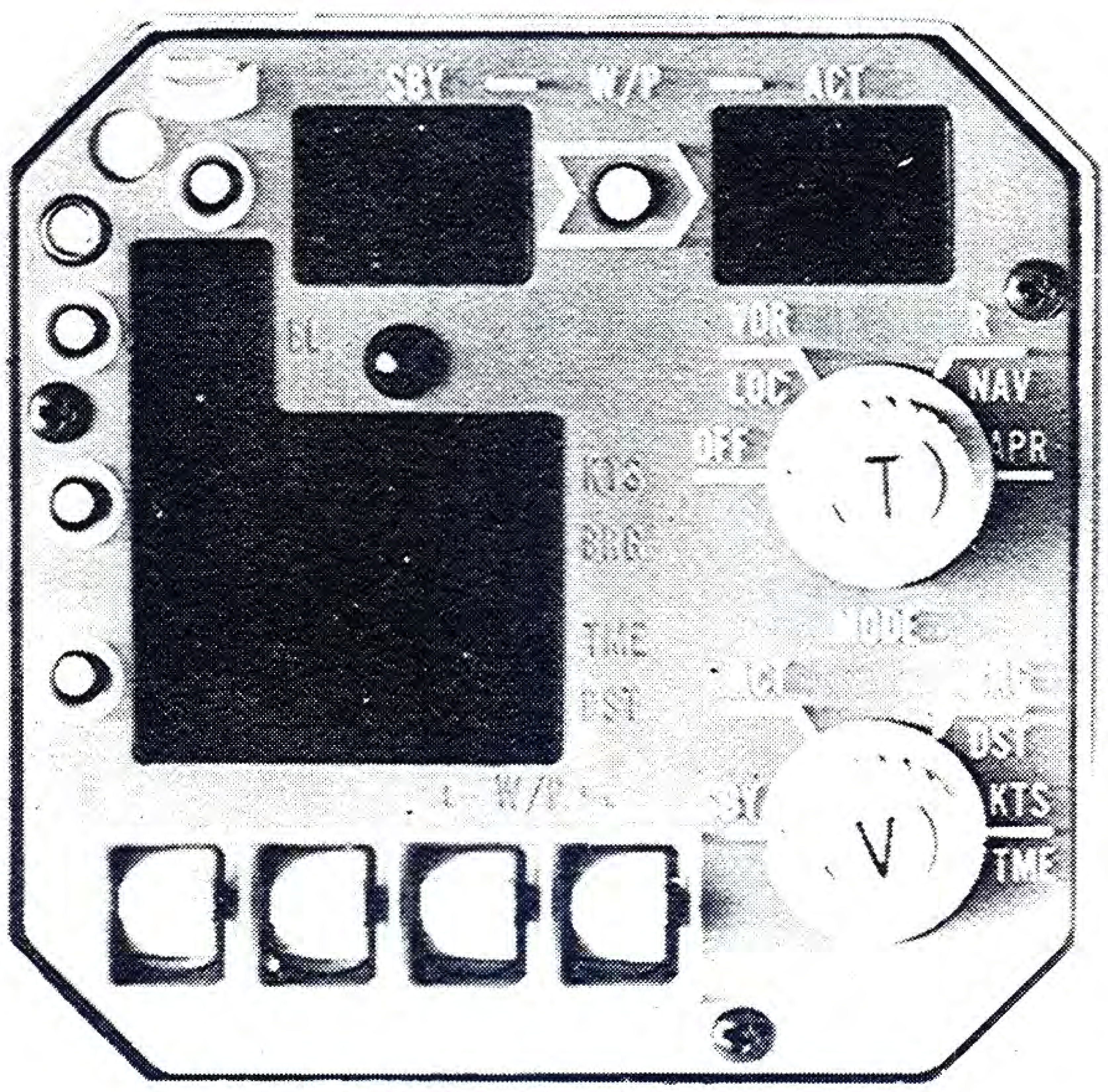
If the impact switch is inadvertently set, activating the transmitter, it may be reset by pushing either of the RESET buttons. One is on the instrument panel next to the guarded EMER-NORM switch; the other is next to the ON-OFF switch on the dorsal fin. The RESET button must be depressed and held for a minimum of three seconds.

AREA NAVIGATION

The optional Bendix RNS-3500 Area Navigation System is an airborne system which gives the pilot the capability of navigating "point to point" within the coverage of co-located VOR/DME (VORTAC) ground stations selected on the NO. 1 VHF navigation receiver. The system has the capability to store 32 waypoints (0-31). The waypoint parameters are stored indefinitely within the system. Removal of power will not erase the stored waypoints. System components include a CD-3501A control display unit and the IU-3404A interface unit.

The Control Display Unit is a panel-mounted unit that contains the operating controls and readout displays required to program, monitor, operate and test the area navigation system.

The Interface Unit receives inputs from the altitude encoding system, NAV 1 receiver (VOR bearing), DME and the control unit. It produces conventional navigational displays to the selected waypoint on the ADI, HSI and both RMIs. The information is also supplied to the autopilot system for automatic tracking.



Mode Control Switch

The mode control switch is a four position switch labeled OFF, VOR/LOC, RNAV and APR. A pushbutton labeled T is located in the center of the mode control switch and is used for system self-test. The function of each switch position is as follows:

OFF

Removes electrical power from the system

VOR/LOC

Supplies power to the unit and permits it to be programmed. Normal VHF navigation is not affected.

RNAV

Provides computed area navigation information to the selected waypoint. This information is displayed on the pilot's HSI in the form of course deviation and distance. The No. 1 VOR position on the pilot's and co-pilot's RMIs will show magnetic bearing to the waypoint. Flight director command steering as well as the autopilot can be used to track the selected course. In the RNAV position, full scale deflection of the HSI course deviation indicator is equal to a five mile off-course error and no longer represents angular deviation from the selected course. Selection of RNAV will display the RN readout in the pilot's HSI.

APR

The APR mode functions the same as the RNAV mode, however, full scale deflection of the HSI course deviation indicator is equal to 1.25 n.m. off course error. In addition to the scale factor change, the APR mode has automatic advancing of the stored waypoint parameters into the standby register as a NAV active waypoint is selected. Selection of APR will display the RN readout in the pilots HSI.

"T" Self-Test

The RNAV system can be tested any time by simply turning on the No. 1 NAV receiver, turning the MODE selector to VOR/LOC, programming a waypoint in any register (distance should be 10 n.m. or greater) and depressing the test switch "T", for eight seconds or more. The following sequence of events will occur:

Lighting Test — Control segment lamps will be lighted to 8's for two seconds.

Flag Test — Control segment lamps will indicate dashes for two seconds.

Computed BRG and DST Test — The center readout shall display the computed waypoint bearing and the BRG legend shall be illuminated. The computed bearing shall agree with the noted waypoint BRG within $\pm$ 2° if a VOR signal is being received and $\pm$ 10° without a VOR signal.

The lower readout shall display the computed waypoint distance and the DST legend shall be illuminated. The computed distance shall agree with the noted waypoint DST within ±0.3 n.m. or ±1.5% of the waypoint distance (whichever is greater) if a VOR signal is being received. The computed distance shall agree within ±0.5 n.m. or ±3% of waypoint distance without a VOR signal.

With the OBS set to the ACT W/P BRG, the left/right needle shall be centered with a "T" indication.

Display Control Switch

The display control switch is a four position rotary switch labeled SBY, ACT, BRG/DST, KTS/TME and a center button labeled V.

SBY

Parameters for the standby waypoint are displayed and may be reprogrammed as desired.

ACT

Parameters for the active waypoint are displayed.

BRG/DST

BRG/DST identification lights are illuminated adjacent to the display windows and the magnetic bearing and distance to the active waypoint are displayed if in the RNAV or APR mode. If the mode selector is in the VOR/LOC mode, bearing and distance to the VOR/DME (VORTAC) station are displayed.

KTS/TME

KTS/TME identification lights are illuminated adjacent to the display windows and the groundspeed and time to waypoint are presented if in the RNAV or APR mode. Displays groundspeed and time to VOR/DME (VORTAC) if in the VOR/LOC mode.

"V"

Depressing the "V" pushbutton in the center of the display control switch will present bearing/distance information to the VORTAC station selected in the No. 1 NAV receiver on the RMIs and the DME readout in the pilot's HSI. Releasing the button returns the displays to RNAV computed information. This feature allows the pilot to monitor his position relative to the VORTAC station without interrupting RNAV guidance.

Displays

The standby and active waypoints are displayed at the top of the control display unit in the SBY window and the ACT window and the ACT window. Pressing the address button located next to the SBY window activates the standby waypoint register. Waypoints can then be changed from 0 to 31 by using the two right hand paddle switches. The pushbutton between the windows is used to transfer the SBY waypoint into the ACT waypoint register.

An address pushbutton is located to the left of each of the three display windows. Depressing the appropriate address button causes the EL, BRG, or DST identification light to flash indicating a new parameter may be programmed by utilizing the paddle switches located directly beneath the display windows. The address pushbuttons will have no effect if the displayed information is being used for navigation. The display switch must be set to SBY position to insert waypoint parameters into the registers.

Programming the Waypoint

To insert waypoint parameters, SET MODE to VOC/LOC, RNAV or APR. Set DISPLAY to SBY. Depress SBY W/P address pushbutton. Using the two right-hand paddle switches select waypoints between 0 and 31 for which parameters are to be entered or altered.

Select values for waypoint parameters (elevation, bearing and distance). Depress EL address pushbutton; insert elevation of VOR/DME station by actuating left-hand paddle switch. Depress BRG address pushbutton; insert bearing from VOR/DME station to waypoint by actuating paddle switches. Depress DST address button; insert distance from VOR/DME station to waypoint by actuating paddle switches.

Complete the above steps for each waypoint desired.

Waypoint Alert

An amber light located in the pilot's HSI is illuminated whenever the airplane has approached to within approximately 3.5 n.m. of the waypoint.

Limited Access Memory

As an aid to retaining information stored in memory an RNAV WAYPOINT ACCESS/LIMIT switch is located on the co-pilot panel. In the ACCESS position the information in all 32 waypoints can be changed. In the LIMIT position the information stored in waypoints 11 through 31 cannot be changed.

ANGLE OF ATTACK

The optional Teledyne angle of attack system is powered by 28 VDC from the left main DC bus and is comprised of four units.

The angle of attack transmitter is the basic sensor which detects the direction of airflow at the side of the fuselage by means of a probe extending into the airstream. The transmitter has a conical probe with slots in it, and rotates to achieve uniform airflow. The probe is heated for anti-icing by selection of PITOT & STATIC anti-ice.

The flap position sensor provides a signal to the interface unit so it is able to compensate for any flap position. The interface unit computes angle of attack from the transmitter signals and flap sensor and compensates for all configurations and weights so as to give a standard readout on the angle of attack gauge.

A full range indicator is the primary type used in the CITATION. The gauge is calibrated from 0 to 1.0 and marked with red, yellow and green arcs. The indicator displays lift information with 0 representing zero lift and 1.0 representing stall. Lift is presented as a percentage, and with flap position information, the display is valid for all aircraft configurations and weights. Therefore, at 1.0 on the gauge where full stall occurs, 100% of the available lift is being produced. At 0, zero lift is being produced. The red bank on the indicator is a warning area and represents the beginning of low speed buffet to full stall. The yellow range is a caution area where the aircraft is approaching a critical angle of attack. The green arc is the normal operating range of the aircraft. The angle of attack gauge has reference indices at .8 where low speed buffet begins, and at .6 which is optimum approach speed (1.3 V_{SO}). The index at .6 also represents the maximum value of Lift/Drag (L/D max.), which equates to maximum endurance and maximum angle of climb.

A moveable bug may be set by the factory at .35, the angle of attack at which the greatest ratio of velocity to drag occurs in the CITATION. This represents maximum range in still air.

A second angle-of-attack display is provided on the ADI as a vertical readout of the optimum approach angle-of-attack. This information is repeated from the primary indicator.

An approach indexer, mounted on the windshield center post, provides a "heads up" display of deviation from the approach reference.

SECTION IV

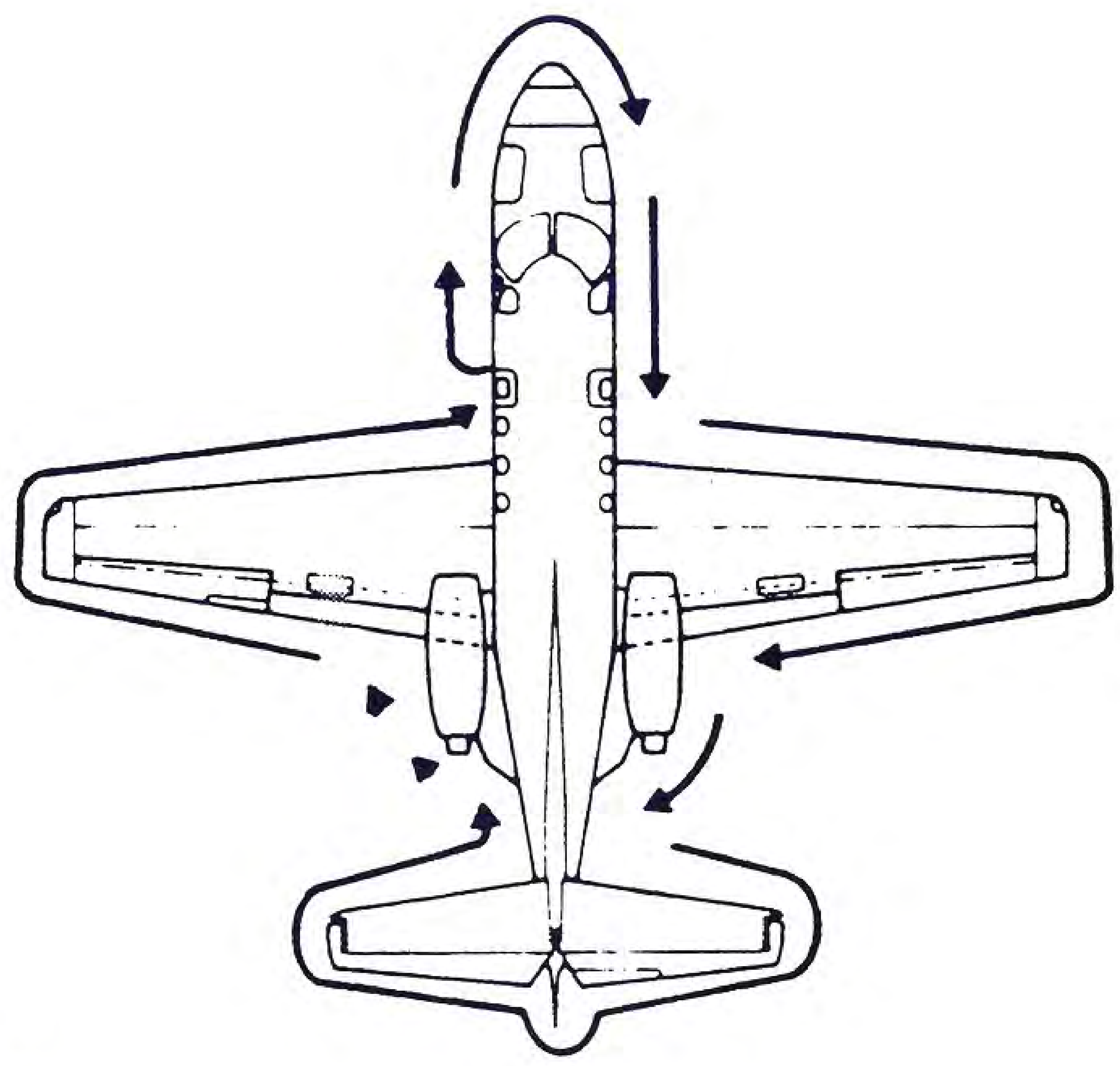
OPERATING INFORMATION

PREFLIGHT

COCKPIT INSPECTION

A preliminary cockpit inspection should be made on the first flight of each day. Ensure that the Airworthiness and Registration Certificates and radio license are displayed in the airplane and that the FAA Approved Airplane Flight Manual is on board. FAA regulations also require a flashlight and first aid kit to be carried on transport category airplanes. Check that oxygen masks, headsets and microphones are on board. Check the OXYGEN PRIORITY and PASS OXY MASK valves both in NORMAL position. Check the portable fire extinguisher under the copilot's seat is serviced and secure. It is located in a quick-release holder. The pressure gage should read in the white ARC indicating a 150 p.s.i. charge.

1. Control Lock - Unlocked
   Control surfaces should be free for exterior inspection.
2. Gear Handle - DOWN
3. Elevator Trim - POSITION trim tab indicator within takeoff trim range.
4. Flap Handle - AGREES WITH FLAP POSITION
5. If anti-skid system is installed, depress pilot's brake pedal and check for "soft" pedal. This check must be made prior to applying power to the anti-skid system hydraulic pump.
6. Left and Right Circuit Breakers - IN
7. Generators - GEN or OFF
   Generators OFF if external power is to be used for start.
8. All Other Switches - OFF or NORM
9. Throttles - OFF
10. Battery Switch - BATT
    Check for a minimum of 24 volts.
11. Landing and Exterior Lights - ON
    Check for illumination; then OFF.
12. Passenger Advisory Lights - ON
    Check emergency exit and seat belt/no smoking light illumination; then OFF.
13. Passenger Reading Lights - ON
    Check for illumination; then OFF.
14. Pitot & Static Heat - ON.
    Allow thirty seconds for pitot tubes and static ports to heat; then OFF.
15. Battery Switch - OFF
    Expedite the light and pitot heat check if external power is not used to reduce battery drain.
16. Passenger Oxygen Supply Valves - CHECK
    Check both valves in NORMAL (AUTO and NORMAL on 500-0061 and prior).



EXTERIOR INSPECTION

Make a general check for security, condition, and cleanliness of the aircraft and components. Check particularly for damage, any fluid leakage, security of access panels, and removal of keys from locks.

LEFT NOSE

1. Static Ports - CLEAR and WARM
   At high outside temperatures it is difficult to feel heat from the static port. Running the back of a finger from the aircraft skin over the static port and onto the skin again is the easiest way to feel the higher temperature of the port.
2. Baggage Door - SECURE and LOCKED
   Check locks firmly closed. Ensure door locked microswitch is seated. The baggage doors should be key locked for flight to enhance door security.
3. Nose Gear, Doors, and Tire - CONDITION and SECURE
   Chine and tread of nose tire must be in good condition to meet the water/slush runway operating limitation. Nose tire inflation pressure is 120 PSI, +5 PSI or -5 PSI. On the ground, the two forward gear doors are closed but the rear door is open allowing a visual inspection of the nose gear assembly, shimmy damper and nose gear steering bellcrank. Proper nose oleo strut extension of a fully fueled aircraft is approximately five inches.
4. Pitot Tube - CLEAR and HOT
   Do not grasp pitot tube firmly as severe burns can result.

PREFLIGHT

RIGHT NOSE

1. Pitot Tube - CLEAR and HOT
2. Emergency Gear and Brake Pressure Gauge - GREEN ARC
   Pressure should read between 1800 and 2000 p.s.i.
3. Hydraulic Brake Reservoir Gauge - FLUID VISIBLE
   The metal "star" in the sight gauge will have a purple tint when reservoir is full. Ball should be at the top of the sight gauge in 500-0156 thru -0349.
4. Windshield Alcohol Sight Gauge - FLUID VISIBLE
   Ball should be at top of sight gauge.
5. Optional Anti-Skid Accumulator Pre-charge Indicator - LEFT GREEN ARC
   If power has been applied to anti-skid hydraulic pump prior to inspection and system has had time to cycle - RIGHT GREEN ARC.
6. Baggage Door - SECURE and LOCKED
   Check locks firmly closed. Ensure door locked microswitch is seated. The baggage doors should be key locked for flight to enhance door security.
7. Oxygen Blowout Disc - GREEN
   Green disc should be in place. If it is missing, oxygen bottle will be empty.
8. Overboard Vent Lines - CLEAR
   Check vacuum vent, brake reservoir vent, alcohol bottle vent, and gear and brake air bottle vent.
9. Static Ports - CLEAR and WARM
   Note comment for static ports on left side.
10. Angle of Attack Sensor - CLEAR, HOT, ROTATES
    Use caution in rotating probe when hot; check that the slots in the probe are unobstructed.

RIGHT WING

1. Dorsal Fin Air Inlet - CLEAR
   A visual check can be made of the air inlet from a position in front of the wing.
2. Engine Fan Duct and Fan - CHECK
   Check for bent blades, nicks, and foreign objects. If the fan is windmilling, place hand on bullet nose or install engine cover to stop the rotation. If damage is observed, refer to Chapter 72 of Engine Maintenance Manual.

3. Fuel Quick Drains - DRAIN AND CHECK FOR CONTAMINATION
   Push straight up on the drains when taking fuel samples. The drain may lock open if it is turned.
4. Main Gear, Door, Tire and Landing Light - CONDITION and SECURE
   Check tire for wear and inflation.

500-0001 thru -0051 Not Incorporating SB32-1	79 PSI, +3 or -1 PSI
500-0052 thru -0070 Not Incorporating SB32-1	90 PSI, +3 or -1 PSI
500-0071 and On and -0001 thru -0070 Incorporating SB32-1	100 PSI, +5 or -5 PSI

   Check door and landing light for security. Check gear for general security, fluid leakage, and an approximate oleo strut extension of 1 to 2 inches if airplane is fully fueled. If optional anti-skid system is installed, check hubcaps for condition and security.
5. Deice Boot - CONDITION and SECURE
   Check boot for cuts that might prevent inflation and any indication of delamination.
6. Fuel Filler Cap - SECURE
   Check locking latch closed and directed aft.
7. Recognition Lights (if installed) - CONDITION
   Check lens for cracks and security. Check fence for condition and security.
8. Fuel Tank Vent - CLEAR
   If vent is blocked, a negative pressure may build up in the wing during fuel transfer causing the tank to collapse.
9. Navigation and Strobe Light - CONDITION
   Check lenses for cracks and integrity.
10. Static Wicks - CHECK
    There should be two static wicks on the trailing edge of the aileron, one on the trailing edge of the wing and one on the wing tip. If an aileron static wick is missing, it should be replaced before the aircraft is flown to ensure proper control surface balance.
11. Aileron, Flap and Speedbrakes - CONDITION, SECURE and MOVEMENT
    Check ailerons for freedom and hinge points for security. Check flaps and speedbrakes for security.

RIGHT NACELLE

1. Oil Level - CHECK; Filler Cap and Access Door - SECURE
   Check for correct level on the dipstick. An accurate oil check must be done with the engine still hot. If in doubt about oil quantity, run engine for a minimum of two minutes, shut down, and recheck. The oil level may be checked up to approximately ten minutes after shutdown with an accurate reading. Make certain filler cap is on securely and fasten access door.
2. Engine Exhaust and Bypass Ducts - CONDITION and CLEAR
   Check for fuel leakage, damage to turbine blades, cracks, general security.
3. T_2 Sensor and Drain Lines - CLEAR
   It is normal to find some residual fluid on the drain lines and sensor.
4. Thrust Reverser Buckets - CONDITION and STOWED (if applicable)
   Check for cracks, damage and general security.
5. Thrust Reverser Lock-Out Tool - REMOVED (if applicable)
   Lock-Out tool insertion is at the aft section of the outboard stang.
6. Air Conditioning Overboard Vent - CLEAR
   Vent is located on the fuselage under the right nacelle.
7. Deice Boot Overboard Vent - CLEAR
   These vents exhaust bleed air that is used to maintain a vacuum to keep the boots deflated with the engines running.
8. Hydraulic Fluid Drain Mast - CLEAR and SECURE
   No fluid should be coming from the drain and hydraulic panel access door should be secure.

EMPENNAGE

1. Right Horizontal and Vertical Stabilizer Deice Boots - CONDITION and SECURE
   Check boots for cuts that might prevent inflation and for any indication of delamination.
2. Elevators and Trim Tabs - MOVEMENT AND CONDITION. Assure trim tab position matches elevator trim tab position indicator.
   Check elevators for freedom and hinge points for security. Check two static wicks in place on each elevator. If a static wick is missing, it should be replaced prior to flight to ensure proper control surface balance.
3. Navigation and Strobe Light - CONDITION
   Check lenses for cracks and security.
4. Ventral Fin - CONDITION and SECURE
   Check two static wicks in place.

5. Rudder and Trim Tab - SECURE and CORRECT SERVO TAB ACTION

   Check rudder for freedom and hinge points for security. Ensure trim tab moves in opposite direction when rudder is displaced. Check one static wick on tip of vertical stabilizer and two static wicks in place on trailing edge of the rudder. If a rudder static wick is missing, it should be replaced prior to flight to ensure proper control surface balance.

6. Left Horizontal Stabilizer Deice Boot - CONDITION and SECURE

   Check boots for cuts that might prevent inflation and any indication of delamination.

AFT COMPARTMENT

1. Hydraulic Fluid Quantity - CHECK

   Check sight gauge on hydraulic reservoir for a reading above the REFILL mark.

2. Fire Bottle Pressure Gauges - CHECK TEMPERATURE PRESSURE RELATIONSHIP

   Check that the pressure in the bottles is within limits for the ambient temperature. A pressure/temperature chart is located between the bottles in the tailcone compartment. Checking for correct bottle pressure is the only way to determine the bottles are full. The BOTTLE ARMED light on the glareshield will illuminate when the ENG FIRE switch is pushed regardless of bottle condition.

3. Circuit Breakers - IN

   Check all visible circuit breakers. Five for the left wing heaters are located just forward of the tailcone access door. The five for the right wing are visible behind the Air Cycle Machine. A single circuit breaker is visible underneath each J-Box.

4. Air Cycle Machine Oil - CHECK

   Level is shown in a small plastic sump in the middle of the ACM. Oil should be serviced when the level drops below the FILL line. Holding a flashlight behind the sump makes the oil quantity clearly visible.

5. Throttle Load Limiting Brackets - CHECK (if applicable)

   Check left and right throttle load limiting brackets to ensure that neither has been actuated.

6. Aft Compartment Light - OFF and SECURE

7. Access Door - SECURE

   Check locks are firmly closed and ensure door locked microswitch is seated. The aft compartment access door should be key locked for flight to enhance door security.

8. External Power Receptacle Door - SECURE

LEFT NACELLE

1. T_2 Sensor and Drain Lines - CLEAR.
2. Engine Exhaust and Bypass Ducts - CONDITION and CLEAR
   Check for fuel leakage, damage to turbine blades, cracks and general security.
3. Oil Level - CHECK; Filler Cap and Access Door - SECURE
   Check that oil is visible on the dipstick. An accurate oil check must be done with the engine still hot. If in doubt about oil quantity, run engine for a minimum of two minutes, shut down, and recheck. Oil can be checked up to approximately ten minutes after engine shutdown with an accurate reading.
4. Thrust Reverser Buckets - CONDITION and STOWED (if applicable)
   Check for cracks, damage and general security.
5. Thrust Reverser Lock-Out Tool - REMOVED (if applicable)
   Lock-Out tool insertion is at the aft section of the outboard stang.

LEFT WING

1. Speedbrakes, Flap, Aileron and Trim Tab - CONDITION, SECURE and MOVEMENT.
   Check ailerons for freedom and hinge points for security. Check flaps and speedbrakes for security. Check trim tab hinge point and position.
2. Static Wicks - CHECK
   There should be two static wicks on the trailing edge of the aileron, one on the trailing edge of the wing and one on the wing tip. If an aileron static wick is missing, it should be replaced before the aircraft is flown to ensure proper control surface balance.
3. Navigation and Strobe Lights - CONDITION
   Check lenses for cracks and security.
4. Fuel Tank Vent - CLEAR
   If vent is blocked, a negative pressure may build up in the wing during fuel transfer causing the tank to collapse.
5. Recognition Lights (if installed) - CONDITION
   Check lens for cracks and security. Check fence for condition and security.
6. Fuel Filler Cap - SECURE
   Check locking latch directed aft.
7. Deice Boot - CONDITION and SECURE
   Check boots for cuts that might prevent inflation and any indication of delamination.

8. Main Gear, Door, Tire, and Landing Light - CONDITION and SECURE.
   Check tire for wear and inflation; door and landing light for security. Check gear for general security, fluid leakage and approximate oleo strut extension of 1 to 2 inches if airplane is fully fueled. If optional anti-skid system is installed, check hubcaps for condition and security.
9. Fuel Quick Drains - DRAIN and CHECK FOR CONTAMINATION
   Push straight up on the drains when taking fuel samples. The drain may lock open if it is turned.
10. Engine Fan Duct and Fan - CHECK
    Check for bent blades, nicks and foreign objects. If the fan is windmilling, place hand on bullet nose or install engine cover to stop the rotation. If damage is observed, refer to Chapter 72 of the Engine Maintenance Manual.
11. Dorsal Fin Air Inlet - CLEAR
    A visual check can be made of the air inlet from a position in front of the wing.

CABIN INSPECTION

1. Emergency Exit - SECURE
   Check fit of door, handle stowed, guard in place, and locking pin removed.
2. Right Aft Facing Seat - FULL AFT and UPRIGHT
   This seat should be tracked full aft for takeoff and landing to prevent blocking the emergency exit.
3. Passenger Seats - UPRIGHT and OUTBOARD
   Seats should be outboard to prevent blocking the aisle during takeoff and landing.
4. Door Entry Lights - OFF
   Switch located on entry door post.
5. Luminescent Exit Placards - SECURE
6. Portable Fire Extinguisher - SERVICED and SECURE

BEFORE STARTING

1. Preflight Inspection - COMPLETE
2. Cabin Door - CLOSE and LOCK
   Check green indicators for proper door pin position, handle vertical and in the detent, and the handle locking pin inserted.
3. Passenger Briefing - Complete
   Ensure that passengers are informed of the escape routes from the airplane, and are informed of the location of and how to use emergency equipment that is on board the airplane.

4. Oxygen System - CHECKED
   Check quantity gauge at 1600 to 1800 p.s.i. and crew masks connected to side console outlets. Pilot's side console oxygen valve switches properly positioned to NORMAL (AUTO and NORMAL on 500-0001 thru -0061). Caution should be exercised if these switches are not as desired upon entering the aircraft. Placing the PRIORITY VALVE to NORMAL with the PASS OXY VALVE in MANUAL DROP (ON), will result in inadvertent deployment of the cabin masks.
5. Seats, Seat Belts, Shoulder Harnesses, and Rudder Pedals - ADJUST and SECURE
   Crew seats adjust fore and aft with the handle below the forward center seat section, vertically with the handle on the aisle side forward corner, and tilt with the handle at the lower rear on the aisle side. Check seats locked in the desired position. Check seat belts snug and shoulder harnesses latched to the buckle. Rudder pedals adjust individually by depressing the tab on the inboard side and moving fore or aft. Three positions are available. Check locked in the desired position.
6. Parking Brake - SET
   Depressing the brake pedals and pulling the parking brake handle out traps applied pressure to the wheel brakes.
7. Control Lock - OFF.
   Rotate the handle clockwise 45° from horizontal and push in to release. Ensure that the handle is fully in and controls and throttles are free. With the control lock on, the throttles are held in the cutoff detent. It is possible, however, to force a throttle past the lock, which may require disassembly of the quadrant to restore normal operation of the controls.
8. Circuit Breakers - CHECKED
   Circuit breakers on both panels checked in.
9. LH and RH Gyro Slave - AUTO (500-0001 thru -0274, copilot's (RH) gyro slave switch - NORM).
10. Generators - GEN (OFF if external power is to be used for start).
11. Boost Pumps - NORMAL
12. Crossfeed - OFF
13. All Other Switches - OFF or NORM.
    Switches OFF or NORM, generators ON for battery start. All radios and avionics off to preclude the possibility of equipment damage due to voltage variances during start.

Because the engine bleed ports do not open until positive pressure is evident, it is not necessary to turn off the pressurization source selector and it may be left in BOTH for starting and all normal operation. Check boost pumps and ignition NORM, crossfeed OFF and engine synchronizer OFF.

14. Windshield Bleed Air Valves - OFF.
15. Throttles - OFF
    Check both throttles latched in the cutoff position.
16. External Power - CONNECTED (if applicable)
17. Battery Switch - BATT, CHECK VOLTAGE
    Place battery switch in the BATT position. Voltmeter checked at 24 volts for battery start; 28 with external power applied.
18. Warning Systems - CHECKED and OFF
    Perform warning test with rotary selector. Check in the OFF position with the red light extinguished.
19. Engine Instruments - Warning Indicators - NOT SHOWING
    NO power OFF indicators visible on the face of each engine instrument indicates all instruments are receiving electrical power.
20. Fuel Quantity - CHECKED
    Confirm flight plan fuel is on board. Maximum allowable quantity differential between tanks is 800 pounds.
21. Anticollision Lights or Optional Rotating Beacon Light - ON
    Alerts personnel in the area of impending engine start. If a rotating beacon is installed, its use is preferred over the strobe lights which are of high intensity and can be disturbing to others during ground operation.

NORMAL PROCEDURES

This Chapter presents the abbreviated cockpit checklist provided with each CITATION in expanded form. Should any conflict exist between this information and the checklist in the FAA Approved Airplane Flight Manual, the Flight Manual shall take precedence. Any implied technique presented assumes that proper pilot skill and judgment is exercised.

NORMAL PROCEDURES CHECKLIST

START

Clear the area behind the aircraft and check for foreign objects in front of the engine inlet.

Either engine may be started first. If the door is secured prior to battery start initiation, it is recommended that the left engine be started first. Spool up will be slightly faster due to less line loss because the battery is mounted on the left side of the tailcone compartment. Due to foreign object ingestion hazard, the left engine should not be running during boarding or deplaning. If last minute boarding and use of BLEED AIR GND is anticipated, the right engine should be started first.

Turn center panel lights full bright for night operations.

Momentarily depressing an ENGINE START button causes the button and engine instrument floodlights to illuminate, activates the fuel boost pump and the associated FUEL BOOST ON annunciator light, and commences engine rotation. At 8-10% Turbine RPM, lifting the cut-off latch and advancing the thrust lever to idle activates the ignition and the associated igniter light. After light off occurs, fuel pressure sensing at approximately 30% N_2 causes the starter relay to open, terminates ignition and fuel boost, and turns off the start button and engine instrument floodlights. During a battery start with the GEN switch ON, the generator will come on the line extinguishing the GEN OFF light at approximately 40 - 42% N_2. The second engine is started as soon as the first is complete, a generator is on the line, and 48 to 50% N_2 is set on the operating engine. Proper RPM is necessary to ensure correct torque on the operating generator drive. This procedure is designed to take advantage of the cross generator start capability to reduce battery heat by eliminating a charging cycle.

With external power in use, the GEN switches should be off until starting is complete. It may not be possible to bring the generators on the line until the external power unit is removed. In any case, electrical equipment should not be turned on until both GEN OFF lights are extinguished.

On 500-0275 thru -0349, an overcurrent and overvoltage protection system is provided during use of an APU. The control unit monitors the external power unit voltage and will de-energize the external power relay if the voltage is above 32.5 volts. During an engine start using the external power unit, a signal is applied by the current to the control unit. If the signal indicates more than 1200 amps for two seconds or more, the control unit will de-energize the external power relay and terminate the start. External power cannot be reapplied to the aircraft until the current has been interrupted after the start termination for the current protection or until the voltage is reduced below 32.5 volts for the voltage protection.

Should automatic start sequencing not terminate, the boost pump, ignition, and associated lights will remain on. The starter, however, will discontinue cranking due to speed sensing which governs at approximately 40 - 43% N_2. Depressing the STARTER DISENGAGE button will terminate the automatic start sequence. This button is illuminated any time the PANEL LIGHT CONTROL master light is ON.

Engine Instruments - CHECKED

Engine instruments within limits. Check that starter has disengaged and that all annunciator lights are out except F/D AC PWR FAIL, RAD AC PWR FAIL and, if selected, BLEED AIR GROUND. Check vacuum or pressure gauge as applicable in green arc.

Fuel System Annunciator Lights - CHECK EXTINGUISHED.

Check L and R FUEL BOOST ON and L and R FUEL PRESS LO lights extinguished.

External Power - CHECK CLEAR

After the second engine is started, check the external power unit (if used for start) is disconnected and clear of the airplane before taxiing.

Generators - GEN (if external power was used for start)

BEFORE TAXIING

Lights - AS REQUIRED

Inverters - CHECKED & ON

Inverters and crossover switching can be checked by turning on the No. 2 inverter and observing the RAD AC PWR FAIL light go out. Then move crossover switch to XOVER. The F/D AC PWR FAIL light should go out and the RAD AC PWR FAIL light come on. Turn on the No. 1 inverter and the RAD AC PWR FAIL light should go out. Return the XOVER switch to NORM and check both AC annunciator panel lights extinguished.

DC Amperes and Volts - CHECK for normal reading

The voltmeter reads bus voltage and should indicate 28 volts in all positions. The ammeters should indicate that each generator is accepting an equal load.

Passenger Advisory Lights - PASS SAFETY

Aft Facing Seats - CHECK FULL AFT and UPRIGHT

Must be positioned upright and tracked full aft (towards aft of the airplane) to provide unobstructed access to the emergency exit.

Avionics - AS REQUIRED

Gyro Vacuum - CHECK

Check gyro vacuum in the green.

Auto Temperature Select - AUTOMATIC; AS DESIRED

Position automatic temperature selector as desired.

Pressurization - SET ALTITUDE and RATE

500-0001 thru -0213

Smooth transition to pressurized flight after liftoff is best achieved by programming the controller as close to departure airport pressure altitude as possible. This causes ambient pressure to be maintained as the safety outflow valve closes with weight off the left main gear squat switch after takeoff.

Since the controller references standard pressure, field pressure altitude must be known. This is easily obtained by setting 29.92 in an altimeter and reading the value directly.

BEFORE TAXIING

Lights - AS REQUIRED

Avionics Power Switches - INV1 & ON

AC power is supplied by either inverter with remaining inverter available as a backup. Selecting INV 1 or INV 2 will extinguish the AC FAIL annunciator light. Both inverters should be selected during preflight to ensure both operate. The switch can then be left in either INV 1 position or INV 2 position.

The second avionics ON/OFF switch is a master switch for all avionics equipment. Individual on/off switches can be left on with power to each controlled by the master switch. During ground operation the radar should be switched to STNDBY.

DC Amperes and Volts - CHECK for normal reading

The voltmeter reads bus voltage and should indicate 28 volts in all positions. The ammeters should indicate that each generator is accepting an equal load.

Passenger Advisory Lights - PASS SAFETY

Aft Facing Seats - CHECK FULL AFT and UPRIGHT

Must be positioned upright and tracked full aft (towards aft of the airplane) to provide unobstructed access to the emergency exit.

Avionics - AS REQUIRED

Gyro Pressure - CHECK

Check gyro pressure in the green.

Auto Temperature Select - AUTOMATIC; AS DESIRED

Position automatic temperature selector as desired.

Pressurization - SET ALTITUDE and RATE

500-0001 thru -0213

Smooth transition to pressurized flight after liftoff is best achieved by programming the controller as close to departure airport pressure altitude as possible. This causes ambient pressure to be maintained as the safety outflow valve closes with weight off the left main gear squat switch after takeoff.

Since the controller references standard pressure, field pressure altitude must be known. This is easily obtained by setting 29.92 in an altimeter and reading the value directly.

Most controllers have an inherent error of approximately minus 200'. In other words, to achieve a value of 800', 600' would be set with the CABIN ALT knob. Once the pressure altitude is determined, apply the controller error and set that value in the controller. As an example, a pressure altitude of 300' and controller error of minus 200' would dictate a setting of 100'. Excessive rates of cabin climb or descent after lift off indicated on the cabin vertical speed indicator suggests that the error correction is either excessive or insufficient. If the cabin climbs excessively, apply a slightly greater minus error on subsequent takeoffs to determine a comfortable setting. The inverse would be applicable if it descends excessively.

Set the controller as soon after engine start as possible to allow adequate time for the normal outflow valve to reach the programmed position. Set the RATE knob at mid-range.

Pressurization - SET 500-0214 and On

Select desired cruise altitude on dial labeled ACFT. Cabin altitude at this cruise altitude will be displayed on the adjacent scale labeled CABIN. Position Cabin Rate Control Selector Knob so that the pointer falls within the nominal white arc.

Crossfeed Switch - LH TANK or RH TANK for one minute.

Perform only on first flight of the day to clear fuel crossfeed line of possible water contamination.

Brakes - CHECK (during taxi)

Deice System - CHECK (when icing conditions are anticipated)

Actuate SURFACE DEICE switch to ON and visually check operation of the boots and illumination of the annunciator light. Actuation of the boots will result in one complete inflation and deflation cycle.

CAUTION

DO NOT OPERATE DEICE BOOTS WHEN AMBIENT AIR TEMPERATURE IS BELOW -40°C (-40°F).

Anti-Ice - CHECK and AS REQUIRED

Clearing the area behind the aircraft, set power at or above 60% N_2. Rising ITT, decreasing RPM, an increase in amperage, and ignition and ENG ICE FAIL light illumination when ENGINE ANTI-ICE is turned ON indicates proper system function. Select pitot-static, engine, and windshield anti-ice as required.

CAUTION

LIMIT GROUND OPERATION OF PITOT/STATIC HEAT TO TWO MINUTES TO PRECLUDE DAMAGE TO THE ANGLE-OF-ATTACK SYSTEM.

NOTE

When operating in visible moisture and Ambient Air Temperature is between 40°F and -22°F, turn pitot and static heat (not to exceed two minutes continuous ground operation) and engine LH & RH anti-ice systems ON. (On 500-0041 thru -0349, and 500-0001 thru -0040 incorporating SB30-1, if temperature is above 0°F, turn W/S bleed air switch to LO. If temperature is 0°F or below, turn W/S bleed air switch to HI. Check W/S bleed air valves MAX.) For sustained ground operation, the engines should be operated for one out of every four minutes at 65% turbine RPM or above.

TAXI

Gradually apply just enough thrust to break inertia. Reduce power to the amount necessary to achieve desired taxi speed. Avoid riding the brakes and always place the thrust levers to idle before commencing braking. Caution should be exercised in congested areas to reduce the possibility of blast damage to equipment and personnel.

Taxiing on one engine may be advisable at light weights to reduce brake wear, particularly in very cold weather when residual thrust is relatively high. Turning radius into the live engine is increased however, and consideration should be given to the direction of anticipated turns in deciding which engine to operate. Peak exhaust velocity to generate the necessary thrust will be higher on one engine. Maneuvering in close quarters may dictate the use of both engines.

Greater nose gear steering authority is incorporated on 500-0101 thru -0274 and may be retrofited to earlier aircraft. A brake modification, standard on 500-0168 thru -0274, reduces brake drag requiring less taxi power.

Ground operations in visible moisture with an OAT from -22°F to +40°F requires that ENGINE ANTI-ICE be ON and the engines run at or above 65% N_2 one minute out of every four.

Brakes - CHECKED

Four pedals checked for proper function early in the taxi.

BEFORE TAKEOFF

Seats, Seat Belts and Shoulder Harnesses - CHECK SECURE

Check seats locked in the desired position. Check seat belts snug and shoulder harnesses latched to the buckle.

Ignition - ON

May preclude flameout should engine ingestion problem arise during takeoff phase. RPM will increase by approximately 1%.

Engine Instruments - CHECK

Check all engine indications normal or in the green.

Fuel Quantity - CHECK

Avionics/Flight Instruments - CHECKED and SET

No warning flags visible in the ADI, HSI, or PN-101. Navigation radios tuned to desired frequencies and courses set. Check vertical gyros erect and for correct indication on vacuum or pressure gauge as applicable. Observe RMIs and compasses correct, in agreement, turning freely, and turn and bank indicators for proper movement. Check LH GYRO SLAVE in AUTO and VSI's at zero.

Autopilot - PUSH TO TEST (500-0275 and On)

The test button on the autopilot controller provides a test for the torque limit and the autopilot disconnect warning horn. After engaging the autopilot, pressing the TEST button will cause the autopilot to disengage by simulating a failure in the torque limiters.

The AUTOPILOT OFF light on the instrument panel will illuminate and the autopilot off warning horn will sound. This test should be performed prior to each flight. If the autopilot does not disconnect, the system should be checked before using the autopilot in flight.

Autopilot - Electric Elevator Trim - FUNCTIONAL TEST (500-0275 and On)

Engage the autopilot with the elevators and ailerons in the neutral position. Rotation of the pitch wheel must result in movement of the elevators in the direction of pitch wheel movement. Rotation of the turn knob must result in movement of the aileron in the direction of the turn knob movement. Engage the heading mode with the heading cursor under the lubber line. Move the heading cursor to the left of the lubber line and the control wheel should roll left. Engage the altitude hold mode then set the pilot's altimeter to a lower altitude and the control wheel should move aft. Disengage the altitude hold mode. Pull aft on the control wheel, after a short delay the elevator trim wheel must start trimming nose down. Disengage the autopilot with the AP/TRIM DISC switch on the control wheel. The autopilot must disengage and the AUTOPILOT OFF light must illuminate for one second. Operate electric elevator trim nose up and push AP/TRIM DISC switch. Verify elevator trim wheel stops rotating. Repeat check for nose down trim. Repeat check using copilot's AP/TRIM DISC switch (if installed).

Trims - SET FOR TAKEOFF

Set rudder and aileron trim at neutral, ensure elevator trim is in the takeoff range.

Flight Controls - FREE and CORRECT; Speedbrakes - CYCLE

Check for full travel of all controls. Observe aileron and elevator for correct movement. The elevator and ailerons can be seen from the cockpit.

Extend speedbrakes. HYD PRESS ON light should be on until speedbrakes are extended, then go out. SPD BRAKE EXTENDED light should be on. Observe speedbrakes on top of wing. Retract speedbrakes. Note HYD PRESS ON light on, then off, SPD BRAKE EXTENDED light out, and speedbrakes retracted.

Flaps - SET FOR TAKEOFF

Thrust Reversers (if installed) - CYCLED and STOWED

Check Sequencing and Timing of Lights

Deploy each thrust reverser. Actuate each emergency stow switch. The DEPLOY and UNLOCK light shall extinguish. The ARM and HYD PRESS ON lights will remain illuminated. Return the thrust reverser lever to the stowed position and then turn each emergency stow switch off. All lights shall extinguish.

WARNING

DO NOT ATTEMPT TO FLY THE AIRPLANE IF THE THRUST REVERSER PREFLIGHT CHECK IS UNSUCCESSFUL.

Pressurization Selector - BOTH

Pressurization source selector in BOTH. Do not leave in GND as excessive bleed air extraction will take place from the right engine and it will not develop full takeoff thrust. Shortly before takeoff, position the AUTO TEMP SELECT in mid-range. If conditions are such that it is suspected that the mixing valve may have driven full hot, go to MAN, toggle the MAN COOL SWITCH 5 to 6 seconds, and return the selector to AUTO mid-range. This should preclude the possibility of an AIR DUCT O'HEAT light after applying takeoff thrust.

V_1, V_R, V_2 Fan Speed Settings - CONFIRM

Check gross weight against runway available using actual temperature, slope, wind, and pressure altitude information. Compute takeoff N_1; V_1, V_R, V_2, and best single engine climb speed. Set N_1 setting in reminder above N_1 tachometer.

Pitot/Static Heat - ON

Annunciator Panel - CLEAR

All annunciator lights should be extinguished with the possible exception of ENG ICE FAIL if that system is selected with low power.

TAKEOFF

Monitoring the engine instruments, apply power slowly while referencing the cabin vertical speed indicator. Very rapid thrust application can cause a pressure surge due to increased airflow into the cabin. A rolling takeoff may be used with sufficient runway available, but it should be remembered that Flight Manual takeoff field length data and takeoff N_1 settings assume a static runup.

Directional control is normally maintained with nose gear steering and rudder; and upwind (wing down) aileron in crosswind conditions. It is suggested that the copilot perform the engine instrument monitoring function and set the thrust levers enabling the pilot to direct his full attention to aircraft control. N_1 should be closely observed, and thrust lever corrections made as necessary to ensure symmetrical thrust application. Large differential power changes, particularly at the higher thrust settings, can induce significant yaw.

It is recommended that the copilot verbally state when takeoff thrust is set, a cross-check of airspeed indicators at 70 knots, and when reaching V_1 and V_R. Positive back pressure is required to rotate the CITATION and it should be accomplished precisely at V_R. Early or late rotation will degrade takeoff performance. It should be done smoothly however, so that a decrease in airspeed does not occur.

Should a serious irregularily become evident before reaching V_1, the takeoff should be aborted. With a problem after V_1, the takeoff should normally be continued. Abort, and single engine takeoff procedures are outlined in the EMERGENCY section. Normal rotation angle is 10 to 12° nose up with both engines operating and 7 to 10° single engine.

AFTER TAKEOFF

Landing Gear - UP & INDICATING

When a positive rate of climb is indicated, pulling the gear handle out and moving UP initiates the retraction cycle illuminating the GEAR UNLOCKED and HYD PRESS ON lights. Check both lights extinguished indicating the gear are up and locked.

Flaps - UP & INDICATING

At a comfortable altitude with wings level and a minimum airspeed of $V_2 + 10$ KIAS, push the flap handle in (to clear the T.O. & APPR detent) and full forward. Observe the position indicator to the left of the handle move to FLAP UP.

While the minimum retraction airspeed should be attained, excessive speed will accentuate the pitch change. The effects of flap retraction are nearly imperceptible at $V_2 + 10$ to 20 KIAS.

Ignition - NORM

When clear of any bird hazard and cockpit workload permits, return the IGNITION switches to NORM.

Climb Power - SET

Engine Synchronizer - SET

Select FAN or TURB position as desired.

Landing Lights - OFF

Landing lights will go off regardless of switch position when the gear are retracted. Switches should be turned off to correspond to light condition.

Pressurization - SET

500-0001 thru -0213

Set RATE knob to minimum (DEC). Use the CABIN ALT knob to slowly increase the cabin altitude setting while referencing the cabin vertical speed indicator. The rate of climb will increase briefly and then stabilize. When it has stabilized, the CABIN ALT knob can be turned as fast as desired to the appropriate cruise altitude. The altitude selected in the bottom window should be slightly higher than actual cruise altitude to provide a margin against possible atmospheric pressure changes. When the controller has been set, slowly adjust the RATE knob to achieve a comfortable cabin rate of climb (usually 300 to 500 fpm).

Pressurization - SET

500-0214 thru -0349, aircraft incorporating SB21-9

The pressurization controller was programmed to cruise altitude plus 1000 feet prior to taxi. Adjust the RATE knob to achieve a comfortable cabin rate of climb (usually 300 to 500 fpm).

Passenger Advisory Lights - AS REQUIRED

Placing the switch to SEAT BELT leaves that cabin advisory light illuminated and extinguishes the NO SMOKING and emergency exit lights. If no turbulence is anticipated, placing the switch to OFF extinguishes both the advisory, and emergency exit lights.

Anti-ice Systems - AS REQUIRED

Select anti-ice systems as required for climb.

Crew Oxygen Masks - ABOVE FLIGHT LEVEL 250, ENSURE MASK IS IN QUICK-DONNING POSITION AND SET AT 100%

CLIMB

Using indicated temperature and the NORMAL CLIMB/CRUISE THRUST SETTING graph in Section IV of the FAA Approved Airplane Flight Manual (or the CLIMB THRUST SETTING chart on the back of the abbreviated checklist), determine climb N_1. Cross check the remaining engine instruments within limits. Fan (N_1) RPM will increase with altitude and several thrust lever adjustments may be necessary during climb to maintain the specified thrust setting. Use of engine anti-ice reduces allowable fan speed and dictates close monitoring of ITT and RPM limits.

Observe the differential pressure/cabin altitude and cabin vertical speed gauges for proper programming and comfortable rate. Periodic checks of time to climb remaining, cabin altitude, and rate of cabin ascent will provide the required information to determine any adjustments necessary. As an example, passing 20,000 feet with a cabin altitude of 4000' and an estimated climb time remaining of 10 minutes to 35,000' (8000' cabin altitude), would require a cabin climb rate of 400 fpm to attain planned cruise and cabin altitudes concurrently. With RATE set too low, maximum differential pressure may be reached before cruise altitude. This takes control of the system away from the crew because the outflow valve will relieve as necessary to maintain maximum differential. A RATE setting too high may be uncomfortable and will result in programmed cabin altitude being reached before cruise flight level. A thorough understanding of DIFF PRESS/CABIN ALT gauge interpretation will aid the crew in smooth operation of the pressurization system.

CRUISE

Climb thrust is normally maintained upon level off until acceleration to the desired cruise mode takes place. Thrust is then adjusted to the appropriate setting. For the maximum range case, thrust necessary to maintain optimum angle-of-attack diminishes with fuel burn off because of increased performance and lower airspeed requirements as weight decreases.

Although the CITATION is not operationally restricted in rough air, flight in severe turbulence should be avoided. If severe turbulence is encountered, it is recommended that the igniters be turned ON and airspeed maintained at approximately 180 KIAS. Maintain a constant attitude, avoid abrupt or large control inputs, and do not chase airspeed and altitude indications. Use of the autopilot in the TURB mode (500-0001 thru -0274) or SOFT RIDE mode (500-0275 thru -0349) is recommended.

A comfortable cabin temperature is normally maintained with the AUTO TEMP SELECT in the 12 to 2 o'clock position. During daylight, the crew environment may not be an accurate reference to cabin comfort level due to solar heating taking place through the wide expanse of cockpit windows. An approximate indication of airflow warmth into the cabin can be determined by placing a hand over an open crew foot warmer outlet. The foot warmers are an extension of the cabin underfloor ducting and can be used as a reference for AUTO TEMP SELECT adjustments to maintain a comfortable cabin.

The COCKPIT & DEFOG FAN should be turned on and foot warmers closed approximately 15 minutes before descent to reduce condensation on the windshield and cockpit side windows. This is particularly important when a rapid let down into an area of high humidity is anticipated after cold soaking at altitude.

CAUTION

DO NOT OPERATE DEICE BOOTS WHEN INDICATED OAT IS BELOW -40°C (-40°F).

NOTE

Check deice system for proper operation prior to entering areas in which icing might be encountered.

DESCENT

Defog Fan - ON

Windshield Bleed Air Valves - MAX

Foot Warmers - CLOSED

Check COCKPIT & DEFOG FAN on and foot warmers closed for maximum airflow to the windshield. Closing the foot warmers will increase the flow of air available for windshield defogging and also isolate dry conditioned air between the cockpit side windows to inhibit condensation formation. Use the HI position for humid conditions at destination or if the fan was not activated prior to initiating descent. WINDSHIELD BLEED AIR can be used to externally warm the windshield in extreme conditions.

Pressurization - SET

500-0001 thru -0213

Turn RATE to minimum (DEC), and slowly decrease controller CABIN ALT setting. Initially, the cabin vertical speed indicator will show a slight descent and then stabilize at or near zero. When it has stabilized, the CABIN ALT knob may be turned as rapidly as desired. A suggested method of determining CABIN ALT setting for landing involves figuring destination pressure altitude, applying controller error, and ensuring depressurization just prior to touchdown. Once destination altimeter setting is known, pressure altitude can be determined because each 0.10 inch of mercury deviation from 29.92 equates to 100' difference between field elevation and pressure altitude. An altimeter setting above standard gives a pressure altitude below field elevation and the inverse is also true. As an example, descending to a field elevation of 350' with a reported altimeter of 29.77 would result in a field pressure altitude of 500'. Assuming a controller error of minus 200', the cabin altitude should be set at 300' plus a small increase (50-100') to ensure depressurization prior to touchdown. RATE is normally adjusted to give a 300 to 500 fpm cabin rate of descent.

Monitor the differential pressure/cabin and cabin vertical speed gauges. A high cabin altitude and low differential pressure indicates an insufficient rate of descent and depressurization will occur when cabin and aircraft altitude are identical. High cabin descent rates may be uncomfortable and may result in programmed cabin altitude being reached well before landing. Optimum comfort is realized by spreading cabin descent required over the majority of aircraft let down time.

Pressurization - SET

500-0214 thru -0349 and aircraft incorporating SB21-9

After beginning descent, set destination field pressure altitude +200' in the CABIN dial of the controller.

Once destination altimeter setting is known, field pressure altitude can be determined because each 0.10 inch of mercury deviation from 29.92 equates to 100' difference between field elevation and pressure altitude. An altimeter setting above standard gives a pressure altitude below field elevation and the inverse is also true. As an example, descending to a field elevation of 350' with a reported altimeter of 29.77 would result in a field pressure altitude of 500'. The cabin altitude should be set at 700' to ensure depressurization prior to touchdown. Rate is normally adjusted to give a 300 to 500 fpm cabin rate of descent.

Monitor the differential pressure/cabin altitude and cabin vertical speed gauges. A high cabin altitude and low differential pressure indicates an insufficient rate of descent and depressurization will occur when cabin and aircraft altitude are identical. High cabin descent rates may be uncomfortable and may result in programmed cabin altitude being reached well before landing. Optimum comfort is realized by spreading cabin descent required over the majority of aircraft let down time.

Anti-ice - AS REQUIRED

PITOT & STATIC and ENGINE ANTI-ICE should be on and operating and W/S BLEED as required when operating in visible moisture at an indicated OAT from +4°C to -30°C (+40°F and -22°F). Maintain sufficient engine power for anti-icing; above approximately 60% N_2 RPM.

Radio Altimeter - SET

If installed, set bug to decision height, minimum descent altitude, or as desired for VFR operation to provide terrain proximity warning.

Altimeters - SET & CHECKED

Set landing field barometric pressure in both altimeters passing transition altitude and cross check for agreement.

Speedbrakes - AS REQUIRED

BEFORE LANDING

Seats, Seat Belts and Shoulder Harnesses - SECURE.

Check seats locked in the desired position. Check seat belts snug and shoulder harnesses latched to the buckles.

Computations - COMPLETE

Based on destination field information and estimated arrival gross weight, check runway requirements and determine V_{REF}. Compute takeoff N_1 and V_2 for use in the event of a missed approach.

Passenger Advisory Lights - PASS SAFETY

Turn on SEAT BELT/NO SMOKING signs and emergency exit lights.

Aft Facing Seat - CHECK FULL AFT and UPRIGHT

This will provide unobstructed access to the emergency exit door.

Crossfeed - OFF

Check CROSSFEED knob OFF and INTRANSIT and FUEL BOOST ON lights extinguished.

Flight Instruments - CHECKED

Check vertical gyros, no warning flags visible; compass headings, altimeters, and airspeed in agreement. Navigation equipment tuned, identified, and courses set. Program flight director as desired. Check annunciator panel clear.

Ignition - ON

May preclude flameout should engine problem arise during approach and landing phase.

Landing Gear - DOWN and INDICATING

Pulling gear handle out and moving it DOWN illuminates the HYD PRESS ON and GEAR UNLOCKED lights while gear is extending. Check three green lights on and GEAR UNLOCKED and HYD PRESS ON lights extinguished.

Maximum extension or operating airspeed is 176 KIAS.

Flaps - LAND

Flaps may be extended to T.O. & APPR below 202 KIAS and LAND below 176 KIAS. Should be in the LAND position for all normal landings. Check indicator to verify position. Handle must be pushed in to clear T.O. & APPR detent when LAND flaps are desired.

Airspeed - V_{REF}

Engine Synchronizer - OFF

Engine synchronization should be off to prevent excessive wear with large or frequent throttle movement.

Autopilot and Yaw Damper - OFF

Yaw damper OFF to give complete rudder authority to the pilot for landing. Utilize the AP/TRIM DISC button on the pilot's control wheel or the AP DISC button on the copilot's control wheel.

Consistently comfortable and safe landings are best achieved from a stabilized approach. The point at which the aircraft should be stabilized with airspeed at V_{REF} to $V_{REF} + 10$, full flaps, and the desired descent rate is normally coincident with commencing the final descent to landing. Under instrument conditions, this usually occurs at the final approach fix inbound. During visual approaches, this would be a point approximately equal to a turn onto base leg, adjusted for the altitude difference between the traffic pattern and field elevation.

After passing the instrument approach fix outbound or nearing the airport traffic area, airspeed should be reduced below 202 KIAS and the flaps extended to the APPR (15°) position. Approaching the final instrument fix inbound (one dot from glideslope intercept on an ILS), or a downwind abeam position, extend the landing gear below 176 KIAS. At the point where final descent to landing is begun, extend FULL flaps, establish the desired vertical rate, and adjust power to maintain V_{REF} to $V_{REF} + 10$ indicated airspeed.

Power management during the approach/landing phase is relatively easy in the CITATION because an N_1 setting in the 60 - 65% range will normally result in desired indicated airspeeds for the various configurations. Depending on air traffic control requirements, thrust necessary for the entire approach can often be set during descent keeping in mind that fan (N_1) RPM will decrease slightly for a fixed thrust lever setting with a decrease in altitude or indicated airspeed. Using a sea level airport with zero wind at a typical landing weight (9000 pounds), a thrust lever setting that results in about 60% N_1 in close will give approximate level flight indicated airspeeds of 160 knots clean and 140 with flaps APPR.

Gear extended, flaps FULL, and commencing an average descent (500 fpm) will result in approximately V_{REF} airspeed. Higher field elevations, landing gross weights, and/or headwind component will require a greater power setting.

For maneuvering prior to final approach, minimum airspeeds of V_{REF} + 30, V_{REF} + 20, and V_{REF} + 10 should be maintained clean, flaps APPR, and flaps LAND respectively to provide an adequate margin above stall.

Speed control on final should be precise for optimum landing performance and this is best accomplished by establishing V_{REF} airspeed well before crossing the threshold. In gusty wind conditions, it is recommended that one half the gust factor in excess of 5 knots be added to V_{REF}.

Annunciator Panel - CLEAR

Pressurization - CHECK ZERO DIFFERENTIAL

Speedbrakes - RETRACTED PRIOR TO 50 FEET

Approaching within approximately 50' of airport elevation, power should be gradually reduced to counter the acceleration induced by ground effect. Wind velocity and direction will dictate the rate at which the thrust levers are retarded. In very high surface headwind conditions, as an example, it may be necessary to maintain at or near approach power until close to touchdown. With a tailwind, a fairly rapid power reduction may be necessary in the final descent to landing phase for accurate speed control. In ground effect, where induced drag is reduced, leaving approach power on will cause the aircraft to float to a longer touchdown than desired. Retarding the thrust levers gradually in the final descent will normally result in idle thrust being reached just before touchdown.

On final approach, the YAW DAMPER should be turned off as it will attempt to override pilot rudder input during touchdown and roll out. Passing approximately 500' AGL, check the cabin differential pressure near zero. If it is in excess of about one half p.s.i., select a higher cabin altitude and adjust RATE to ascend the cabin. Differential pressure should be at zero for landing. Any pressure existing at touchdown will be dumped by the safety outflow valve (actuated by the left main gear squat switch) and may cause discomfort.

LANDING (without Thrust Reversers)

Touchdown, preceded by a slight flare, should occur on the main wheels. Check thrust at idle and extend the speedbrakes while lowering the nose wheel. Braking should be commenced according to runway length available to reduce brake wear. Normally with excess runway, braking is begun after aerodynamic deceleration to below 80 KIAS takes place. Apply smooth, gradually increasing pressure until a comfortable turn off speed is reached.

Suggested crosswind technique involves flying a crab down final approach and aligning the longitudinal axis of the airplane to runway center line with rudder just before touchdown. The wide expanse of cockpit visibility makes small crab angles difficult to detect and particular attention should be devoted to this area to achieve smooth crosswind landings.

LANDING (with Thrust Reversers)

Touchdown, preceded by a slight flare, should occur on the main wheels. Check thrust at idle and extend the speedbrakes while lowering the nose, apply wheel brakes and deploy the thrust reversers. The aircraft pitches slightly upward during the deployment of the reversers. Therefore, slight nosedown elevator pressure should be used during thrust reverser deployment especially at high speeds such as a refused takeoff or a no flap landing. The nose wheel must be on the ground before actuation of the thrust reversers to eliminate the possibility of FOD and improve directional control. To avoid possible jamming of the throttle lockout cams, do not exceed approximately 15 pounds force on the thrust reverser levers during deployment. Check illumination of the thrust reverser lights.

CAUTION

DO NOT ATTEMPT TO RESTOW REVERSERS AND TAKE OFF ONCE REVERSERS HAVE STARTED TO DEPLOY. THROTTLE LINKAGE DAMAGE MAY OCCUR RESULTING IN LOSS OF POWER OR FLAMEOUT.

Once the thrust reversers are deployed, move the thrust reverser levers aft to a maximum reverse thrust of takeoff power. For convenience, "stops" have been installed on the thrust reverser levers and are set to provide 90% N_1 at 16°C (60°F) at sea level. This will allow the pilot to keep his attention on the landing rollout instead of diverting his attention to the reverse power settings, except in an abnormal ambient temperature condition.

At 60 KIAS, return the thrust reverser levers to the idle reverse detent position leaving the thrust reversers deployed for aerodynamic drag. Thrust reversing and braking should be commenced according to runway length. Normally with excess runway, braking is begun after thrust reverser deceleration is below 60 knots. The thrust reversers should not be used for touch and go landings; a full stop landing should be made once the reversers are selected.

AFTER LANDING

It is recommended that the checklist be delayed until the aircraft is clear of the runway. Turn OFF optional strobe lights if installed.

Thrust Reversers (if installed) - STOW

Do not advance the throttles while the thrust reversers are being stowed. The automatic engine power retard system will activate causing misrigging of the throttle linkage system. This would result in only partial takeoff power or possibly a flameout if the throttle was placed in idle position. To avoid activating the automatic retard system, do not advance the primary throttle after moving the reverse thrust lever to stow until the "UNLOCK" light is out.

Flaps & Trim - UP & SET

Retract flaps and check rudder and aileron trim indicators neutral, and elevator in the takeoff range.

Ignition - NORM

Both IGNITION switches to NORM

Speedbrakes - RETRACT

Check HYD PRESS ON and SPD BRAKE EXTEND lights extinguished.

Radar & Transponder - OFF

Turn radar OFF before entering flight line. Turn transponder OFF to prevent signal interference with airborne aircraft. All unnecessary radios may also be turned off at this time.

Anti-ice - OFF

Turn anti-ice equipment off. W/S BLEED may be used as required in falling precipitation. Turn ENG ANTI-ICE ON and operate the engines at or above 65% N_2 for one minute out of four during taxi in visible moisture with a temperature of -22 to +40°F.

Pressurization Selector - AS REQUIRED

GND for maximum conditioned airflow in temperature extremes. Normally left in BOTH.

SHUTDOWN

Exterior Lights - OFF

All EXTERIOR LIGHTS switches turned off. ANTI COLL lights or optional rotating beacon light should be ON until shutdown is complete to alert personnel to the engine operating hazard.

Passenger Advisory Lights - OFF

Radios & Avionics Power Switches - OFF

Remaining communication and navigation equipment off.

Inverters - OFF (500-0001 thru -0274)

NO 1 and NO 2 AC POWER switches OFF and XOVER in NORM. Wait until aircraft is parked before removing flight director AC power so that CB-70 compass system agrees with aircraft heading.

Cabin & Defog Fans - OFF

Both switches to the center (OFF) position.

Throttles - CUTOFF

Lifting the latch and placing the thrust levers full aft terminates fuel flow to the engine. On 500-0001 thru -0213 not incorporating SB71-2 a canister collects manifold fuel on shutdown and vents it into the atmosphere during the next flight. 500-0001 thru -0213 incorporating SB71-2 are equipped with a canister that is drained by the crew through a manual valve. Repeated starts for ground operation will cause the canister to overflow through the lower nacelle after the third shutdown. On 500-0214 thru -0274 the fuel from the manifold is carried by a return system back to the main tanks. Allow ITT to stabilize at minimum value for one minute.

NOTE

In conditions of blowing or drifting snow, install engine covers after shutdown as soon as engine cools sufficiently.

Battery - OFF

BATT switch to the center OFF position. Care should be exercised that it is not placed in EMER. Although most emergency bus items (COMM 1, NAV 2, floodlights) are normally off, the PN-101 would drain the battery significantly over an extended period of time.

Control Lock - ENGAGE

Parking Brake - SET, or Wheels - CHOCK

Do not leave airplane unattended without chocks or the parking brake set. Parking brake should not be used if the brakes are very hot. This can increase heat transfer from the brakes to the wheel, causing the fusible plug to melt, deflating the tire.

Engine Covers - INSTALL (after engines have cooled)

In conditions of drifting or blowing snow, install engine covers after shutdown as soon as engines cool sufficiently.

Always check cabin differential pressure at zero before opening the door. Any pressure existing due to malfunction of the left main gear squat switch or safety outflow valve could cause the door to open rapidly presenting a hazard to personnel in the vicinity.

For deplaning at night, the battery switch may be left in BATT to make available all cabin lighting until passengers and cabin baggage are disembarked. Turning the EXTERIOR WING INSP LIGHTS switch ON provides additional illumination in front of the cabin door. An illuminated courtesy light switch located on the forward door post is wired to the hot battery bus and turns on the emergency exit lights. On 500-0071 thru -0349 this switch also illuminates one aft baggage compartment light.

When securing the aircraft, install the engine and pitot tube covers. Check the BATT, passenger advisory, and courtesy light switches off. Closing the door extinguishes integral courtesy light switch illumination. All doors and the nose avionics compartment can be key locked. A locking pin can be installed in the internal emergency exit door handle to prevent access from the outside. This pin must be removed prior to flight.

GENERAL INFORMATION

SHORT FIELD OPERATION

For takeoff, taxi into position as close to the approach end as possible and apply takeoff thrust while holding the brakes. FAA Approved Airplane Flight Manual takeoff field length data assumes a static runup and use of all available runway. When specified thrust is set, release the brakes. Rotate smoothly right at V_R as a delay will result in degradation of takeoff climb performance. Retract the gear when positively climbing and climb at V_2 with T.O. (15°) flaps until clear of any obstacles.

Landing field length data in the FAA Approved Airplane Flight Manual assumes a threshold crossing speed of V_{REF} at an altitude of 50' with thrust reduced to idle at that point; and touchdown occuring 580' down the runway. In practice, it is suggested that for minimum field operations the threshold be crossed at comfortable obstacle clearance altitude allowing some deceleration to take place approaching the runway. Touchdown should occur with maximum available runway remaining at minimum safe speed.

The energy to be dissipated during roll out is directly related to aircraft weight and velocity at touchdown. Although weight is normally dictated by cabin loading and reserves required, flight planning into short fields should include avoiding carrying excessive weight in stored fuel. This consideration offers the side benefit of improved enroute performance. Velocity is something that can be controlled in nearly every case. Precise speed control is important in the short field environment. A 1% increase in speed will require approximately 2% more roll out distance.

In general, short field landings are accomplished the same as normal landings except for heavier braking and closer attention to touchdown point and speed. A stabilized approach at V_{REF} provides the best possible starting point because any corrections necessary will be small. Establish a glide angle that will safely clear any obstacles and result in touchdown as comfortably close to the approach end as feasible. Avoid a very flat approach as they generally result in excessive power being required in close and the vertical gust protection margin is reduced. At approximately 50' AGL, power reduction is normally begun to cross the threshold at a speed not in excess of V_{REF}. Check the thrust levers at idle and avoid an excessive flare that may cause the aircraft to float. Deceleration will take place much more rapidly on the runway than it will airborne.

If thrust reversers are not used, extend the speedbrakes while lowering the nose and commence braking with steadily increasing pressure. Once braking has begun, back pressure on the yoke will create elevator drag without affecting weight on the gear providing the nose wheel is not lifted off the runway.

For landings utilizing thrust reversers, after touchdown on the mains, lower the nose, apply wheel brakes, extend speedbrakes and deploy the thrust reversers. Slight forward pressure on the yoke should be applied during reverser deployment. Check illumination of the ARM, UNLOCK, and DEPLOY lights. Once the thrust reversers are deployed apply maximum reverse thrust of takeoff power. Once braking has begun and maximum reverse power is reached, back pressure on the yoke will provide additional weight on the main gear providing the nose is not raised. At 60 KIAS return the thrust reverser levers to the idle reverse detent position. Leave the thrust reversers deployed for aerodynamic drag and idle reverse thrust.

ADVERSE FIELD CONDITIONS

All flight manual field length data assumes a dry, hard surface runway except where otherwise noted. Precipitation-covered runway conditions will degrade braking effectiveness and will require significantly greater actual takeoff abort and landing field lengths.

Considerations for landing on a precipitation-covered runway are similar to those for short field operations where velocity and speed are minimized and maximum roll out distance is made available. Runway composition, condition and construction, the amount of precipitation and the depth of main landing gear tire tread remaining affect the magnitude of braking degradation so it is impossible to apply a fixed factor to cover all conditions. Please refer to the FAA Approved Airplane Flight Manual, Section VII, Advisory Information for data that will permit estimation of the minimum runway required under various precipitation-covered runway conditions. Again, maximizing roll out runway available and touching down at minimum safe speed will provide the greatest possible margin.

Use of the thrust reversers, if installed, on precipitation covered runways, is the same as that for a landing on a normal or dry runway. Cockpit visibility is not hampered by blowing rain, snow or ice thrown forward by the thrust reverser. Single engine reversing during crosswind landings on precipitation-covered runways should be used with discretion.

With precipitation cover on the runway, braking should be very judicious. If runway length permits, delay braking slightly until some aerodynamic deceleration has taken place. Under normal braking conditions the optional antiskid system is very effective in preventing skids and producing minimum stopping distances; however, on a precipitation-covered runway, the phenomenon of hydroplaning may greatly reduce the antiskid effectiveness, due to the possibility of the airplane wheels not rotating up to a speed equal to the airplane ground speed. Airplanes equipped with the optional skid warning system instead of the antiskid system will experience the same reduced effectiveness. With 100 PSI main tires, the CITATION's minimum dynamic hydroplaning initiating ground speed may occur at speeds above approximately 70 knots. Since ground speed is the critical factor, landing on precipitation-covered runways with any tailwind component should be avoided. Good tread depth tends to relieve hydrodynamic pressure under the tire on wet runways and inflation is important because a low tire pressure lowers the minimum hydroplaning speed. Anticipated operation on precipitation-covered runways dictates close monitoring of tire condition and pressure.

After landing on ice or slush, a complete check of the aircraft, including overboard vents and control surfaces, should be conducted.

ENGINE ANTI-ICE

The importance of proper system use cannot be over emphasized as serious engine damage can result from ice ingestion. Its function is preventative in nature and flight into visible moisture with an outside air temperature from -30°to +4°C (-22°to +40°F) should be anticipated so that the system is operational when icing conditions are encountered. Turning it on after ice has accumulated could result in ice from the inlet and inboard wing leading edge being freed and ingested by the engine.

A minimum of 60% N_2 is required to activate the system. In descent, it should be turned on well before entering an icing environment to ensure that sufficient time is available for all system parameters to be met. Approximately 400 pounds per hour per engine fuel flow will be necessary to sustain proper system operation.

Ice formation observed on the wing is not a valid indication of possible engine icing. The ENG ANTI-ICE system should be ON and operating any time there is visible moisture with a temperature between -30°and +4°C (-22°amd +40°F). During ground operation in those conditions, the system should be turned ON and the engine operated above 65% N_2 one minute out of every four.

PASSENGER COMFORT

When parked during daylight in hot weather, it is suggested that the cabin window shades be closed to reduce solar heat transfer. An optional exterior windshield cover performs the same function for the cockpit and is very effective. To circulate cool air in the interior, the right engine may be started and the PRESS SOURCE SELECT placed in GND. Turning the AUTO TEMP SELECT to MAN and holding the MAN COOL switch for 12 seconds will drive the temperature mixing valve full cold. Closing unused overhead outlets and placing the CABIN fan to HI will provide maximum airflow to occupied seats. Increased air circulation in the cockpit is available by turning on the COCKPIT & DEFOG FAN. Operating the right engine above idle RPM will increase airflow and air cycle machine efficiency.

Increasing or decreasing engine bleed air extraction can cause a slight momentary bump in cabin pressure. Always check power stabilized at idle when changing the PRESS SOURCE SELECT on the ground and turn ENG ANTI-ICE switches on or off one at a time with a slight delay in between at high power settings.

The abbreviated checklist is designed to enable the crew to perform all prestart functions in advance. This permits items such as the Warning Test to be complete before passenger boarding and accelerates the ramp departure without compromising safety or thoroughness.

Leaving the chocks, brake checks can be done lightly and smoothly. If heavy braking is required on landing roll, using up elevator to create drag also counters the nose down pitching moment so that deceleration feel in the cabin is less abrupt. Do not apply excessive back pressure as weight may be lifted from the main wheels decreasing braking effectiveness and increasing the possibility of a blown tire.

The pressurization system procedures outlined in this chapter may at first appear complex, but thorough understanding of the controller and indicators coupled with minimal practical experience greatly simplifies operation. Optimum system performance in terms of passenger comfort is best achieved by slow, smooth selection of altitudes and rates and reducing the variables when setting the controller by not making power changes simultaneously.

Although it is not mandatory, use of the yaw damper is recommended when hand flying the aircraft. It reduces pilot rudder input required and the aircraft rides better in rough air. The yaw damper must be off for takeoff and landing.

Power management has an impact on cabin comfort and changes should be made smoothly and symmetrically. An approximate estimate of synchronization can be made by observing the RPM gauges and exact adjustments made audibly or with the optional engine synchronizer, if installed. Although the higher pitched turbine sound is generally more noticeable in the cockpit, the lower, fan out of sync condition is usually more prevalent in the area of the rear seats.

Good crew coordination and smooth operation of the controls and systems serves the best interests of safety, economy, and passenger comfort.

NAVIGATION/COMMUNICATION

DME ground speed or time to station readouts are only accurate when the aircraft is proceeding directly to or from the selected station. Since it is slant range that is computed, ground speed or time to station accuracy increases with distance from the station. The readouts can be considered reasonably close to actual speed when distance from the station in miles is equal to or greater than the aircraft altitude in thousands of feet.

With the optional area navigation unit installed, NAV 1 must be on and functioning with DME receiving in the NAV 1 position for proper system operation. Caution should be exercised when VOR navigation is desired. With the area navigation system in the RNAV or APPR mode, HSI and ADI (if programmed) azimuth information will be to the last selected waypoint. Always check the area nav mode in OFF or VOR/LOC for VOR or ILS approaches.

ADF identification is best received in the ANT position with BFO normally off. Relative bearing information is available only with the ADF position selected. The LOOP switch should always be used after tuning to ascertain proper needle sensing. When ADF is not required for navigation, place the selector in ANT to eliminate excessive RMI needle seeking.

During ground operation radio transmissions can be blocked by surrounding terrain or structures. This may possibly be overcome by using the other COMM because of aircraft antenna location. On 500-0001 thru -0100 the COMM 1 antenna is on the top of the vertical stabilizer and COMM 2 is on the underside of the fuselage. Antenna leads are reversed on 500-0101 thru -0349 so that the COMM 1 antenna is on the underside of the fuselage and the COMM 2 antenna is on the vertical stabilizer fin cap. Flying through dry precipitation, it is possible for static electricity build up to cause the VHF COMMs to automatically squelch to a point where reception range is greatly reduced. Disabling the squelch by depressing the SQ knob will cause background static in the speaker or headset, but normal reception range will be restored. If the headset microphone fails to function properly, check that the oxygen mask is firmly on the stowage hook in 500-0001 thru -0100, or the side console switch in MIC HEADSET on 500-0101 thru -0349.

COLD WEATHER OPERATION

If the aircraft has been cold soaked below -12°C (+10°F), an external power unit and/or preheat should be used for starting. If a start is attempted and the starter will not motor to 8% N_2 minimum, terminate the sequence. Advancing the thrust lever to idle below 8% N_2 can be damaging to the engine and battery.

Engine preheating is best accomplished by installing the engine covers and directing hot air through the oil filler access door. A warm battery provides some benefit and the heater hose can be placed in the tailcone with the door propped as far closed as possible to minimize heat loss. With sufficient hose length, the cabin and cockpit area can be warmed through the pilot's side window.

Maximum heat from the air conditioning system is obtained with the right engine operating and the PRESS SOURCE SELECT in GND. Rotating the AUTO TEMP SELECT to MAN and selecting MAN HEAT for 12 seconds ensures that the temperature mixing valve is in the full hot position. Turning on the COCKPIT & DEFOG FAN will increase air circulation in the cockpit. Operating the right engine above idle RPM increases temperature and airflow.

Operating in extremely cold temperatures reduces the solubility and super-cools any water particles in the fuel increasing the possibility of fuel system icing. The five tank, and one fuel filter drain under each wing should be drained frequently and thoroughly. It is possible for water to settle in the sump and freeze, blocking the drain, in which case heat should be applied until fuel flows freely. Maintain heat after flow begins to ensure that all ice particles have melted and collect the drainage in a clear, clean container to inspect for water globules.

TURBULENT AIR PENETRATION

Flight through severe turbulence should be avoided if possible. The following procedures are recommended for flight in severe turbulence.

1. Ignition - ON.
2. Airspeed approximately 180 KIAS. Do not chase airspeed.
3. Maintain a constant attitude without chasing the altitude. Avoid sudden large control movements.
4. Operation of autopilot is recommended using the soft ride mode with altitude hold, IAS hold and/or vertical speed hold disconnected as applicable.

SERVICING

FUEL

A variety of fuels can be used in the airplane but each must have anti-icing additive incorporated or added to the fuel during refueling. Commercial kerosene Jet A, Jet A-1, Jet A-2, Jet B, JP-4, JP-5, and JP-8 are approved fuels as well as Aviation Gasoline in specified amounts. Any grade of Aviation Gasoline is permitted for a maximum of fifty hours or 3500 gallons between engine TBOs providing the pilot operates the airplane within the limits specified in Section II of the Airplane Flight Manual. For record keeping purposes, one hour of engine operation equals seventy gallons of gasoline. Refer to the FAA Approved Airplane Flight Manual for limitations and fuel control density settings for optimum engine acceleration.

MIL-I-27686E must be used with fuel that does not contain an anti-icing additive. Start refueling while simultaneously applying the fuel additive. Assure that additive is directed into the flowing fuel stream for proper mixing. Additive flow should be started after fuel flow begins and stopped before fuel flow ends. Do not allow concentrated additive to contact coated interior of fuel tank or airplane painted surface. Do not use less than twenty fluid ounces of additive per 260 gallons of fuel or more than twenty fluid ounces per 104 gallons of fuel. Insufficient additive concentrations may result in fuel system icing. Excessive additive may cause fuel tank damage or erroneous fuel quantity indications.

WARNING

ANTI-ICING ADDITIVES CONTAINING ETHYLENE GLYCOL MONOMETHYL ETHEL (EGME) ARE HARMFUL IF INHALED, SWALLOWED OR ABSORBED THROUGH THE SKIN, AND WILL CAUSE EYE IRRITATION. ALSO, IT IS COMBUSTIBLE. BEFORE USING THIS MATERIAL, REFER TO ALL SAFETY INFORMATION ON THE CONTAINER.

When refueling, do not operate radios, radar or other electronic equipment and ensure the fuel truck is grounded and a ground is connected to the aircraft. A fuel ground plug attachment point is located under each wing tip.

It is not necessary to maintain fuel balance during refueling; however, maximum asymmetric fuel differential for flight is 800 pounds.

SERVICING

OIL

WARNING

PERSONS WHO HANDLE ENGINE OIL ARE ADVISED TO MINIMIZE SKIN CONTACT WITH USED OIL, AND PROMPTLY REMOVE ANY USED OIL FROM THEIR SKIN. A LABORATORY STUDY, WHILE NOT CONCLUSIVE, FOUND SUBSTANCES WHICH MAY CAUSE CANCER IN HUMANS. THOROUGHLY WASH USED OIL OFF SKIN AS SOON AS POSSIBLE WITH SOAP AND WATER. DO NOT USE KEROSENE, THINNERS OR SOLVENTS TO REMOVE USED ENGINE OIL. IF WATERLESS HAND CLEANER IS USED, ALWAYS APPLY SKIN CREAM AFTER USING.

Each engine oil tank has an oil filler neck with a dipstick and cap assembly. Oil is added to each engine directly through the filler neck, and quantity is measured on the dipstick in U.S. quarts. An accurate check of oil quantity can only be made when the engine is hot, within approximately ten minutes after engine shutdown.

EXXON TURBO OIL 2380, CASTROL 5000, AERO SHELL TURBINE OIL 500, ROYCO TURBINE OIL 500, MOBIL JET OIL II and MOBIL JET OIL 254 are all approved oils. Normally different brands of oil should not be mixed; however, if oil replenishment is required and oil of the same brand as tank contents is not available, follow procedures set forth in Section I of this manual, under OIL. The type of oil used in each airplane is noted in the engine logbook as well as on a placard inside the filler access door.

The latest revision of Pratt and Whitney Canada, Inc., Bulletin 7001 may also be consulted for approved oils.

HYDRAULIC

Servicing the main hydraulic reservoir requires equipment capable of delivering hydraulic fluid under pressure and is normally performed by maintenance personnel.

The reservoir should be serviced with one of the approved fluids, SKYDROL 500 A, B, B-4, C or LD-4; HYJET, HYJET W, III or IV only.

The hydraulic brake reservoir can be serviced by removing the right-hand baggage compartment aft liner to allow access to the reservoir. The filler plug can then be removed and the reservoir filled to within one-half inch of the opening. The brake reservoir should be serviced with one of the approved fluids, SKYDROL 500 A, B, B-4, C or LD-4; HYJET, HYJET W, III or IV only.

SERVICING

AIR CYCLE MACHINE

Mounted on the ACM is a translucent oil sump which contains approximately one-half cup of oil when properly serviced. Oil should be replenished if it falls below the FILL mark on the sump. If oil level is difficult to see, a flashlight held on the back side of the oil sump will illuminate it.

The sump is serviced by removing the filler plug and adding oil by means of a squirt can. The air cycle machine may be serviced with either oil conforming to MIL-2-7808 specifications or engine oil, but different type oils must not be mixed.

OXYGEN

The oxygen filler valve is located inside a small access door in the right nose baggage compartment. Oxygen servicing should be done by maintenance personnel using breathing oxygen conforming to MIL-O-27210, Type I. Reference the cockpit gauge while servicing to prevent overfill.

ALCOHOL

An alcohol reservoir is located next to the brake reservoir behind the right baggage compartment aft liner. The liner must be removed for servicing. The filler plug on the reservoir should be removed and alcohol added to bring the fluid level up to the neck of the filler plug. Filling to above the sight gauge provides a reserve supply of alcohol to perform preflight or operational checks without replenishing the reservoir.

FIRE BOTTLES

Underserviced fire bottles must be exchanged by authorized maintenance facilities.

Gear and Brake Pneumatic System

The emergency gear and brake bottle should be serviced when the pressure gauge reads below 1800 PSI. Maintenance personnel should perform the servicing with high pressure nitrogen and refill the bottle to 2000 PSI. Servicing is accomplished through a charging valve on the bottle which is located behind the right baggage compartment aft liner.

SERVICING

TIRES

Main gear tire pressures should be maintained at the following values:

500-0001 thru -0051 Except Airplanes Incorporating SB32-1	79 PSI, +3 or - 1 PSI
500-0052 thru -0070 Except Airplanes Incorporating SB32-1	90 PSI, + 3 or - 1 PSI
500-0071 and On and -0001 thru -0070 Incorporating SB32-1	100 PSI, + 5 or - 5 PSI

Service Bulletin 32-1 refers to the increased gross weight modification. The nose tire pressure is 120 +5 or -5 PSI on all airplanes. Since tire pressure will decrease as the temperature drops, a slight overinflation can be used to compensate for cold weather. Main tires inflated at 21°C (70°F) should be overinflated 1.5 PSI for each 10°C (18°F) drop in temperature anticipated at the coldest airport of operation. Nose tires at 21°C (70°F) should be overinflated only 0.5 PSI for each 10°C (18°F) anticipated drop in temperature.

TOILET

The standard toilet is serviced by removing the waste container and replacing the plastic bag.

The optional flush toilet reservoir requires servicing when the liquid level becomes too low or when liquid appears to have incorrect chemical balance. The reservoir can be emptied by turning the battery ON and inserting a coin, key or metal object in a slot located in the upper right-hand corner of the raised seat cover. This will actuate the flush motor and pump the liquid into the waste container for emptying. Add the proper mixture of water and chemical (one to two ounces of chemical per gallon of water) to the reservoir until water level reaches the "FILL TO HERE" line. It will take approximately two gallons of liquid if the reservoir is empty. If outside temperatures are below freezing and the aircraft is kept in an unheated hangar, add anti-freeze to both the reservoir and the waste container.

The waste container itself can be lifted out of the toilet and emptied and cleaned as necessary.

AIRPLANE CLEANING AND CARE

PAINTED SURFACE

The painted exterior surfaces of your new airplane require an initial curing period which may be as long as 90 days after the finish is applied. During this curing period some precautions should be taken to avoid damaging the finish or interfering with the curing process. The finish should be cleaned only by washing with clean water and mild soap, followed by a rinse water and drying with cloths or a chamois. Do not use polish or wax, which would exclude air from the surface, during this 90-day curing period. Do not rub or buff the finish and avoid flying through rain, hail or sleet.

To help prevent development of corrosion, particularly filiform corrosion, the airplane should be spray washed at least every two or three weeks (especially in warm, damp and salty environments), and waxed with a good grade of water repellant wax to help keep water from accumulating in skin joints and around countersinks. A heavier coating of wax on the engine nose will help reduce abrasions.

DEICE BOOTS

The optional deice boots have a special, electrically conductive coating to bleed-off static charges which cause radio interference and may perforate the boots. Fueling and other servicing operations should be done carefully, to avoid damaging this conductive coating or tearing the boots.

To prolong the life of surface deice boots, they should be washed and serviced on a regular basis. Keep the boots clean and free from oil, grease and other solvents which cause rubber to swell and deteriorate. Outlined below are recommended cleaning and servicing procedures.

CAUTION

Use only the following instructions when cleaning boots. Disregard instructions which recommend petroleum base liquids (Methyl-Ethyl-Ketone, non-leaded gasoline, etc) which can harm the boot material.

Clean the boots with mild soap and water, then rinse thoroughly with clean water.

NOTE

Isopropyl alcohol can be used to remove grime which cannot be removed using soap. If isopropyl alcohol is used for cleaning, wash area with mild soap and water, then rinse thoroughly with clean water.

AIRPLANE CLEANING AND CARE

To possibly improve the service life of deice boots and to reduce the adhesion of ice, it is recommended that the deice boots be treated with AGE MASTER Number 1 and ICEX.

AGE MASTER Number 1, used to protect the rubber against deterioration from ozone, sunlight, weathering, oxidation and pollution, and ICEX, used to help retard ice adhesion and for keeping deice boots looking new longer, are both products of and recommended by B.F. Goodrich.

The application of both AGE MASTER Number 1 and ICEX should be in accordance with the manufacturer's recommended directions as outlined on the containers.

CAUTION

Protect adjacent areas, clothing, and use plastic or rubber gloves during applications, as AGE MASTER Number 1 stains and ICEX contains silicone which makes paint touchup almost impossible.

Ensure that the manufacturer's warnings and cautions are adhered to when using AGE MASTER Number 1 and ICEX.

If a high gloss finish is desired on the deice boots, ACROSEAL coating (available form Huber Janitorial Supplies, 114 North St. Francis Street, Wichita, KS 67202) may be used in lieu of AGE MASTER Number 1 and/or ICEX. Preparation for application of ACROSEAL is the same as required for AGE MASTER Number 1 and ICEX. Apply a thin layer of ACROSEAL on the clean and dry surface of the deice boot with a cloth swab. Let dry thoroughly and hand buff with a soft cloth.

Small tears and abrasions can be repaired temporarily without removing the boots and the conductive coating can be renewed.

ENGINES

The engine compartments should be cleaned, using a suitable solvent. Most efficient cleaning is done using a spray-type cleaner. Before spray cleaning, ensure protection is afforded for other components which might be adversely effected by the solvent. Refer to the Airplane Maintenance Manual for proper lubrication of components after engine cleaning.

AIRPLANE CLEANING AND CARE

INTERIOR CARE

To remove dust and loose dirt from the upholstery, headliner and carpet, clean the interior regularly with a vacuum cleaner.

Blot up any spilled liquid promptly with cleansing tissue or rags. Don't pat the spot; press the blotting material firmly and hold it for several seconds. Continue blotting until no more liquid is taken up. Scrape off sticky materials with a dull knife, then spot clean the area.

Oily spots may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

WARNING

Use all cleaning agents in accordance with the manufacturer's recommendations.

The use of toxic or inflammable cleaning agents is discouraged. If these cleaning agents are used, ensure adequate ventilation is provided to prevent harm to the user and/or damage to the airplane.

Soiled upholstery and carpet may be cleaned with foam-type detergent, used according to the manufacturer's instructions. To minimize wetting the fabric, keep the foam as dry as possible and remove it with a vacuum cleaner.

The plastic trim instrument panel and control knobs need only be wiped with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with kerosene, Volatile solvents, such as mentioned in paragraphs on care of the windshield, must never to used since they soften and craze the plastic.

WINDOWS AND WINDSHIELDS

The acrylic windshields and windows should be kept clean and waxed at all times. To prevent scratches and crazing, wash them carefully with plenty of soap and water, using the palm of the hand to feel and dislodge dirt and mud. A soft cloth, chamois or sponge may be used, but only to carry water to the surface. Rinse thoroughly, then dry with a clean, moist chamois. Rubbing the surface of the plastic with a dry cloth builds up an electrostatic charge which attracts dust particles in the air. Wiping with a moist chamois will remove both the dust and this charge.

AIRPLANE CLEANING AND CARE

Remove oil and grease with a cloth moistened with kerosene, never use gasoline, benzine, acetone, carbon tetrachloride, fire extinguisher fluid, lacquer thinner or glass cleaner. These materials will soften the acrylic and may cause it to crase.

After removing dirt and grease, if the surface is not badly scratched, it should be waxed with a good grade of commercial wax. The wax will fill in minor scratches and help prevent further scratching. Apply a thin, even coat of wax and bring it to a high polish by rubbing lightly with a clean, dry, soft flannel cloth. Do not use a power buffer; the heat generated by the buffing pad may soften the acrylic.

Do not use a canvas cover on the windshield unless freezing rain or sleet is anticipated. Canvas covers may scratch the acrylic surface.

OXYGEN MASKS

The crew masks are permanent-type masks which contain a microphone for radio transmissions. The passenger masks are oro-nasal type which forms around the mouth and nose area. All masks can be cleaned with alcohol. Do not allow solution to enter microphone or electrical connections. Apply talcum powder to external surfaces of passenger mask rubber face-piece.

SECTION V

ABNORMAL PROCEDURES

PAGE

ICE and RAIN PROTECTION

Windshield Anti-Ice Failure (W/S HEAT FAIL Light On).
(500-0001 Thru -0040 Except Airplanes Incorporating SB30-1)

1. Anti-ice Controls - CHECK SWITCHES and CIRCUIT BREAKERS.
   Check windshield bleed air off. Using windshield bleed air with electric windshield will disable the windshield heat circuit and cause illumination of the respective W/S HEAT FAIL light.
2. Windshield Bleed Air Valves - AS REQUIRED.
   Turn off electric windshield heat switch and turn bleed air on only on the side with the inoperative windshield anti-ice.

Windshield Bleed Air Failure.
(500-0041 and On and -0001 thru -0040 Incorporating SB30-1)

1. Windshield Bleed Air Switch and Valves - OFF.
2. Windshield Alcohol Anti-ice - AS REQUIRED.
   A ten minute supply of alcohol is available to the pilot's windshield only.
3. Leave icing environment.

Windshield Air Overheat.

The windshield bleed air system will be inoperative when the W/S AIR O'HEAT light is illuminated.

MOMENTARY ILLUMINATION

1. Windshield Bleed Air Valves - REDUCE.
   The manually controlled bleed air valves reduce the amount of bleed air reaching the windshield.

CONTINUOUS ILLUMINATION

1. Windshield Bleed Air Valves - LH and RH OFF (500-0001 thru -0040 except airplanes incorporating SB30-1).

Bleed air is prevented from reaching the windshield by the bleed air valves.

1. Windshield Bleed Air Switch and Valves - OFF (500-0041 and On and -0001 thru -0040 incorporating SB30-1).
   If the W/S AIR O'HEAT light remains on it indicates that the windshield bleed air shutoff valve has failed in the open position. The amount of air reaching the windshield will still be regulated by the manual control valves.
2. Windshield Alcohol Anti-ice - AS REQUIRED.
3. Leave icing environment.

Engine Anti-Ice Failure (ENGINE ICE FAIL Light On)

CONTINUOUS ILLUMINATION

1. Throttle - INCREASE POWER

   A minimum of 60% N_2 must be maintained for effective engine anti-icing.
2. Engine Anti-ice Controls - CHECKS SWITCHES and CIRCUIT BREAKERS.
3. Leave icing environment.

MOMENTARY ILLUMINATION

1. Advisory - Indicates failure of the normal temperature controller or of a wing heating element and the system is cycling on the over-temperature sensor.

Pitot-Static Failure

1. Anti-ice Switches and Circuit Breakers - CHECK.

   Check pitot heat switch on.
2. Determine Inoperative System.

   On 500-0001 thru -0274, the autopilot references the co-pilot's pitot static system; therefore, the altitude hold function will be inoperative if the co-pilot's pitot static system fails. Angle-of-attack, if installed, will be available for airspeed reference in the event of a dual pitot-static failure. As an emergency altitude reference, cabin pressure can be dumped and the cabin altimeter utilized for a rough altitude reference.

APPROACH and LANDING

Single-Engine Approach And Landing

1. Seats, Seat Belts and Shoulder Harnesses - SECURE.
   Check seats locked in the desired position. Check seat belts snug and shoulder harnesses latched to the buckle.
2. V_{REF}, V_2, Fan Speed Settings - CONFIRM
   Based on destination field information and estimated arrival gross weight check runway requirements and determine V_{REF}. Compute takeoff N_1 and V_2 for use in the event of a missed approach.
3. Passenger Advisory Lights - PASS SAFETY.
   Turn on SEAT BELT/NO SMOKING signs and emergency exit lights.
4. Aft Facing Seat - CHECK FULL AFT and UPRIGHT.
   This will provide unobstructed access to the emergency exit door.
5. Crossfeed - OFF.
   Check CROSSFEED knob OFF and INTRANSIT and FUEL BOOST ON lights extinguished.
6. Ignition (Operating Engine) - ON.
   May preclude flameout should engine ingestion problem occur during approach and landing.
7. Flaps - T.O. and APPR.
   If flaps are in the LAND position at the time of the engine failure, they should be raised to the T.O. and APPR position for optimum maneuvering. If the airplane is established on glide slope at the time of engine failure, a 4-5% N_1 power addition when the flaps are brought to T.O. and APPR should be sufficient to maintain a stabilized rate of descent and approach speed.
8. Landing Gear - DOWN and LOCKED.
   May be extended below 176 KIAS.
9. Airspeed - V_{REF}, +10 KIAS
   A target N_1 power setting of between 65-70% depending on gross weight can be used to establish V_{REF} +10 KIAS in the single engine, T.O. and APPR flap configuration.
10. Annunciator Panel - CHECK.
    With one engine shut down by the throttle, the appropriate OIL PRESS LO, GEN OFF, FUEL BOOST ON and HYD PRESS LO lights will be on. Initially, the FUEL PRESS LO light would be on, but when the fuel boost pump is turned on to prevent damage to the engine fuel pump, this light will extinguish. If the engine is shut down by the firewall shutoff switch, the appropriate F/W SHUTOFF, OIL PRESS LO, FUEL PRESS LO, GEN OFF and HYD PRESS LO lights will be on. The low fuel pressure will turn on the fuel boost pump, but in this case, it should be manually cycled to OFF.

11. Flaps - LAND (When Landing Assured).
    At the pilot's discretion, flaps may be left at T.O. and APPR or lowered to LAND. If T.O. and APPR flaps are used, maintain V_{REF} +10 KIAS or "on speed" angle of attack. LAND flaps are used under most conditions since little pitch change is encountered when they are selected and touchdown speed can be reduced.
12. Airspeed - V_{REF}.
    Maintain V_{REF} after flaps placed to LAND.
13. Antiskid (if installed) - CHECK ON.
14. Engine Synchronizer - OFF.
15. Autopilot and Yaw Damper - OFF.
16. Annunciator Panel - CLEAR.
    Annunciator panel clear except for annunciations caused by inoperative engine.
17. Pressurization - CHECK ZERO DIFFERENTIAL.
18. Speedbrakes - RETRACTED PRIOR TO 50 FEET.

Approach and Landing with a Thrust Reverser Deployed

AFFECTED ENGINE AT IDLE OR SHUTDOWN

1. Inadvertent Inflight Deployment Checklist - COMPLETE.
2. Use Single Engine Approach and Landing Procedure.

Single-Engine Go-Around

1. Throttle (Operating Engine) - T.O. POWER
   T.O. power for go-around should be set in N_1 counter before commencing the approach.
2. Flaps - T.O. & APPR.
   If flaps have been lowered to LAND, they must be raised to T.O. & APPR. or the single engine climb performance of the aircraft will be degraded.
3. Landing Gear - UP (when positive rate of climb is established).
4. Climb - NORMAL, using single-engine climb speed.
   If angle of attack is installed, monitor it closely during the transition to a climbing attitude. Holding .6 on the indicator will provide the best Lift/Drag ratio and best angle of climb. Once all obstructions are cleared and the aircraft is climbing comfortably, retract the flaps at V_{REF} +10 minimum and transition to the appropriate single engine climb speed.

APPROACH and LANDING

Single Engine Reversing

1. Thrust Levers - IDLE.
2. Brakes - APPLY.
3. Speed Brakes - EXTEND.
4. Thrust Reverser - DEPLOY (AFTER NOSEWHEEL ON GROUND).
5. Reverser Indicator Lights - CHECK ILLUMINATION OF "ARM", "UNLOCK", AND "DEPLOY" LIGHTS.
6. Reverser Power - AS REQUIRED.
7. Thrust Reverser - Reverser LEVER TO IDLE REVERSE AT 60 KIAS

NOTE

Reverse thrust may need to be reduced during crosswind landings on wet or icy runways.

Flaps Inoperative Approach and Landing

1. Seats, Seat Belts and Shoulder Harnesses - SECURE.
   Check seats locked in the desired position. Check seat belts snug and shoulder harnesses locked to the buckle.
2. Approach Speed, V_2, Fan Speed Setting - CONFIRM.
   Approach Speed: Flaps 15°, V_{REF} +10 KIAS
   Flaps 0° or Unknown, V_{REF} +20 KIAS.
   V_2 Speed: Flaps 15° (refer to Approach and Landing Section in Airplane Flight Manual.) for V_2 Speed.)
   Flaps 0°or Unknown, V_{REF} +10.
3. Airspeed - V_{REF} +10 KIAS (Flaps 15°) or V_{REF} +20 KIAS (Flaps 0°)
   If angle of attack is installed, fly "on speed" indication, cross checking with airspeed indicator. Due to the increased airspeed and low drag configuration, the airplane will have an increased tendency to "float" in ground effect. To counter this, the airplane should be flown onto the runway, using only a slight flare to break the rate of descent. Touchdown attitude will be flatter than normal and speed should not be in excess of V_{REF} +20 KIAS. Landing field length increases approximately 40% for a no flap landing.
4. Flap Control and Flap Motor Circuit Breakers - CHECK IN.
   Check both of these circuit breakers on the left circuit breaker panel engaged.
5. Passenger Advisory Lights - PASS SAFETY.
6. Aft Facing Seat - CHECK FULL AFT and UPRIGHT.
   This will provide unobstructed access to the emergency exit door.

7. Crossfeed - OFF.
   Check CROSSFEED Knob OFF and INTRANSIT and FUEL BOOST ON Lights extinguished.
8. Ignition - ON.
   May preclude flameout should engine ingestion problem occur during approach and landing.
9. Landing Gear - DOWN and LOCKED.
10. Engine Synchronizer - OFF.
11. Autopilot and Yaw Damper - OFF.
12. Annunciator Panel - CLEAR.
13. Pressurization - CHECK ZERO DIFFERENTIAL.
14. Speedbrakes - RETRACTED PRIOR TO 50 FEET.

Jammed Elevator Trim Tab

CRUISE

1. Maintain trim speed as long as practical. DO NOT extend flaps for approach or landing. Use FLAPS INOPERATIVE APPROACH AND LANDING procedure.

TAKEOFF or GO AROUND

1. Reduce power as necessary to maintain 120 KIAS or less. DO NOT change flap position. Minimum speed is V_{REF} for flaps in land position, V_{APP} for flaps in T.O. & APPR. position or V_{REF} +20 KIAS FOR 0-degree flaps. DO NOT retract landing gear. Land as soon as practical. If flaps are not in LAND position, use FLAPS INOPERATIVE LANDING procedure.

Landing Gear Will Not Extend

FREE FALL EXTENSION

1. Landing Gear Handle - CHECK DOWN (Airspeed Below 176 KIAS).
   With the gear handle in the down position, gear warning lights will be available for subsequent gear free-fall. Also check GEAR CONTROL circuit breaker in.
2. Airspeed - BELOW 176 KIAS
3. Auxiliary Gear Control - PULL THE HANDLE AND ROTATE TO LOCK
   Pull the handle to the full extent and rotate clockwise approximately 45° to mechanically release the three landing gear uplatches.

4. Rudder - YAW AIRPLANE if necessary to achieve downlock indications.

   Yawing provides an aerodynamic side load on the main gear which will assist the locking process.

   If practical, stabilize the aircraft at 150 KIAS with the flaps up, the optimum speed/configuration for free-fall extension.

5. Auxiliary Gear Control - PULL KNOB TO BLOW DOWN (for positive downlock).

   This will route high pressure air to the down side of the hydraulic cylinders forcing them into the locked position. Do not reset the knob.

Antiskid System Failure (ANTI-SKID INOP Light On)

1. Antiskid Switch - ON.
2. Skid Control Circuit Breaker - RESET.

IF LIGHT REMAINS ON

3. Antiskid Switch - OFF.

NOTE

Power brakes will still be operational with antiskid OFF and skid control circuit breaker in. Excessive braking can cause a wheel to lock, resulting in a blowout.

Power Brake System Failure (PWR BRK PRESS LO Light on)

1. Skid Control Circuit Breaker - RESET.

IF LIGHT REMAINS ON

2. Plan to use the emergency brake system for landing.
3. Brake Pedals - REMOVE FEET FROM BRAKE PEDALS.

   If the brakes are depressed while the emergency air brakes are actuated, high pressure air will bypass the shuttle valve and possibly rupture the brake fluid reservoir.

4. Emergency Brake Handle - PULL AS REQUIRED.

   Pulling the emergency brake handle will apply equal pressure to both brakes. The emergency air bottle holds enough air for approximately ten full applications, but excessive modulation should be avoided. Best results are obtained using slow steady pressure until the airplane is stopped. Although differential braking is not available, directional control can be easily maintained utilizing nose gear steering, rudder and aileron. If the landing gear has been lowered by the emergency air method, emergency braking will continue to be available; however, the number of applications available will be reduced.

NOTE

Antiskid system does not function during emergency braking. Excessive pressure on emergency brake handle can cause both wheel brakes to lock, resulting in blowout of both tires.

Wheel Brake Failure

1. Brake Pedals - REMOVE FEET FROM BRAKE PEDALS.

   If the brakes are depressed while the emergency air brakes are actuated, high pressure air will bypass the shuttle valve and possibly rupture the brake fluid reservoir.

2. Emergency Brake Handle - PULL AS REQUIRED.

   Pulling the emergency brake handle will apply equal pressure to both brakes. The emergency air bottle holds enough air for approximately ten full applications, but excessive modulation should be avoided. Best results are obtained using slow steady pressure until the airplane is stopped. Although differential braking is not available, directional control can be easily maintained utilizing nose gear steering, rudder and aileron. If the landing gear has been lowered by the emergency air method, emergency braking will continue to be available; however, the number of applications available will be reduced.

NOTE

The antiskid system does not function during emergency braking. Excessive pressure on emergency brake handle can cause both wheel brakes to lock, resulting in blowout of both tires.

FUEL

Low Fuel Pressure (FUEL PRESS LO Light ON)

1. Fuel Boost - ON.

   Check fuel boost pump circuit breakers in. Low fuel pressure should activate the boost pump automatically, but the switch should be turned on to ensure the pump is being powered.

2. Fuel - CHECK.
3. Crossfeed - IF REQUIRED.

   Crossfeeding will allow the boost pump in the opposite tank to pressurize the entire fuel system and should extinguish the light.

Low Fuel Quantity (FUEL LEVEL LO Light On)

1. Advisory - The illumination of this light serves notice to the pilot that a minimum of 170 pounds of fuel remains in either tank.
2. Fuel Boost - ON.

   Check fuel boost pump circuit breakers in. To ensure uninterrupted fuel flow to the engines, the boost pump switches must be positioned ON when the low fuel lights illuminate.

3. Land As Soon As Practical.

Fuel Filter Bypass

1. Advisory - Inspect filters after landing. If FUEL FILTER BYPASS light illuminates during high altitude flight, suspect ice formation across filter. Check tank sump and filter quick drains after landing for water accumulation and refer to airplane maintenance manual for additional information.

HYDRAULIC

Low Hydraulic Pressure (HYD PRESS LO Light On)

1. Advisory: Appropriate HYD PRESS LO light will illuminate when pump output is abnormally low. Illumination of this light is common during single engine operation. During normal operation, illumination of either HYD PRESS LO light may indicate an inoperative hydraulic pump, in which case gear extension may be slower than usual.

Low Hydraulic Fluid Level (HYD LEVEL LO Light On)

1. Land as soon as practical - the speedbrakes and thrust reversers may not operate and the gear may not operate using normal procedures.

Hydraulic System Remains Pressurized

Isolate the problem by:

1. Speedbrake Control Circuit Breaker - PULL.
   If system remains pressurized, RESET the circuit breaker.
2. Gear Control Circuit Breaker - PULL.
   If system remains pressurized, RESET the circuit breaker.
3. Thrust Reverser Circuit Breakers - PULL ONE AT A TIME.
   If system remains pressurized, RESET the circuit breakers.
4. Leave the affected Circuit Breaker(s) - PULLED.
   Pulling a circuit breaker removes electrical power from the affected control valve causing it to send an "open" signal to the hydraulic open center bypass valve which relieves the hydraulic pressure.

NOTE

With a thrust reverser circuit breaker pulled, the emergency stow system of the opposite reverser is deactivated.

5. If none of the above circuit breakers relieve the hydraulic pressure - LAND as soon as practical. If the system remains pressurized, fluid overheating may occur and damage the system.
6. Reinstate the circuit breakers before landing for operation of gear, speedbrakes and thrust reversers.

Single Generator Failure (GEN OFF Light On)

1. Electrical Load - DECREASE if required (400 amps maximum up to 35,000 ft.)
   (On 500-0214 and On, 325 amps maximum above 35,000 ft.)
2. Failed Generator - CHECK SWITCHES and CIRCUIT BREAKERS; RESET AND REINSTATE APPROPRIATE GENERATOR AS REQUIRED

Rotating the voltage selector knob to the appropriate position may aid in isolating the problem. If the voltage is normal, it indicates that the generator power relay has tripped due to reverse current or undervoltage and generator reset is unlikely. A reading of zero indicates that the generator field relay has tripped due to an overvoltage, feeder fault or use of the Fire Switch. In this case a reset may be possible.

IF UNABLE TO RESET

3. Failed Generator - OFF.

#1 AC Power Failure (FD AC PWR OFF Light On)

1. #1 Inverter - OFF.
   Since the inverter may have failed from either a high or low voltage condition, the failed inverter should always be turned OFF before selecting XOVER.
2. AC Power Crossover - XOVER.
   All functions of the FD AC bus operate normally. Since the radar is no longer receiving AC power, it should be turned off to prevent overheating of its DC powered components.

#2 AC Power Failure (RAD AC PWR OFF Light On)

1. #2 Inverter - OFF.
   The radar and the Bendix radio altimeter, if installed, will be inoperative. The Collins radio altimeter has its own power source and will operate in the event of a radar AC bus failure. The #1 AC inverter can be used to power the radar by use of the crossover switch, but if the flight director AC bus inverter is not being powered, the radar antenna will not be gyro stabilized, as radar stabilization input is normally received from the ADI.
2. Radar - OFF.

ELECTRICAL

Single Generator Failure (GEN OFF Light On)

1. Electrical Load - DECREASE if required (400 amps maximum up to 35,000 ft.,
   325 amps maximum above 35,000 ft.)
2. Failed Generator - CHECK SWITCHES and CIRCUIT BREAKERS; RESET AS REQUIRED.
   Rotating the voltage selector knob to the appropriate position may aid in isolating the problem. If the voltage is normal it indicates that the generator power relay has tripped due to reverse current or undervoltage and generator reset is unlikely. A reading of zero indicates that the generator field relay has tripped due to an overvoltage, feeder fault or use of the Fire Switch. In this case a reset may be possible.

IF UNABLE TO RESET

3. Failed Generator - OFF.

AC Power Failure (AC PWR FAIL Light On)

1. Avionics Power - Select Opposite Inverter (INV 1 or INV 2 as appropriate).
   Either inverter will supply total AC requirements. Switching to the standby inverter will reinstate all power to equipment requiring AC.

ELECTRICAL

Electric Elevator Trim Failure

RUNAWAY TRIM

1. Autopilot/Trim Disengage Switch - PRESS.
   This will stop the electric trim. Pull the PITCH TRIM circuit breaker to permanently remove power to the trim motor.
2. Manual Elevator Trim - AS REQUIRED.

Electric Trim Inoperative

1. Electric Trim Circuit Breaker (Pitch Trim) - CHECK IN.

IF STILL INOPERATIVE

2. Manual Elevator Trim - AS REQUIRED.

Low Oil Pressure

500-0001 thru -0349 not incorporating SB79-1

BETWEEN 35 and 65 P.S.I.

1. Throttle (Affected Engine) - REDUCE POWER.

   If the oil pressure stabilizes between 35 and 65 p.s.i. when power is reduced, the engine may be run at reduced power setting for the completion of the flight.

BELOW 35 P.S.I.

1. Throttle (Affected Engine) - OFF.

   With oil pressure below 35 p.s.i. the engine should be shut down or a landing be made as soon as possible using the minimum power required to sustain flight.
2. Accomplish Engine Failure/Precautionary Shutdown Checklist

Low Oil Pressure - "OIL PRESS LO" Light On

500-0001 thru -0349 incorporating SB79-1

ABOVE 65 PSI

1. Land as soon as practical.

BETWEEN 35 AND 65 PSI

1. Throttle (Affected Engine) - REDUCE POWER

   Maintain reduced power setting for the remainder of the flight.
2. Land as soon as practical.

BELOW 35 PSI

1. Throttle (Affected Engine) - OFF

   With oil pressure below 35 PSI, the engine should be shut down or a landing be made as soon as possible using minimum power required to sustain flight.
2. Accomplish Engine Failure/Precautionary Shutdown Checklist.

Low Oil Pressure - "OIL PRESS LO" Light Off

500-0001 thru -0349 incorporating SB79-1

BETWEEN 35 AND 65 PSI

1. Throttle (Affected Engine) - REDUCE POWER.

   If the oil pressure stabilizes between 35 and 65 PSI when power is reduced, the engine may be run at reduced power setting for the completion of the flight.

BELOW 35 PSI

1. Land as soon as practical.

ENGINE

False Engine Start (Engine Does Not Light)

1. Throttle - OFF.

   If no light off within 10 seconds move the throttle to OFF to cut off fuel to the engine.

2. Starter Disengage - PRESS.

   Allow the engine to windmill on the starter for fifteen seconds to blow excess fuel out of the tailpipe. After engine has windmilled for fifteen seconds, PRESS starter disengage.

Engine Fire During Ground Shutdown (High or Sustained ITT)

1. Throttle - CHECK OFF.

   Fuel is cut off to the engine.

2. Start Button - PRESS momentarily.

   This will start the engine windmilling to extinguish the fire and remove residual fuel.

3. Starter Disengage - PRESS after fifteen seconds.

   If the fire continues, depress the Engine Fire Switch and fire the freon bottle.

NOTE

A $C0_2$ fire extinguisher should not be used on a hot engine, except as a last resort, since it can cause severe engine damage due to extremely rapid cooling.

ENVIRONMENTAL

Environment System Air Duct Overheat (AIR DUCT O'HEAT Light On)

1. Circuit Breakers - RESET.

   TEMP control circuit breaker on LH circuit breaker panel must be in for either manual or automatic temperature control.

2. Auto Temp Select - MAN.
3. Manual Heat/Manual Cool Switch - MAN COOL.

   Hold in this position until the overheat light goes out. Approximately 11 seconds are required for the mixing valve to travel from the full hot to the full cold position.

IF LIGHT DOES NOT GO OUT

4. Pressurization Source Selector - LH or RH.

   Reduce power on selected engine if necessary.

AFTER LIGHT GOES OUT

5. Control cabin temperature manually with MAN HEAT/MAN COOL switch.

   If the auto temp control has been at a very warm setting for ground operation, an overheat condition may occur when takeoff power is applied. Setting the auto temp control to the twelve o'clock position just prior to takeoff should preclude this. If an overheat does occur, cabin temp control can be returned to the automatic mode once the overheat light is out.

Emergency Pressurization On (Automatic Actuation)

Advisory: Indicates air cycle machine failure or shutdown.

1. Temp Control - ADJ. TO WARMER SETTING.

   A time delay relay will lock the system into emergency pressurization if air cycle machine temperature remains too high for 12 seconds or more. If the machine cools sufficiently in less than 12 seconds, the system will automatically return to the previously selected mode.

2. Pressurization Source Selector - EMER.

   Wait at least one minute after pressurization source selector has been positioned to EMER before making the next selection.

3. Pressurization Source Selector - RH, LH or BOTH.

IF EMERGENCY PRESSURIZATION REMAINS ON

4. Press Source Select - EMER.
5. Control Cabin Temperature with LH Throttle.

   Emergency pressurization air is hot air only and temperature cannot be regulated by temperature selectors.

Vacuum System Failure

1. Pressurization Source Selector - OFF before landing.

   Turning the pressurization source selector to OFF before landing will remove the pressurization air source, allowing the cabin pressure to bleed overboard. The cabin outflow valve will be driven to the full closed position by spring pressure. Maximum differential pressure will be maintained by the safety outflow valve. The emergency dump valve will be inoperative. In Aircraft S/N 0001-0213, the copilot's attitude gyro will also be inoperative.

Door Not Locked (Door Not Locked Light On)

Advisory: Indicates unlocked/unlatched nose or tailcone doors, failure or improper position of one of more door switches, and/or possible disengagement of the lower forward cabin door pin.

On the Ground:

1. Correct condition prior to flight.

In Flight:

1. Cabin Altitude - SELECT to 9500 feet.
2. Airspeed - REDUCE.
3. Passenger Advisory Light - PASS SAFETY.
4. Cabin Door - KEEP CLEAR.
5. Descend to a lower altitude.
6. Land as soon as practical.

SECTION VI

EMERGENCY PROCEDURES

ENGINE

Procedures in this section outlined in red [ ] are immediate action items and should be committed to memory.

Engine Failure or Fire During Takeoff (without Thrust Reversers)

SPEED BELOW V_1 - TAKEOFF SHOULD NORMALLY BE ABORTED

1. Brakes - AS REQUIRED.
2. Throttles - IDLE.
3. Speedbrakes - EXTEND.

IF ENGINE FIRE

4. Accomplish ENGINE FIRE procedures.

IF ENGINE FAILURE

4. Accomplish ENGINE FAILURE/PRECAUTIONARY SHUTDOWN procedure.

NOTE

The takeoff field lengths assume that the pilot has maximum effort applied to the brakes at the scheduled V_1 speed during the aborted takeoff.

SPEED ABOVE V_1 - TAKEOFF SHOULD NORMALLY BE CONTINUED

1. After establishing a positive rate of climb, retract landing gear. Climb at V_2.
2. At 400 feet, retract the flaps at V_2+10 and accelerate to 140 KIAS.

IF ENGINE FIRE

3. Accomplish ENGINE FIRE procedures.

IF ENGINE FAILURE

3. Accomplish ENGINE FAILURE/PRECAUTIONARY SHUTDOWN procedure.

Engine Failure or Fire During Takeoff (with Thrust Reversers)

SPEED BELOW V_1 - TAKEOFF SHOULD NORMALLY BE ABORTED

1. Brakes - AS REQUIRED.
2. Throttles - IDLE.
3. Speedbrakes - EXTEND.
4. Thrust Reverser - DEPLOY ON UNAFFECTED ENGINE.

5. Reverser Indicator Lights - CHECK ILLUMINATION of ARM, UNLOCK AND DEPLOY LIGHTS
6. Thrust Reverser - REVERSE POWER ON THE UNAFFECTED ENGINE.

IF ENGINE FIRE

7. Accomplish ENGINE FIRE procedures.

IF ENGINE FAILURE

7. Accomplish ENGINE FAILURE/PRECAUTIONARY SHUTDOWN procedure.

NOTE

The takeoff field lengths assume that the pilot has maximum effort applied to the brakes at the scheduled V_1 speed during the aborted takeoff.

Engine Failure/Precautionary Shutdown

1. Throttle (affected engine) - OFF.
2. Electrical Load - REDUCE as required.
   Monitor ammeters to keep electrical load below 400 amps maximum up to 35,000 ft., 325 amps maximum above 35,000 ft.
3. Crossfeed - AS REQUIRED.
   Do not exceed 800 lbs. asymmetric fuel load. If no fire hazard exists, leave firewall shutoff open and turn boost pump ON to prevent damage to engine-driven fuel pump. If engine windmills with firewall shutoff CLOSED or with no indication of oil pressure, refer to engine maintenance manual.
4. Generator (affected engine) - OFF.
   Any one or more of the following indications might suggest a precautionary shutdown: abnormal or rising ITT, engine vibration, fan/turbine RPM fluctuating or abnormally high or low, abnormal oil pressure, abnormal oil temperature, or erratic fuel flow. Circumstances will normally dictate whether to continue to operate the engine with possible further damage, or shut it down.

Engine Failure During Coupled Approach

1. Power (operating engine) - INCREASE as required.
   Only a small power increase will be required to maintain approach speed and correct rate of descent.
2. Rudder Trim - TRIM toward operating engine.
   The yaw change will be relatively small since the operating engine is at an approach power setting.
3. Airspeed V_{REF} + 10.
4. Flaps - T.O. & APPR.
   Accelerate to V_{REF} + 10 before raising flaps.

5. Throttle (affected engine) - OFF.
6. If Engine Fire, accomplish ENGINE FIRE procedure.
7. Passenger Advisory Lights - PASS SAFETY.
8. Aft Facing Seat - CHECK FULL AFT & UPRIGHT. Ensures unobstructed access to Emergency Exit.
9. Ignition (operating engine) - ON.
10. Landing Gear - DOWN and LOCKED.
11. Annunciator Panel - CHECK.
    With one engine shut down by the throttle, the appropriate OIL PRESS LO, GEN OFF, FUEL BOOST ON, and HYD PRESS LO lights will be on. Initially, the FUEL PRESS LO light would be on, but when the fuel boost pump is turned ON to prevent damage to the engine-driven fuel pump, this light will extinguish. If the engine is shut down by the firewall shutoff switch, the appropriate F/W SHUTOFF, OIL PRESS LO, FUEL PRESS LO, GEN OFF and HYD PRESS LO lights will be on. The low fuel pressure will turn on the fuel boost pump, but in this case it should be manually placed to OFF. In either case, if the MASTER WARNING light is flashing, it should be extinguished to reduce distraction.
12. Flaps - LAND (when landing assured).
    At the pilot's discretion, flaps may be left at T.O. & APPR. or lowered to LAND. If T.O. & APPR. flaps are used, maintain V_{REF} +10 KIAS or "on speed" angle of attack. LAND flaps are used under most conditions since little pitch change is encountered when they are selected and touchdown speed can be reduced.

ENGINE

Emergency Restart - One Engine

FOLLOWING SHUTDOWN - WITH STARTER ASSIST

1. Throttle - OFF.
2. Generator - GEN.
3. Firewall Shutoff - CHECK OPEN.
4. Ignition - ON.
5. Start Button - PRESS momentarily.

   Generator cross start is disabled with weight off the left main gear squat switch to preclude generator damage from excessive N_2 RPM on the operating engine.
6. Throttle - IDLE at 8 to 10% N_2.
7. Engine Instruments - MONITOR.

   Maximum start ITT - 700° for two seconds.
8. Ignition - NORM.

Emergency Restart - One Engine

FOLLOWING SHUTDOWN - WINDMILLING WITH AIRSPEED ABOVE 200 KIAS

1. Throttle - OFF.
2. Firewall Shutoff - CHECK OPEN.
3. Ignition - ON.
4. Boost Pump - ON.

   Associated engine ignition and boost pump switches must be selected ON since automatic sequencing and selection of these functions does not occur when the start button is not utilized.
5. Throttle - IDLE.

   With airspeed maintained above 200 KIAS, throttle should be brought to IDLE. An N_2 of 8-10% is not required.
6. Engine Instruments - MONITOR..
7. After Engine Stabilizes - Boost Pump and Ignition - NORM.

   It may be necessary to select the associated generator RESET position momentarily to reinstate the generator following a windmilling airstart. Maximum start ITT - 700° for two seconds.
8. Generator - GEN.

Emergency Restart - Two Engines

1. Ignition - BOTH ON.
2. Boost Pumps - BOTH ON.
   Engine ignition and boost pump switches must be selected ON since automatic sequencing and selection of these functions does not occur when the start button is not utilized.
3. Throttles - IDLE.
   Throttles remain at idle for attempted immediate light-off.
4. If Altitude Allows - INCREASE AIRSPEED TO 200 KIAS.
   Possibilities of immediate start are increased if airspeed is over 200 KIAS.
5. Firewall Shutoff - CHECK OPEN.
6. All Anti-ice Switches - OFF.
   They are turned OFF to minimize engine bleed air losses.
7. If no start in ten seconds; Either Start Button - PRESS momentarily. Attempt a starter assist restart if altitude and time permit.

Maximum Glide - Emergency Landing

1. Airspeed - BEST GLIDE AT 8500 LBS. - 125 KIAS.
2. Flaps - UP.
3. Speedbrakes - RETRACT.
4. Landing Gear - UP.
5. Transponder - EMERGENCY.
6. ATC - ADVISE.
7. Passenger Advisory Switch - PASS SAFETY.
8. Shoulder Harness - SECURE.
9. Landing Gear, Speedbrakes, and Flaps - AS REQUIRED for landing anticipated.

Engine Fire (Engine Fire Switch Illuminated)

1. Throttle (Affected Engine) - IDLE.

IF LIGHT REMAINS ON

2. Engine Fire Switch - LIFT COVER and PUSH.

   Cuts off fuel to engine, hydraulic fluid supply to engine-driven pump, trips the generator field, positions a valve to allow both bottles to be fired into the affected engine, and illuminates the bottle armed lights.

3. Either Illuminated Bottle Armed Light - PUSH.

4. Ignition - NORM.

   If ignition is ON, return the switch to NORM.

5. Throttle (affected engine) - OFF.
6. Reduce Electrical Load - AS REQUIRED (400 amps maximum up to 35,000 ft., 325 amps maximum above 35,000 ft.)
7. Boost Pump - OFF.

   If pump is ON, return the switch to OFF.

   IF FIRE WARNING LIGHT ON AFTER 30 SECONDS

8. Remaining Illuminated Bottle Armed Light - PUSH.
9. Land as soon as possible.

IF LIGHT GOES OUT AND SECONDARY INDICATIONS ARE NOT PRESENT

2. Land as soon as practical.

AIRPLANES WITH THRUST REVERSERS

Inadvertent Deployment During Takeoff

SPEED BELOW V_1 - TAKEOFF SHOULD BE ABORTED

1. Brakes - AS REQUIRED.
2. Throttles - IDLE.
3. Speed Brakes - EXTEND.
4. Thrust Reversers - BOTH DEPLOY.
5. Reverser Indicator Lights - CHECK ILLUMINATION of ARM, UNLOCK and DEPLOY LIGHTS.
6. Thrust Reversers - REVERSE POWER ON BOTH ENGINES.

SPEED ABOVE V_1 - TAKEOFF SHOULD NORMALLY BE CONTINUED

1. Emergency Stow Switch - ACTUATE ON AFFECTED ENGINE.
2. After establishing a positive rate-of-climb, retract landing gear. Do not exceed 125 KIAS until thrust reverser stows.
3. At 400 feet, retract flaps at $V_2 + 10$ and accelerate. Do not exceed 200 KIAS after thrust reverser stows.
4. Land As Soon As Practical.

IF THRUST REVERSER WILL NOT STOW

5. Throttle (affected engine) - CUTOFF.
6. Airspeed - Maintain 150 KIAS OR BELOW.
7. Refer to Abnormal Procedures for Landing.

Inadvertent Inflight Deployment

1. Reverser Indicator Lights - CHECK ILLUMINATION of ARM, UNLOCK AND DEPLOY LIGHTS.
2. Affected Throttle - CHECK IDLE.
3. Emergency Stow Switch - ACTUATE ON AFFECTED ENGINE.
4. Airspeed - REDUCE TO 125 KIAS (115 KIAS WITH FLAPS EXTENDED) OR BELOW. AFTER THRUST REVERSER STOWS, DO NOT EXCEED 200 KIAS.
5. Reverser Indicator Lights - UNLOCK and DEPLOY LIGHT EXTINGUISHED - ARM and HYD PRESS ON LIGHT ILLUMINATED.
6. Land as Soon as Practical.

IF THRUST REVERSER WILL NOT STOW:

7. Throttle (affected engine) - CUTOFF.
8. Airspeed - MAINTAIN 150 KIAS OR BELOW.
9. Refer to Abnormal Procedures for Landing.

Thrust Reverser UNLOCK Light On In Flight

1. Emergency Stow Switch - ACTUATE ON AFFECTED ENGINE.
2. Thrust Reverser Levers - CHECK THRUST REVERSER LEVERS AT STOWED (FULL FORWARD) POSITION.

IF LIGHTS WILL NOT EXTINGUISH

1. Maintain 200 KIAS or Below.
2. Land as Soon as Practical.

Thrust Reverser ARM Light On In Flight

1. HYD PRESS ON Light - CHECK.
2. Thrust Reverser Levers - CHECK THRUST REVERSER LEVERS AT STOWED (FULL FORWARD) POSITION.
3. Emergency Stow Switch - VERIFY OFF.

IF LIGHTS WILL NOT EXTINGUISH

1. Refer to Hydraulic System Remains Pressurized Procedure.

Electrical Fire or Smoke

1. Oxygen Masks and Oxygen MIC Switches - DON OXYGEN MASKS, SELECT - 100%, MIC SWITCHES AS REQUIRED.

   Ensure selector is on 100% oxygen when masks are used. On 500-0101 thru -0349, ensure oxygen MIC switch is in MIC OXY MASK position. On Aircraft prior to 500-0101, removing mask from the stowage hook activates the mask microphone.

KNOWN SOURCE

2. Isolate faulty circuit.

   Pull circuit breaker to remove power from faulty equipment.

UNKNOWN SOURCE

2. Battery Switch - EMER
3. Generators - OFF

   (With the battery switch in the emergency position and the generators off, only the PN101 on 500-0001 thru -0274 (copilot's HSI on 500-0275 thru -0349), COMM 1, NAV 2 and overhead floodlights are powered.)

CAUTION

When landing with emergency power (Battery Switch-Emer and both generators off), the following are not available:

The landing gear normal operation is not available. The landing gear must be lowered using the blow-down system and the landing gear warning lights will not illuminate.

The flaps will not operate. If not previously in the landing position, a flap inoperative landing must be made.

The optional antiskid/power brake system (if installed) is inoperative. Only the emergency brake system is available if the antiskid/power brake system is installed.

The engine anti-ice valves will be open. Refer to anti-ice on thrust charts.

The outside air temperature gage is not reliable, so use caution when applying power (except for go-around where ground temperatures can be used).

All engine instruments except the vertical tape N_1 will be inoperative. The vertical tape N_1 will indicate erratically below approximately 50% N_1 but will give reliable indications above 50% N_1.

4. MIC Selector - EMER COMM
   Must be in the EMER COMM position to transmit when operating on emergency battery, and must wear headset to receive.
5. All electrical switches OFF.
6. Windshield Bleed Air Manual Valves - OFF
   With electrical power lost, the windshield bleed air shutoff valve will fail open. The bleed air manual valves are closed to prevent an excessive volume of high temperature air from reaching the windshield.
7. All Circuit breakers - PULL EXCEPT NAV/RMI 2, COMM 1 (headphones required to receive audio), PN-101 (500-0001 thru -0274) or DIRECT GYRO 2 (500-0275 and on), FLOOD (These items are on the Emergency DC bus), DC Power LH Bus (3), DC Power RH Bus (3), RH CB Panel and LH CB Panel.
8. BATT Switch - BATT
9. Generators - GEN
   Still only powering equipment with circuit breakers pushed in.

IF SEVERITY OF SMOKE WARRANTS

10. Initiate SMOKE REMOVAL and/or EMERGENCY DESCENT procedures as required.

IF FIRE OR SMOKE PERSISTS OR IT CANNOT BE VERIFIED THAT THE FIRE IS EXTINGUISHED.

11. Land as soon as possible.

IF FIRE OR SMOKE DECREASES

12. Circuit Breakers and Switches - REINSTATE ONE AT A TIME
    Reinstate until the faulty circuit is found.

Loss of Both Generators

1. Generators - RESET THEN ON.
   Attempt to reset both generators.

IF ONLY ONE GENERATOR COMES ON

2. Electrical Load - REDUCE AS REQUIRED.
   (400 amps. max. up to 35,000 ft., 325 amps. max above 35,000 ft.)
   On aircraft with electric windshields it may be necessary to turn off one or both of them to reduce load to 400 amps. Windshield bleed air should be turned on to maintain anti-ice. Other high load items are engine anti-ice (wing leading edge), Radar bus and the Flight Director bus.

IF NEITHER GENERATOR COMES ON.

2. Battery Switch - EMER.

   (Power only to DIRECT GYRO 2, COMM 1, NAV 2, and overhead floodlight for approximately 30 minutes.)

CAUTION

When landing with emergency power (Battery Switch-Emer and both generators off), The following are not available:

The landing gear normal operation is not available. The landing gear must be lowered using the blow-down system and the landing gear warning lights will not illuminate.

The flaps will not operate. If not previously in the landing position, a flap inoperative landing must be made.

The optional antiskid/power brake system (if installed) is inoperative. Only the emergency brake system is available if the antiskid/power brake system is installed.

The engine anti-ice valves will be open. Refer to anti-ice on thrust charts.

The outside air temperature gage is not reliable, so use caution when applying power (except for go-around where ground temperatures can be used).

All engine instruments except the vertical tape N_1 will be inoperative. The vertical tape N_1 will indicate erratically below approximately 50% N_1 but will give reliable indications above 50% N_1.

3. MIC Selector - EMER COMM.

   Must be in EMER COMM position to transmit while operating on Emergency Battery and headset worn to receive. Volume is controlled at the radio since normal amplification is bypassed.

4. Windshield Bleed Air Manual Valves - OFF.

   (500-0041 and On, and -0001 thru -0040 incorporating SB30-1)

   With electrical power lost, the windshield bleed air shutoff valve will fail open. The bleed air manual valves are closed to prevent an excessive volume of high temperature air from reaching the windshield.

5. Land as soon as possible.

Battery Overheat Light On (Temperature between 145 and 160°F)

1. Battery Switch - EMER.

   In EMER position the battery will be disconnected from the generators and will no longer be charged by them. The DC voltmeter will now indicate the voltage of whatever power source is selected by the Voltage Selector (i.e., LH GEN, BATT, RH GEN). All electrical equipment will continue to receive power since the generators are still on the line and the Emergency DC bus is powered by the battery.

2. Ensure battery disconnected from charging source.

   Thirty seconds after disconnect, battery voltage should read one or more volts less than the generators. Rotate the Voltage Selector to LH GEN and RH GEN position to read Generator Voltage. Battery voltage will be indicated when the Voltage Selector is in the BATT position.

IF BATT O'HEAT LIGHT GOES OUT

3. Battery Switch - BATT.

   After landing, a maintenance inspection of the battery must be conducted since damage may have occured. If a steady BATT O'HEAT light comes on shortly after returning the Battery Switch to BATT, it is advisable to follow the procedures for a flashing BATT O'HEAT light.

IF BATT O'HEAT LIGHT FLASHES (Temperature exceeds 160°F.)

3. Generators - OFF.

   The BATT O'HEAT light will extinguish immediately when the generators are turned off if the battery relay is not stuck. (With the battery switch in the emergency position and the generators off, only PN-101 (500-0001 thru -0274), only the copilot's HSI (500-0275 thru -0349), COMM 1, NAV 2 and the Overhead Floodlights are powered.)

CAUTION

When landing with emergency power (Battery Switch-Emer and both generators off), The following are not available:

The landing gear normal operation is not available. The landing gear must be lowered using the blow-down system and the landing gear warning lights will not illuminate.

The flaps will not operate. If not previously in the landing position, a flap inoperative landing must be made.

The optional antiskid/power brake system (if installed) is inoperative. Only the emergency brake system is available if the antiskid/power brake system is installed.

CAUTION (Continued)

The engine anti-ice valves will be open. Refer to anti-ice on thrust charts.

The outside air temperature gage is not reliable, so use caution when applying power (except for go-around where ground temperatures can be used).

All engine instruments except the vertical tape N_1 will be inoperative. The vertical tape N_1 will indicate erratically below approximately 50% N_1 but will give reliable indications above 50% N_1.

BATT O'HEAT LIGHT GOES OUT (Battery Relay Not Stuck)

4. Generators - GEN (BATT O'HEAT light will come back on until battery cools).
5. Battery Switch - OFF.
6. Land as soon as practical.

CAUTION

After landing, refer to maintenance manual for proper maintenance procedures as damage to the battery may have occurred.

BATT O'HEAT LIGHT STAYS ON (Battery Relay Stuck)

4. Mic Selector - EMER COMM (Headphones required to receive audio).
5. Windshield Bleed Air Manual Valves - OFF.
6. All Circuit Breakers - PULL Except - NAV/RMI 2, PN-101 (500-0001 thru -0274), Direct Gyro 2 (500-0275 and On), Comm 1, Flood, Flap Motor, Flap Control, Gear Control, Gear Warning, DC Power LH Bus (3), DC Power RH Bus (3), RH CB Panel and LH CB Panel.
7. Land as soon as practical.

CAUTION

After landing, refer to maintenance manual for proper maintenance procedures as damage to the battery may have occurred.

Autopilot Hardover

1. Autopilot Trim Disengage Switch - PRESS.
   Press switch on either yoke. Flight director modes will remain selected.

2. Maximum Altitude Losses during Autopilot Malfunction.

	500-0001 thru -0274	500-0275 and on
a. Cruise	500 feet at 35,000 feet	360 feet at 41,000 feet
b. Climb	60 feet at 10,000 feet	160 feet at 10,000 feet
c. Maneuvering	100 feet at 35,000 feet	230 feet at 41,000 feet
d. ILS	36 feet (Autopilot must be off at 95 feet)	

Rapid Decompression

1. Oxygen Masks - DON and 100%.
2. Initiate EMERGENCY DESCENT Procedures - AS REQUIRED.
3. CREW OXY PRIORITY On 500-0001 thru -0061, OXYGEN PRIORITY VALVE On 500-0062 thru -0349 - CHECK NORMAL.
4. Ensure passengers are receiving oxygen.

   Visually check mask drop when cabin reaches 13,500±600 feet. If masks are not down drop them by PASS OXY MANUAL on the left console.
5. Oxygen MIC Switches - MIC OXY MASK (500-0101 thru -0349).

   Switch to MIC OXY MASK in order to use microphone in oxygen mask. On 500-0001 thru -0101, removing mask from the stowage hook activates the mask mircrophone.
6. Transponder - EMER.

CABIN ALTITUDE ABOVE SELECTED ALTITUDE

7. Cabin Altitude Selector - REDUCE.

   Set to lower cabin altitude. The actual cabin altitude will be climbing and the differential pressure will be decreasing. Attempt to increase the differential pressure by calling for a lower cabin altitude forcing the outflow valve to close.
8. Rate Control - FULL INC.

   Go to full increase to program the controller to work as quickly as possible.
9. Pressurization Source Selector - CHECK IN BOTH.

IF SELECTION DOES NOT HOLD PRESSURE

10. Pressurization Source Selector - EMER.

    Selecting EMER will immediately provide a large volume of bleed air to the cabin in an attempt to hold pressurization.

IF NOT ARRESTED BY 14,000 FEET CABIN ALTITUDE

11. Initiate EMERGENCY DESCENT Procedures.
12. Oxygen Priority Valve - CHECK NORMAL.
13. Ensure passengers are receiving oxygen.

    Visually check mask drop when cabin reaches 13,500 ±600 feet. If masks are not down drop them by the PASS OXY MANUAL switch on the left console.

ENVIRONMENTAL

Emergency Descent

1. Throttles - IDLE.
2. Speedbrakes - EXTEND.
3. Initiate Moderate Bank.
4. Passenger Advisory Lights - PASS SAFETY.
5. Maximum Airspeed - V_{MO}/M_{MO}.

   M_{MO}(above 26,000 feet) - 0.705 MACH.

   V_{MO}(14,000 - 26,000 feet) - 289 KIAS.

   V_{MO}(below 14,000 feet) - 262 KIAS.

   Use reduced speed if structural damage has occurred.
6. Transponder - EMERGENCY 7700.

Environmental System Smoke or Odor

1. Oxygen Mask and Oxygen MIC Switches (Aircraft S/N 0101-0349) - AS REQUIRED.

   Oxygen selector on 100% and MIC oxygen switch in MIC OXY MASK position in order to use MIC in oxygen mask. In aircraft prior to S/N 0101 removing mask from stowage hook activates mask microphones.
2. Cabin Fan - OFF.
3. Cockpit Defog Fan - OFF.

   Both cabin and cockpit defog fans off to prevent further circulation of smoke through the aircraft and possibly identify them as the source.
4. Pressurization Source Selector - Isolate source by selecting: LH, RH or EMER.

   Pressurization source selector must remain in each position long enough to allow adequate system purging to determine the source of smoke. If smoke has not begun to clear in a minute, switch to another source.

Smoke Removal

1. Oxygen Mask - ON.

   Check oxygen selector is on 100%.
2. Pass Oxy Mask - MANUAL DROP.
3. Oxygen Priority Valve - CHECK NORMAL.

4. Ensure passengers are receiving oxygen.
   Visually check mask drop when cabin reaches 13,500 ±600 feet. If masks are not down, drop them by PASS OXY manual switch on the left console. Check CREW OXY PRIORITY VALVE in NORMAL position.
5. Oxygen Mic Switches - MIC OXY MASK (500-0101 thru -0349).
   Switch must be in this position to use microphone in the oxygen mask.
6. Passenger Advisory Light - PASS SAFETY.
7. Emergency Dump Switch - DUMP.
   IF SMOKE PERSISTS OR IT CANNOT BE VERIFIED THAT THERE IS NO FIRE.
8. Land As Soon As Possible.

Overpressurization

1. Cabin Altitude Selector - SET to higher cabin altitude.
   Cabin altitude will be descending and differential pressure will be increasing. Attempt to decrease the differential pressure by calling for a higher cabin altitude forcing the outflow valve to open.
2. Rate Control - INC.
   Go to full increase to program the controller to work as rapidly as possible.

IF STILL OVERPRESSURIZED

3. Pressurization Source Selector - LH or RH.
   Attempt to control cabin pressure with the appropriated throttle by reducing power, thereby letting a smaller amount of air into the aircraft to pressurize the cabin.

IF UNABLE TO CONTROL

4. Oxygen Masks - DON.
5. Pass Oxy Mask - MANUAL DROP.
6. Oxygen Priority Valve - CHECK NORMAL.
7. Assure passengers are receiving oxygen.
   Visually check mask drop when cabin reches 13,500 ±600 feet. If masks are not down, drop them by PASS OXY manual switch on the left console. Check CREW OXY PRIORITY VALVE in NORMAL position.
8. Oxygen MIC Switches - MIC OXY MASK (500-0101 and on).
   Switch to MIC OXY MASK in order to use microphone in oxygen mask.
9. Passenger Advisory Light - PASS SAFETY.
10. Emergency Dump Switch - DUMP.
    This switch manually opens the normal dump valve to rapidly depressurize the aircraft. Passenger advisory lights should be turned to PASS SAFETY prior to dumping cabin. All smoking material should be extinguished.

SPINS

Intentional spins are prohibited and were not conducted during flight tests of the aircraft. Should a spin occur, the following procedures are recommended:

1. Power to idle on both engines.
2. Neutralize yoke and apply full rudder opposite the direction of rotation.
3. Approximately 1/2 turn of spin after applying rudder, push yoke forward.
4. Remove rudder input as rotation slows so that rudder is centered when rotation stops.
5. Pull out of the dive with smooth steady control pressure.
6. Indicated airspeed, or angle of attack if installed, should be closely monitored during the pullout to avoid a secondary stall.

DITCHING

Good crew coordination is essential to the success of any ditching. Radio contact should be attempted giving aircraft identification, position, heading, altitude, and the transponder set on 7700. Passengers should be briefed and don life jackets keeping them uninflated until outside the airplane. Plan on approach to parallel any uniform swell pattern and attempt to touch down along a wave crest or just behind it. If the surface wind is very strong or the water surface rough and irregular, ditch into the wind on the back side of a wave. Gear should be left up with the flaps in the LAND position. The LDG GEAR circuit breaker can be pulled to silence the gear warning horn. Speed should be maintained at V_{REF} with the rate of descent at 200 - 300 feet per minute. Ditch while power is available if possible, so that the most desirable approach can be made. Touchdown should be slightly nose high and the throttles cut off just before water contact. Passengers and crew exit through the emergency escape hatch inflating the life jacket when clear.

1. Radio - MAYDAY.
   Identify airplane, position, heading, altitude and IAS.
2. Transponder - 7700.
3. Bleed Air Selector - OFF.
   Prevents water from entering through bleed valves.
4. Passenger Advisory Switch - PASS SAFETY.
   Check aft facing seats full aft and all seats upright and outboard.
5. Passenger Life Jackets - ON.
   Life jackets should not be inflated until outside airplane.
6. Gear - UP.
7. Flaps - LAND.
8. Speed - V_{REF}.
9. Rate of Descent - 200 - 300 feet per minute.
10. Plan approach to parallel any uniform swell pattern and attempt to touchdown along a wave crest or just behind it. If the surface wind is very strong or the water surface rough and irregular, ditch into the wind on the backside of a wave. Airplane should touch down nose high with a minimum rate of descent.
11. Throttles - CUT-OFF. Just prior to contact.
12. Emergency Exit - OPEN.

FORCED LANDING

All the considerations for a successful forced landing are similar to those for ditching. Attempt to establish radio contact, squawk the emergency code, and brief the passengers. The approach should be made with the gear DOWN, flaps in LAND position, speed V_{REF} , and a 200 - 300 feet per minute rate of descent. If possible, establish an abeam position with gear extended and altitude sufficient to enable a safe landing to be made in the event of power loss. Just before touchdown, place the throttles in cut-off and turn off the battery. Touchdown should be made in a normal landing attitude and emergency braking employed if necessary.

1. Radio - MAYDAY.
   Identify airplane, position, heading, altitude and IAS.
2. Transponder - 7700.
3. Passenger Advisory Switch - PASS SAFETY.
   Brief passengers as thoroughly as possible.
4. Gear - DOWN.
5. Flaps - LAND.
6. Speed - V_{REF}.
7. Rate of Descent - As required to effect touchdown in selected landing area.
8. Throttles - CUT-OFF, just prior to contact.