SECTION I

LIMITATIONS

Airspeeds quoted in this section are Indicated Airspeeds (IAS) unless otherwise noted.

Observance of the limitations listed is mandatory.

ENGINES

Take-off and Maximum Continuous Power .... 2900 rpm at 41.5 in. Hg

Maximum Normal Operating Power (Serials P-523 and after) .... 2750 rpm and 36.5 in. Hg

Cruise Power above 27,000 ft .... 2750 rpm and 31 in. Hg. (Minimum)

Engine must be preheated before starting when ambient temperatures are below 10°F (-12°C).

Oil Cooler Baffles are to be removed when OAT exceeds 20°C.

PROPELLERS

Two Hartzell constant speed, full feathering, three-bladed propellers using: HC-F3YR-2 hubs with C7479-2R or C7479B-2R blades or: HC-F3YR-2F or HC-F3YR-2UF hubs with FC7479-2R or FC7479B-2R blades or: HC-F3YR-2UF hubs with FC7479K-2R blades. Pitch settings at 30-inch station: Low 13° - 14°; High 81.7°. Diameter 74 inches (normal), minimum allowable for repair 73-½ inches (no further reduction permitted).

STARTERS

When restarting an engine in flight do not use the starter above 20,000 feet.

FUEL GRADE

100LL (Blue) or 100 (Green) Aviation Gasoline minimum grade
115/145 (Purple) Aviation Gasoline alternate grade

FUEL CAPACITY

147-Gallon Fuel System	142 Gallons Usable
207-Gallon Fuel System	202 Gallons Usable
237-Gallon Fuel System	232 Gallons Usable

FUEL MANAGEMENT

Do not take off if fuel quantity gages indicate in Yellow Arc or with less than 25 gallons of fuel in each wing system.

Both engine-driven fuel pumps and both electric fuel boost pumps must be operable for takeoff. Electric fuel boost pumps must be on for takeoff.

TABLE OF CONTENTS

INSTRUMENT MARKINGS

Oil Temperature
- Minimum (Red Radial) .... 38°C
- Normal Operating Range (Green Arc) (>1200 RPM until 38°C) .... 38 to 118°C
- Maximum (Red Radial) .... 118°C

Oil Pressure
- Minimum Idle (Red Radial) .... 10 psi or 25 psi
- Normal Operating Range (Green Arc) .... 60 to 90 psi
- Maximum (Red Radial) .... 100 psi

Fuel Flow (Serials P-247 thru P-426, P-430, P-434 thru P-465)
- Green Arc .... 60 to 330 pph
- 55% .... 93 to 110 pph
- 65% .... 110 to 131 pph
- 75% .... 131 to 142 pph

Fuel Flow (Serials P-427 thru P-429, P-431 thru P-433, P-466 and after)
- Green Arc .... 60 to 330 pph

OR

- Green Arc .... 60 to 330 pph
- 55% .... 93 to 110 pph
- 65% .... 110 to 131 pph
- 75% .... 131 to 142 pph

Manifold Pressure
- Normal Operating Range (Green Arc) (Serials P-523 and After) .... 14 to 36.5 in. Hg
- Normal Operating Range (Green Arc) (Serials P-247 thru P-522) .... 14 to 41.0 in. Hg
- Maximum (Red Radial) .... 41.5 in. Hg

Tachometer
- Normal Operating Range (Green Arc) (P-523 and After) .... 2350 to 2750 rpm
- Normal Operating Range (Green Arc) (P-247 thru P-522) .... 2350 to 2900 rpm
- Maximum (Red Radial) .... 2900 rpm

Cylinder Head Temperature
- Normal Operating Range (Green Arc) .... 121 to 232°C
- Maximum (Red Radial) .... 246°C

Turbine Inlet Temperature (Red Radial) .... 900°C

Instrument Air
- Minimum Operating Range (Yellow Arc) .... 2.5 to 3.5 in. Hg
- Normal Operating Range (Green Arc) .... 3.5 to 5.5 in. Hg
- Maximum Operating Range (Yellow Arc) .... 5.5 to 6.5 in. Hg
- Red Button Source Failure Indicators

Pneumatic Pressure
- Normal Operating Range (Green Arc) .... 7 to 20 psi
- (Red Radial) .... 20 psi

Cabin Differential
- Normal Operating Range (Green Arc) .... 0 to 4.7 psi
- Maximum (Red Arc) .... 4.7 psi

Propeller Deice
- Normal Operating Range (Green Arc) .... 14 to 18 amps

Fuel Quantity Indicators
- No Take-off (Yellow Arc) .... 0 to 25 gals

AIRSPEED LIMITATIONS (CAS) *(Serials Prior to P-486 without Kit 60-5023)*

Maximum Allowable (Red Radial) (Glide or Dive, Smooth Air)	270 mph/235 kts
Caution Range (Yellow Arc)	240 to 270 mph/208 to 235 kts
Normal Operating Range (Green Arc)	98 to 240 mph/85 to 208 kts
Flap Operating Range (White Arc)	88 to 162 mph/76 to 141 kts
Approach Position - 15°	202 mph/175 kts
Full Down Position - 30°	162 mph/141 kts
Single-Engine Best Rate-of-Climb (Blue Radial)	129 mph/112 kts
Minimum Single-Engine Control Speed (Red Radial)	101 mph/88 kts
Maximum Gear Operation Speed	202 mph/175 kts
Maximum Gear Extended Speed	202 mph/175 kts
Maximum Design Maneuvering	186 mph/161 kts

AIRSPEED LIMITATIONS (IAS) *(Serials P-486 and after or with Kit 60-5023)*

Maximum Allowable (Red Radial) (Glide or Dive, Smooth Air)	268 mph/233 kts
Caution Range (Yellow Arc)	238 to 268 mph/207 to 233 kts
Normal Operating Range (Green Arc)	94 to 238 mph/82 to 207 kts
Flap Operating Range (White Arc)	85 to 161 mph/74 to 140 kts
Approach Position - 15°	200 mph/174 kts
Full Down Position - 30°	161 mph/140 kts
Single-Engine Best Rate-of-Climb (Blue Radial)	127 mph/110 kts
Minimum Single-Engine Control Speed (Red Radial)	98 mph/85 kts
Maximum Gear Operation Speed	200 mph/174 kts
Maximum Gear Extended Speed	200 mph/174 kts
Maximum Design Maneuvering	184 mph/160 kts

ALTITUDE LIMITATION .... 30,000 ft

MANEUVERS

This is a normal category aircraft. Acrobatic maneuvers, including spins, are prohibited.
Maximum slip duration .... 30 seconds

FLIGHT LOAD FACTORS

At design Gross Weight of 6775 lbs: Positive; Flaps Up 3.5 G, Flaps Down 2.0 G.

CENTER OF GRAVITY (Landing Gear Extended)

Forward Limits: 128.0 inches aft of datum at 5100 lbs and under, then straight line variation to 134.6 inches aft of datum at gross weight of 6775 lbs.
Aft Limits: 139.2 inches aft of datum at all weights.

WEIGHTS

Maximum Take-off Weight	6775 lbs
Maximum Landing Weight (10-Ply Rated Tires)	6775 lbs
Maximum Landing Weight (8-Ply Rated Tires)	6600 lbs
Maximum Ramp Weight	6819 lbs

CABIN PRESSURIZATION

Maximum operating cabin pressure differential is 4.7 psi.
Fuselage pressure vessel structural life limit - 15,000 hrs.

MINIMUM FLIGHT CREW .... 1 pilot

AFT FACING CHAIRS

Only aft facing seats are authorized in the aft facing position.
The headrest and seat back of the aft facing seat must be in the fully raised position for take-off and landing.

PLACARDS

On right sidewall:
P-523 and After

AIRSPEED LIMITATIONS

GEAR | MAX. EXTEND 174 KTS IAS
MAX. OPERATION 174 KTS IAS

FLAP | MAX. APPROACH 174 KTS IAS
MAX. FULL 140 KTS IAS

MIN SINGLE ENGINE CONTROL 85 KTS IAS - MAX. MANEUVERING 160 KTS IAS
TWIN ENGINE CLIMBS, BEST ANGLE 99 KTS IAS,
RECOMMEND BELOW 14,000 FT. 110 KTS IAS
RECOMMEND 14,000 FT. AND ABOVE 120 KTS IAS

CAUTION
DO NOT LAND WHILE PRESSURIZED

RECOMMENDED APPROACH
98 KTS IAS

DEMONSTRATED CROSSWIND
25 KTS

OPERATION LIMITATIONS

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS.

NO ACROBATIC MANEUVERS INCLUDING SPINS ARE APPROVED
THIS AIRPLANE IS APPROVED FOR VFR, IFR, DAY & NIGHT OPERATIONS
THIS AIRPLANE IS NOT APPROVED FOR FLIGHT IN KNOWN ICING CONDITIONS

On right sidewall:
P-247 to P-522

AIRSPEED LIMITATIONS

GEAR | MAX. EXTEND 174 KTS IAS
MAX. OPERATION 174 KTS IAS

FLAP | MAX. APPROACH 174 KTS IAS
MAX. FULL 140 KTS IAS

MIN SINGLE ENGINE CONTROL 85 KTS IAS - MAX. MANEUVERING 160 KTS IAS
TWIN ENGINE CLIMBS, BEST ANGLE 99 KTS IAS, BEST RATE 120 KTS IAS

CAUTION
DO NOT LAND WHILE PRESSURIZED

RECOMMENDED APPROACH
98 KTS IAS

DEMONSTRATED CROSSWIND
25 KTS

OPERATION LIMITATIONS

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS.

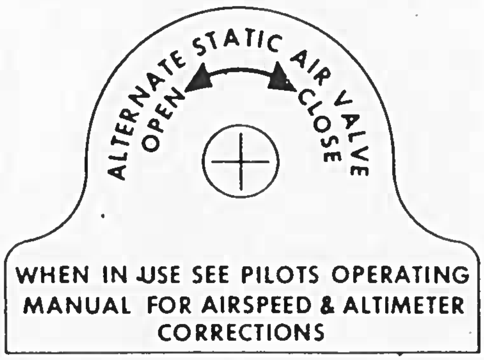
NO ACROBATIC MANEUVERS INCLUDING SPINS ARE APPROVED
THIS AIRPLANE IS APPROVED FOR VFR, IFR, DAY & NIGHT OPERATIONS
THIS AIRPLANE IS NOT APPROVED FOR FLIGHT IN KNOWN ICING CONDITIONS

Airplanes equipped in accordance with Airplane Flight Manual Supplement FLIGHT IN KNOWN ICING CONDITIONS, P/N 60-590001-17 are approved for flight in known icing conditions and the following placard will be placed on the Operation Limitation panel:

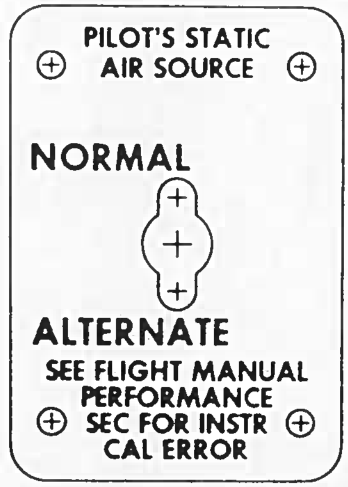
OPE[illegible]
[illegible]IS AIRPLANE [illegible] ED AS A NO[illegible]
[illegible]ANE IN COMPL[illegible] THE OPERATING LIM[illegible] ATED
IN THE FORM OF [illegible]DS, MARKINGS AND MANU[illegible]
NO ACROBATIC MANEUVERS INCLUDING SPINS ARE APPROVED
THIS AIRP[illegible] IS APPROVED FOR VFR, IFR, DAY & NIGHT OPERATIONS
THIS AIRPLANE IS APPROVED FOR FLIGHT IN KNOWN ICING CONDITIONS

PLACARDS (Continued)

On the copilot's sidewall:
P-247 to P-262

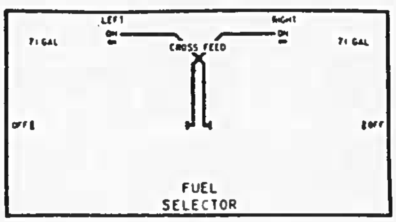


On the copilot's sidewall:
P-263 and after and all prior airplanes incorporating Kit 60-5019

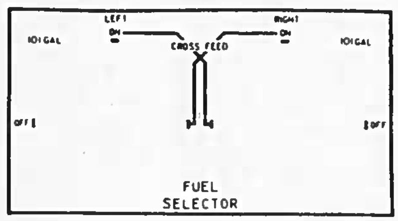


On Fuel Selector Panel on Floor Between Seats:

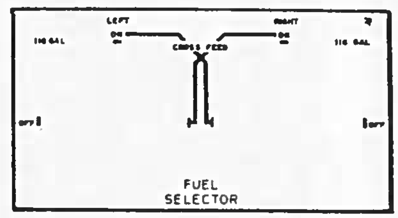
147-Gallon Fuel System



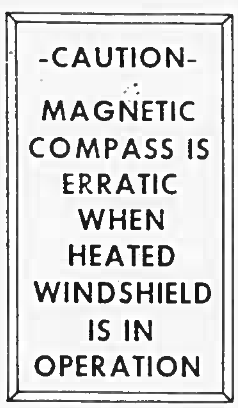
207-Gallon Fuel System



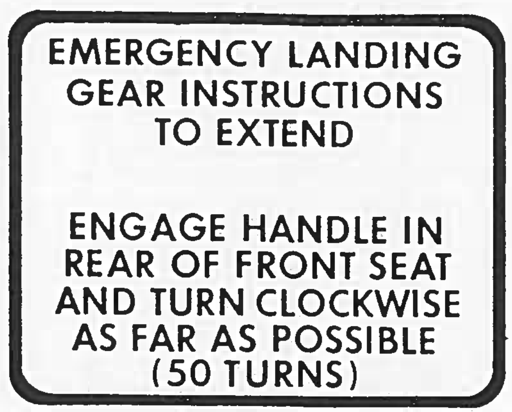
237-Gallon Fuel System



Above magnetic compass:



On the main spar cover between the pilot and copilot seats:



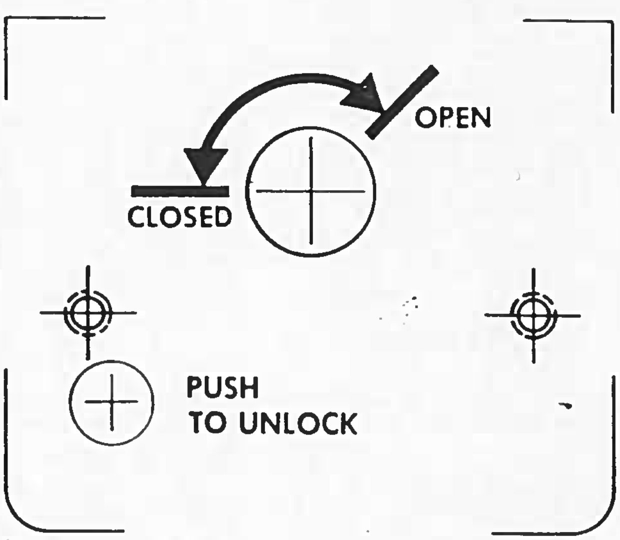
On headliner adjacent to cabin door, if oxygen is installed:

OXYGEN – NO SMOKING WHILE IN USE
PULL PLUG TO STOP FLOW

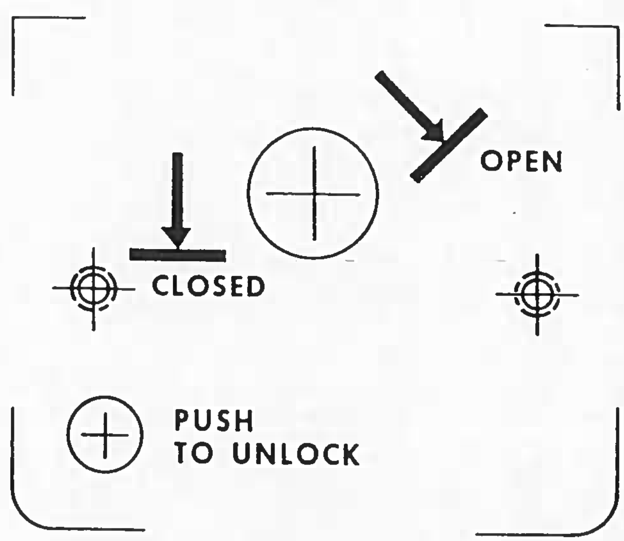
On vertical support member of table:

STOW BEFORE TAKE-OFF AND LANDING

Adjacent to inside cabin door handle:

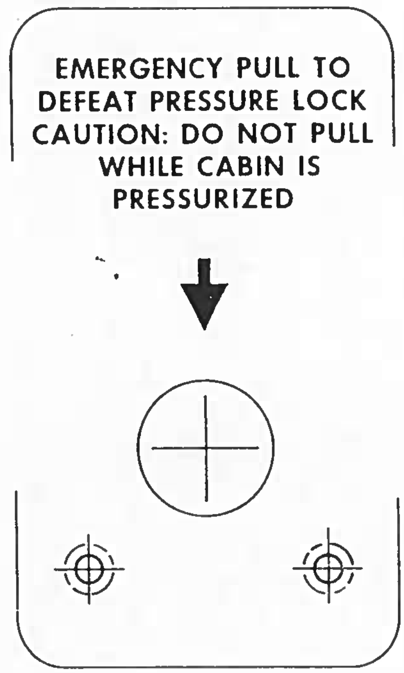


OR



PLACARDS (Continued)

Near cabin door handle:



On headliner above emergency exit window:

EMERGENCY EXIT

PULL CURTAIN ASIDE

On emergency exit:

EMERGENCY EXIT

LIFT COVER, RELEASE CATCH
& PULL HANDLE DOWN FULLY

On right cabin sidewall:

OCCUPANT OF AFT FACING SEAT MUST HAVE
HEAD SUPPORTED AND SEAT BACK FULLY
UPRIGHT DURING TAKE-OFF AND LANDING

When shoulder harness installed, on windows adjacent to pilot's & copilot's seats:

SHOULDER HARNESS MUST BE
WORN AT ALL TIMES WHILE
AT PILOT POSITIONS
ADJUST BUCKLE TO POSITION
AT SIDE OF INBOARD HIP

or;

SHOULDER HARNESS
MUST BE WORN AT
ALL TIMES WHILE AT
PILOT POSITIONS

When shoulder harness installed, on windows adjacent to 3rd & 4th forward facing seats and 5th and 6th seats:

SHOULDER HARNESS
MUST BE WORN DURING
TAKE-OFF AND LANDING
WITH SEAT BACK UPRIGHT

In nose baggage compartment:

COMPARTMENT LOADING
WEIGHT LIMITATIONS

STD LOADING 500 LBS MAX.

SEE WEIGHT & BALANCE SECTION OF FLIGHT MANUAL
FOR ADD'L LIMITATIONS FROM OPTIONAL EQUIP.

On aft cabin bulkhead upholstery panel:

MAX. BAGGAGE LOAD
ON FLOOR
WITH AFT SEATS 70 LBS
WITHOUT AFT SEATS 315 LBS

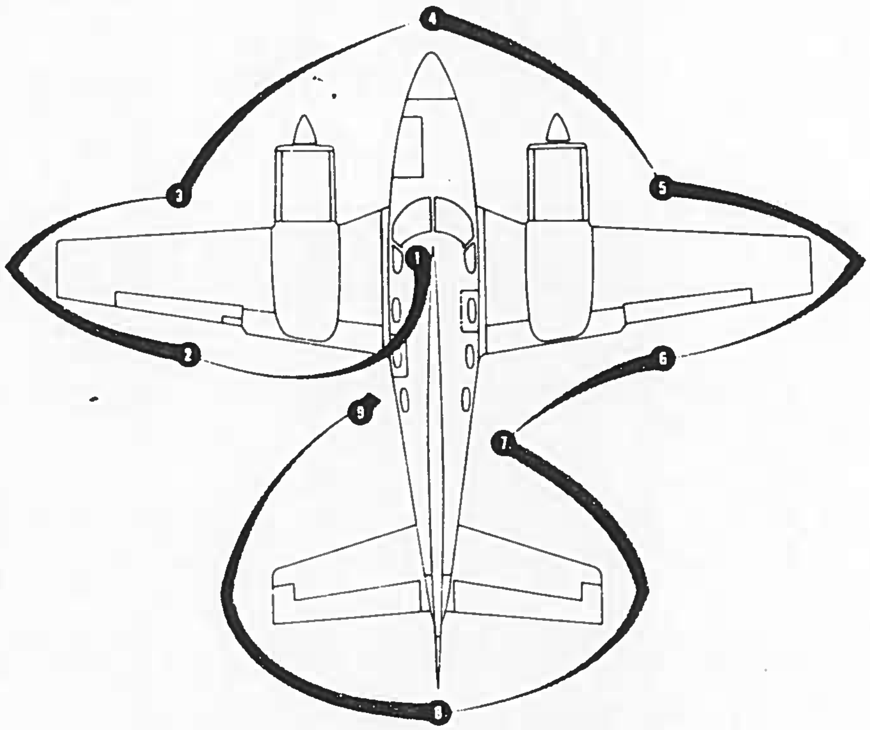
On window trim below storm window on pilot's side (P-479 and after):

TURN STROBE LIGHTS OFF WHEN TAXIING IN
VICINITY OF OTHER AIRCRAFT, OR WHEN
FLYING IN FOG OR CLOUDS. STANDARD POSITION LIGHTS
TO BE USED FOR ALL NIGHT OPERATIONS.

SECTION II

NORMAL PROCEDURES

All speeds quoted in this section are Indicated Airspeeds (IAS)



PREFLIGHT INSPECTION

1. Cockpit Check

1. Control Locks - REMOVE and STOW
2. Parking Brake - SET
3. All Switches - OFF
4. Landing Gear Handle - DOWN
5. Battery Switch - ON
6. Fuel Quantity Indicators - CHECK QUANTITY (See LIMITATIONS for take-off fuel)
7. Cowl Flap Switches - OPEN
8. Battery Switch - OFF
9. Oxygen Pressure - CHECK
10. Trim Tabs (3) - SET TO ZERO

2. Left Wing, Trailing Edge

1. Wing Root Fuel Sump - DRAIN
2. Flaps - CHECK
3. Aileron - CHECK FREEDOM OF MOVEMENT, TAB NEUTRAL WHEN AILERON NEUTRAL

3. Left Wing, Leading Edge

1. Position Light and Wing Tip Landing Light (if installed) - CHECK
2. Fuel - CHECK QUANTITY; CAP(S) SECURE. ALWAYS CHECK WING TIP TANK FIRST (IF INSTALLED); DO NOT REMOVE INBOARD CAP IF FUEL IS VISIBLE IN TIP TANK.
3. Wing Tip Tank (if installed) Sump - DRAIN
4. Fuel Sight Gage (if installed) - CHECK
5. Stall Warning Vane - CHECK FREEDOM OF MOVEMENT
6. Deice Boots - CHECK
7. Wing Ice light (if installed) - CHECK
8. Tie Down, Chocks - REMOVE
9. Engine Oil - CHECK QUANTITY; Cap - SECURE
10. Propeller and Propeller Deice Boots - CHECK
11. Engine Air Intakes - CHECK FOR OBSTRUCTIONS
12. Engine Cowling and Cowl Flap - CHECK
13. Fuel Sumps (2) - DRAIN
14. Wheel Well Doors, Tire, Brake, Shock Strut, and Landing Light (if installed) - CHECK
15. Landing Gear Down-Lock Mechanism - CHECK FOR CONDITION
16. Landing Gear Up-Lock Roller - CHECK FREEDOM OF MOVEMENT
17. Pressurization Intercooler Inlet - CLEAR

4. Nose Section

1. Baggage Door - CHECK
2. Wheel Well Door, Tire and Shock Strut - CHECK
3. Heater Fuel Strainer - DRAIN
4. Pitot(s) - REMOVE COVER, EXAMINE FOR OBSTRUCTIONS
5. Taxi Light - CHECK
6. Nose Cone - CHECK
7. Ram Air Inlet - CLEAR

5. Right Wing, Leading Edge

1. Pressurization Intercooler Inlet - CLEAR
2. Wheel Well Doors, Tire, Brake, Shock Strut, and Landing Light (if installed) - CHECK
3. Landing Gear Down-Lock Mechanism - CHECK FOR CONDITION
4. Landing Gear Up-Lock Roller - CHECK FREEDOM OF MOVEMENT
5. Fuel Sumps (2) - DRAIN
6. Engine Cowling and Cowl Flap - CHECK
7. Engine Oil - CHECK QUANTITY; Cap - SECURE
8. Propeller and Propeller Deice Boots - CHECK
9. Engine Air Intakes - CHECK FOR OBSTRUCTIONS
10. Tie Down, Chocks - REMOVE
11. Deice Boots - CHECK
12. Fuel - CHECK QUANTITY; CAP(S) SECURE. ALWAYS CHECK WING TIP TANK FIRST (IF INSTALLED); DO NOT REMOVE INBOARD CAP IF FUEL IS VISIBLE IN TIP TANK.
13. Wing Tip Tank (if installed) Sump - DRAIN
14. Fuel Sight Gage (if installed) - CHECK
15. Position Light and Wing Tip Landing Light (if installed) - CHECK

6. Right Wing, Trailing Edge

1. Aileron - CHECK FOR FREEDOM OF MOVEMENT
2. Flaps - CHECK
3. Wing Root Sump - DRAIN

7. Fuselage, Right Side

1. Static Port - CLEAR OF OBSTRUCTIONS
2. Antennas - CHECKED
3. Emergency Locator Transmitter - ARMED

8. Empennage

1. Position Light - CHECK
2. Rudder Mounted Rotating Beacon - CHECK
3. Control Surfaces - CHECK
4. Tab - ELEVATOR TAB NEUTRAL WITH ELEVATOR NEUTRAL
5. Deice Boots - CHECK
6. Tie Down - REMOVE

9. Fuselage, Left Side

1. Static Port - CLEAR OF OBSTRUCTIONS

CAUTION

Never taxi with a flat shock strut.

NOTE

If night flight is anticipated, exterior lights should be checked for operation.

BEFORE STARTING

1. Cabin Door, Escape Hatch and Baggage - SECURED
2. Seat and Rudder Pedals - ADJUSTED. SEAT BACKS UPRIGHT
3. Seat Belts and Shoulder Harnesses - FASTEN
4. Flight Controls - FREEDOM OF MOVEMENT and PROPER RESPONSE
5. Cowl Flaps - CHECK OPEN
6. Circuit Breakers - IN
7. Fuel Selectors - ON

STARTING

CAUTION

Do not engage starter for more than 30 seconds in any 4-minute time period.

1. Propeller Controls - FORWARD (Low Pitch)
2. Mixture Controls - IDLE CUT-OFF
3. Battery Switch - ON

CAUTION

If voltmeter indicates less than 20 volts, the battery must be recharged or replaced with a battery indicating 20 volts or greater before using external power as described later in this section.

NOTE

If external power is used, start right engine first.

4. Boost Pumps - ON
5. Start Engines
   a. Cold Starts:
      (1) Throttle 1000 rpm position (approximately 1/2 inch open).
      (2) Mixture control FULL FORWARD for 2 to 3 seconds to prime then to IDLE CUT-OFF.
      (3) Magneto/Start Switch - START
      (4) When the engine starts, return the Magneto/Start switch to BOTH, Slowly advance the mixture control to FULL RICH.
   b. Flooded Engine:
      (1) Mixture Control - IDLE CUT-OFF
      (2) Throttle - ~~1/2~~ OPEN 1/3
      (3) Magneto/Start Switch - START
      (4) When engine starts, return the Magneto/Start switch to BOTH. Retard the throttle and slowly advance the mixture control to FULL RICH position.
   c. Hot Starts:
      (1) Throttle 1300 to 1500 rpm position (approximately 1 inch open).
      (2) Mixture Controls - IDLE CUT-OFF
      (3) Magneto/Start Switch - START

      NOTE

      A small prime may be necessary if the engine does not start after a few revolutions.

      (4) When the engine starts, return the Magneto/Start switch to BOTH. Slowly advance the mixture control to FULL RICH.

less than full rich if high density

6. Throttle 1000 to 1500 rpm
7. Oil Pressure - ABOVE RED RADIAL WITHIN 30 SECONDS
8. Generator Switch - ON
9. External Power (if used) - DISCONNECT
10. BATTERY CHARGE Annunciator Light (if installed) - CHECK

NOTE

Provided sufficient energy is used from the battery during the first engine start, the amber caution light, placarded BATTERY CHARGE, will illuminate approximately 6 seconds after the generator is on the line. This indicates a charge current in excess of 3 amperes. The light should extinguish within 5 minutes. Failure to do so indicates a partially discharged battery. Continue to charge battery. Make a check each 90 seconds using the Shutdown Battery Condition Ch procedure until the charge rate fails to decrease and the light extinguishes. Failure of the light to extinguish indicates an unsatisfactory condition. The battery should be removed and checked by a qualified nickel-cadmium battery shop.

11. Starter Energized Warning Light (if installed) - CHECK for illumination during start. Should not be illuminated after starting.

CAUTION

* — If the starter energized warning light is not installed or is inoperative, and the total of both loadmeters exceeds .2 after two minutes at 1000-1500 rpm, with no additional electrical equipment on, and the indication shows no signs of decreasing, an electrical malfunction is indicated. The battery master and both generator switches should be placed in the OFF position. Do not take off.

12. Use the same procedure to start other engine.
13. Fuel Boost Pumps - OFF

NOTE

* — Use of the fuel boost pumps is recommended for ground operation in ambient temperature of 90°F (32°C) or above.

AFTER STARTING AND TAXI

1. Brakes - CHECK
2. Voltage and Loadmeters - CHECK
3. Avionics - ON
4. Lights - AS REQUIRED
5. Cabin Temperature and Mode - AS REQUIRED
6. Annunciator Warning Lights - PRESS-TO-TEST
7. Instruments - CHECK

BEFORE TAKEOFF

NOTE

All reclining seats must be in the upright position before takeoff.

1. Seat Belts and Shoulder Harnesses - CHECK
2. Parking Brake - SET
3. Engine Warm-up - 1000 TO 1500 RPM
4. Fuel Boost Pumps - ON

NOTE

* — With engine speed below 2000 rpm, a diaphragm failure in the engine driven pump will cause engine roughness and a drop in rpm when the fuel pump is turned on.

5. Fuel Selectors - CROSSFEED (for 10-15 seconds)
6. Fuel Selectors - RETURN BOTH TO ON POSITION
7. Instruments - CHECK, NORMAL INDICATION AND SET
8. Flaps - CHECK OPERATION AND SET
9. Autopilot - CHECK
10. Electric Trim - CHECK OPERATION
11. Trim - SET TO TAKE-OFF RANGE
12. Propeller Synchronizer - OFF
13. Throttles - 2000 RPM
14. Magnetos - CHECK (175 rpm maximum drop within 50 rpm of each other.)

NOTE

Avoid operation on one magneto for more than 5 to 10 seconds.

15. Throttles - 1500 RPM
16. Starter Energized Warning Light (if installed) - CHECK; should be illuminated during start and extinguished after start. If Light is not installed or is inoperative, monitor loadmeters to see that the total of both loadmeters does not exceed .2 after two minutes at 1000-1500 rpm with no additional electrical equipment on. (See Starting Procedures)
17. Propellers - FEATHER CHECK (No more than 500 rpm drop) Repeat 2 or 3 times in cold weather
18. Gyro Pressure and Load Meters - CHECK
19. Throttles - IDLE
20. Pressurization - SET
21. Parking Brake - RELEASE

TAKEOFF

POWER SETTINGS:

Take-off and Maximum Continuous .... 41.5 in. Hg 2900 RPM

1. Power - SET take-off power before brake release.
2. Airspeed - ACCELERATE to and maintain take-off speed.
3. Landing Gear - RETRACT when aircraft is positively airborne.
4. Airspeed - ESTABLISH DESIRED CLIMB SPEED when clear of obstacles.

MAXIMUM PERFORMANCE CLIMB

1. Power - SET (Serials P-247 thru P-522) MAXIMUM CONTINUOUS POWER (41.5 in. Hg 2900 rpm)
   (Serials P-523 and After) NORMAL OPERATING POWER (36.5 in. Hg 2750 rpm)
2. Fuel Boost Pumps - ON
3. Mixtures - FULL RICH
4. Cowl Flaps - OPEN
5. Propeller Synchronizer - ON
6. Airspeed - ESTABLISH TWO-ENGINE RECOMMENDED CLIMB SPEED

CRUISE CLIMB

1. Power - SET CRUISE CLIMB POWER (36.5 in. Hg 2750 rpm)
2. Fuel Flow - 198 LBS/HR/ENGINE
3. Propeller Synchronizer - ON
4. Airspeed - ESTABLISH TWO-ENGINE RECOMMENDED CLIMB SPEED
5. Pressurization Directional Toggle Switch - UP
6. ~~Cowl Flaps - AS REQUIRED (MAINTAIN 225°C CYLINDER HEAD TEMPERATURE OR LESS)~~
7. Boost Pumps - AS REQUIRED

NOTE

Use of fuel boost pump may be discontinued at any time except when excessive fluctuations of fuel flow readings indicate a need for continued use.

CRUISE

1. Power - SET AS DESIRED (Use Cruise Power Settings tables)

NOTE

The minimum and maximum limits of manifold pressure and rpm will not be shown on the Horsepower Calculator.

2. Fuel Flow - LEAN AS REQUIRED (Lean to recommended fuel flow if Turbine Inlet Temperature (TIT) is below 900°C).
3. Fuel Boost Pumps - OFF (Unless needed to prevent fuel flow fluctuations.)
4. Cowl Flaps - AS REQUIRED (Maintain 225°C cylinder head temperature or less)

5. Battery - MONITOR CONDITION (If BATTERY CHARGE annunciator is installed)

NOTE

If the amber caution light, placarded BATTERY CHARGE, illuminates in flight, turn the Battery Switch - OFF and proceed to destination. (The battery switch should be turned on for landing in order to avoid electrical transients caused by power fluctuations.) A battery condition check as outlined under Shutdown Battery Condition Check procedures should be made after landing. If the battery indicates unsatisfactory, it should be removed and checked by a qualified nickel-cadmium battery shop.

OPERATIONAL SPEEDS

Minimum Single-Engine Control .... VMC .... [redacted]/85 kts

Single-Engine Best Angle-of-Climb .... VXSE .... [redacted]/100 kts

Single-Engine Best Rate-of-Climb .... VYSE .... [redacted]/110 kts

Two-Engine Best Angle-of-Climb .... VX .... [redacted]/99 kts

Two-Engine Best Rate-of-Climb
(Serials P-247 thru P-522) .... VY .... [redacted]/120 KTS
(Serials P-523 and after) .... RECOMMENDED BELOW 14,000 ft. .... 110 KTS IAS
RECOMMENDED 14,000 Ft. and above .... 120 KTS IAS

Cruise Climb:

SL - 20,000 feet .... 161 mph/140 kts
20 - 25,000 feet .... 150 mph/130 kts
25 - 30,000 feet .... 138 mph/120 kts

Maximum Demonstrated Crosswind .... [redacted]/25 kts

DESCENT

1. Altimeter - SET
2. Cowl Flaps - CLOSED
3. Windshield Anti-ice and Defroster - AS REQUIRED (On before descent into warm, moist air.)
4. Pressurization - SET
5. Power - AS REQUIRED (to maintain cabin pressurization)

BEFORE LANDING

1. Pressurization - ZERO DIFFERENTIAL PRESSURE
2. Seat Belts and Shoulder Harnesses - FASTEN. SEAT BACKS UPRIGHT
3. Fuel Boost Pumps - ON
4. Propeller Synchronizer - OFF
5. Mixtures - FULL RICH
6. Flaps - APPROACH (15°) (Maximum Extension Speed 200 mph/174 kts)
7. Landing Gear DOWN (Maximum Extension Speed 200 mph/174 kts)
8. Flaps - FULL DOWN (30°) (Maximum Extension Speed 161 mph/140 kts)
9. Airspeed - ESTABLISH LANDING APPROACH SPEED
10. Propeller Levers - FULL FORWARD

BALKED LANDING

1. Power - 2900 RPM and 41.5 in Hg
2. Airspeed - BALKED LANDING CLIMB SPEED
3. Flaps - UP
4. Gear - UP
5. Cowl Flaps - AS REQUIRED

AFTER LANDING

1. Landing and Taxi Lights - AS REQUIRED
2. Flaps - UP
3. Trim Tabs - SET TO ZERO
4. Cowl Flaps - OPEN
5. Fuel Boost Pumps - AS REQUIRED

NOTE

Fuel boost pumps may be turned off if ambient temperature is below 90°F (32°C).

SHUT DOWN

1. Parking Brake - SET
2. Battery - CONDITION AND CHARGE (If the BATTERY CHARGE annunciator is installed). If the BATTERY CHARGE annunciator light is extinguished, the battery is charged and the condition is good. If the light is illuminated, perform the following check:

   a. One Generator - OFF
   b. Engine Speed (engine with generator on) - 1000 RPM (Voltmeter approximately 28 volts)
   c. After loadmeter needle stabilizes, momentarily turn the Battery switch OFF and note change in meter indication.

NOTE

The change in loadmeter indication is the battery charge current and should be no more than .025 (only perceivable needle movement). If the result of the first test is not satisfactory, allow the battery to charge repeating the test each 90 seconds. If the results are not satisfactory within 3 minutes, the battery should be removed and checked by a qualified nickel-cadmium battery shop.

3. Electrical and Avionics Equipment - OFF
4. Cabin Temp Mode - OFF
5. Propellers - LOW PITCH (High rpm)
6. Throttles - 1000 RPM
7. Fuel Boost Pumps - OFF
8. Mixtures - IDLE CUT-OFF
9. Magneto/Start Switches - OFF, after engines stop
10. Battery and Generator Switches - OFF
11. Controls - LOCKED
12. If airplane is to be parked for an extended period of time, install wheel chocks and release the parking brake, as greatly varying ambient temperatures may build excessive pressures on the hydraulic system.

ENVIRONMENTAL CONTROLS

PRESSURIZATION SYSTEM

If, for any reason, both pressurization air shut-off controls are in the PULL TO SHUT-OFF position, the Test/Dump switch must be in the DUMP position to provide adequate ventilation.

BEFORE TAKE-OFF, MANUAL CONTROLLER (P-247 through P-307)

1. Pressurization Air Shut-Off Controls - OPEN (In)
2. Pressure/Dump Switch - PRESSURE POSITION
3. Cabin Altitude Controller - SET 1000 FEET BELOW FIELD ELEVATION
4. Throttles - 2500 RPM
5. Test Switch - PRESS-TO-TEST (Note momentary cabin descent); RELEASE SWITCH
6. Cabin Altitude Controller - SET 1000 FEET ABOVE TAKE-OFF FIELD OR DESTINATION FIELD ELEVATION, WHICHEVER IS HIGHEST

BEFORE TAKE-OFF, MOTORIZED CONTROLLER (P-247 through P-307)

1. Pressurization Air Shut-Off Controls - OPEN (In)
2. Test/Dump Switch - OFF
3. Directional Toggle Switch - OFF
4. Cabin Altitude Controller - MANUALLY SET TO 1000 FEET BELOW FIELD ELEVATION
5. Throttles - 2500 RPM
6. Test/Dump Switch - HOLD TO TEST (Note momentary cabin descent); RELEASE TO OFF POSITION
7. Directional Toggle Switch - UP (Manually set to 1000 feet above field elevation), THEN OFF
8. Red Altitude Selector Ring - SET TO 500 FEET ABOVE CRUISE ALTITUDE

BEFORE TAKE-OFF, CONTROLLER (P-308 and after)

1. Pressurization Air Shut-Off Controls - OPEN (In)
2. Test/Dump Switch - NOR
3. Cabin Altitude Controller - SET OUTER SCALE 1000 FEET BELOW FIELD ELEVATION
4. Throttles - 2500 RPM
5. Test/Dump Switch - HOLD TO TEST (Note momentary cabin descent); RELEASE TO NOR POSITION
6. Cabin Altitude Controller - SET OUTER SCALE TO DESIRED CABIN ALTITUDE OR INNER SCALE TO CRUISE ALTITUDE PLUS 500 FEET
7. Rate Control - SET POINTER TO VERTICAL POSITION

tes + finished

IN FLIGHT, MOTORIZED CONTROLLER (P-247 through P-307)

When Cabin Rate-of-Climb indicates zero

1. Directional Toggle Switch - UP (To raise cabin to selected altitude).

On descent when differential pressure is below 4.0 psi

1. Directional Toggle Switch - DOWN (To lower cabin to 1000 feet above destination field elevation).

CAUTION

Insure that cabin differential pressure is ZERO to avoid landing with a pressurized cabin.

IN FLIGHT. CONTROLLER (P-308 and after)

Before descent

1. Cabin Altitude Controller - SET OUTER SCALE TO FIELD ELEVATION PLUS 500 FEET
2. Rate Control - SET TO ACHIEVE ZERO PRESSURE DIFFERENTIAL BEFORE LANDING

NOTE

During descent, adjust power as required to maintain pressurization.

COLD WEATHER OPERATION

PREFLIGHT INSPECTION

In addition to the normal preflight exterior inspection, remove ice, snow, and frost from the wings, tail, control surfaces and hinges, propellers, windshield, fuel cell filler caps and fuel vents. The wing contour may be changed by these formations sufficiently that its lift qualities are considerably disturbed and sometimes completely destroyed. Complete your normal preflight procedures, including a check of the flight controls for complete freedom of movement.

Conditions for accumulating moisture in the fuel cells are most favorable at low temperatures due to the condensation increase and the moisture that enters as the systems are serviced. Therefore, close attention to draining the fuel system sumps will assume particular importance during cold weather.

ENGINES

Use engine oil in accordance with the Consumable Materials. At temperatures of 10°F and below preheat engines prior to start. Give particular attention to the oil cooler and engine sump to ensure proper preheat. A start with congealed oil in the system may produce an indication of normal pressure immediately after the start, but then the oil pressure may decrease when residual oil in the engine is pumped back with the congealed oil in the sump. If an engine heater capable of heating both the engine sump and cooler is not available, the oil should be drained while the engines are hot and stored in a warm area until the next flight.

The airplane is equipped with an external power receptacle, and, during very cold weather, it is advisable to use external power for starting, when available.

Normal engine starting procedures will be used. If there is no oil pressure within the first 30 seconds of running, or if oil pressure drops after a few minutes of ground operation, shut down and check for broken oil lines, oil cooler leaks or the possibility of congealed oil.

During warm-up, watch engine temperatures closely, since it is quite possible to exceed the cylinder head temperature limit in trying to bring up the oil temperature. Exercise the propellers several times to remove cold oil from the pitch change mechanisms. The propellers should also be cycled occasionally in flight. During letdown and landing, give special attention to engine temperatures, since the engines cool quickly.

STARTING ENGINES USING EXTERNAL POWER

1. Battery switch - ON
2. Generator, Electrical and Avionics Equipment Switches - OFF
3. Connect external power unit
4. Set the output of the power unit at 27.0 to 28.5 volts
5. Auxiliary power unit - ON
6. Start right engine first (use normal start procedures)
7. After engine has been started, turn auxiliary power unit OFF
8. Generator Switches - ON
9. Disconnect external power before starting left engine

TAXIING

Avoid taxiing through water, slush, or muddy surfaces if possible. In cold weather, water, slush, or mud, when splashed onto landing gear mechanisms or control surface hinges may freeze, preventing free movement and resulting in structural damage.

OXYGEN SYSTEM

OPERATION

1. Place the system in operation by rotating the valve to the fully ON position. (The shutoff valve on the oxygen cylinder must also be open.)

CAUTION

The shutoff valves of all high pressure oxygen systems should be opened slowly to prevent possiblity of damage to the system.

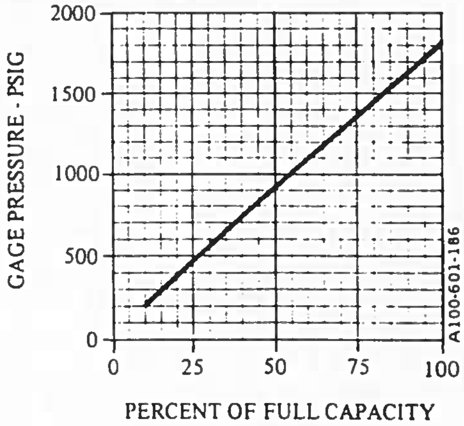
2. Select mask and hose. All are identical and provide the same flow to both pilot and passengers. Check for proper fit of mask and adjust if necessary. Proper fit is important at higher altitudes.
3. Plug in the oxygen mask and check for oxygen flow by noting whether the bag expands or by checking the flow indicator in the hose.
4. Discontinue use by unplugging outlets. The control valve should also be off to ensure complete oxygen flow stoppage. Closing the control valve on the bottle is not recommended except during servicing or prolonged periods of inactivity.

DURATION

Prior to the flight, check for an adequate oxygen supply for the number of people and the trip duration. Determine the supply pressure and convert it to percent of capacity on the Oxygen Available Graph. Find the duration on the Oxygen Duration Table and multiply by the percent of capacity.

OXYGEN AVAILABLE WITH PARTIALLY FULL BOTTLE

1. Determine percent of full bottle from airplane gage pressure.
2. Multiply oxygen duration in minutes by percent of full bottle.



OXYGEN DURATION

Oxygen duration is computed for Scott oxygen masks which regulate the flow rate to 2.5 Standard Liters Per Minute (SLPM). These masks, identified by an aluminum anodized color coded plug-in, are approved for altitudes up to 27,000 feet.

Cylinder Volume Cubic Feet	NUMBER OF PEOPLE USING 1	2	3	4	5	6
	DURATION IN MINUTES					
11	112	55	37	28	22	18
22	222	112	74	54	44	37
49	501	250	167	125	100	83
64	668	334	222	167	133	111

OXYGEN DURATION

Oxygen duration is computed for Scott oxygen masks which regulate the flow rate to 3.0 Standard Liters Per Minute (SLPM). These masks, identified by a green color coded plug-in, are approved for altitudes up to 30,000 feet.

Cylinder Volume Cubic Feet	NUMBER OF PEOPLE USING 1	2	3	4	5	6
	DURATION IN MINUTES					
11	93	46	31	23	18	15
22	187	93	62	46	37	31
49	415	208	138	103	83	69
64	543	271	181	135	108	90

NOISE CHARACTERISTICS

Approach to and departure from an airport should be made so as to avoid prolonged flight at low altitude near noise-sensitive areas. Avoidance of noise-sensitive areas, if practical, is preferable to overflight at relatively low altitudes.

For VFR operations over outdoor assemblies of persons, recreational and park areas, and other noise-sensitive areas, pilots should make every effort to fly not less than 2000 feet above the surface, weather permitting, even though flight at a lower level may be consistent with the provisions of government regulations.

NOTE

The preceding recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgement, an altitude of less than 2000 feet is necessary to adequately exercise his duty to see and avoid other airplanes.

Flyover noise level established in compliance with FAR 36 is:

Serials P-523 and after:

Using MNOP 79.6 dB(A)

NOTE

Flyover noise levels given are not applicable for Serials prior to P-523.

No determination has been made by the Federal Aviation Administration that the noise level of this airplane is or should be acceptable or unacceptable for operation at, into, or out of any airport.

SECTION III

EMERGENCY PROCEDURES

All airspeeds quoted in this section are indicated airspeeds (IAS)

The following information is presented to enable you to form, in advance, a definite plan of action for coping with the most probable emergency situations which could occur. Where practicable, the emergencies requiring immediate corrective action are treated in check list form for easy reference and familiarization. Other situations, in which more time is usually permitted to decide on and execute a plan of action, are discussed at some length. In order to supply one safe speed for each type of emergency situation the airspeeds presented are derived at 6775 lbs.

SINGLE-ENGINE OPERATION

The two major factors that govern single-engine operation are airspeed and lateral/directional control. The airplane can be safely maneuvered or trimmed for normal hands-off operation and sustained in this configuration by the operative engine AS LONG AS SUFFICIENT AIRSPEED IS MAINTAINED.

SINGLE-ENGINE BEST RATE-OF-CLIMB SPEED, 127 MPH/110 KTS

The single-engine best rate-of-climb speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time with gear up, flaps up, and inoperative propeller feathered.

SINGLE-ENGINE BEST ANGLE-OF-CLIMB SPEED, 115 MPH/100 KTS

The single-engine best angle-of-climb speed is the airspeed which delivers the greatest gain in altitude in the shortest possible horizontal distance with gear up, flaps up, and inoperative propeller feathered.

MINIMUM SINGLE-ENGINE CONTROL SPEED, 98 MPH/85 KTS

The minimum single-engine control speed is the airspeed below which the airplane cannot be controlled laterally and directionally in flight with one engine operating at take-off power and the other engine with its propeller windmilling.

DETERMINING INOPERATIVE ENGINE

The following checks will help determine which engine has failed.

1. DEAD FOOT - DEAD ENGINE. The rudder pressure required to maintain directional control will be on the side of the good engine.
2. THROTTLE. Partially retard the throttle for the engine that is believed to be inoperative; there should be no change in control pressures or in the sound of the engine if the correct throttle has been selected. AT LOW ALTITUDE AND AIRSPEED THIS CHECK MUST BE ACCOMPLISHED WITH EXTREME CAUTION.

Do not attempt to determine the inoperative engine by means of the tachometer or the manifold pressure. These indicators often indicate near normal readings.

ENGINE FIRE ON GROUND

1. Mixture Controls - IDLE CUT-OFF
2. Continue to crank affected engine
3. Fuel Selector Valves - OFF
4. Throttle - FULL OPEN
5. Battery and Generator Switches - OFF
6. Shut-down other engine
7. Extinguish with fire extinguisher

ENGINE FAILURE DURING GROUND ROLL

1. Throttle - CLOSED
2. Braking - MAXIMUM
3. Fuel Selector Valves - OFF
4. Battery and Generator Switches - OFF

NOTE

Braking effectivity is improved if the brakes are not locked.

ENGINE FAILURE AFTER LIFT-OFF OR IN FLIGHT

The most important aspect of engine failure is the necessity to maintain lateral and directional control, and to achieve and maintain normal take-off airspeed or above. If practicable, an immediate landing should be made. The following procedures provide for minimum diversion of attention while flying the airplane.

NOTE

If airspeed is below 98 mph/85 kts reduce power on operative engine as required to maintain lateral and directional control.

1. Landing Gear and Flaps - UP
2. Throttle (inoperative engine) - CLOSE
3. Propeller (inoperative engine) - FEATHER
4. Power (operative engine) - AS REQUIRED
5. Airspeed - AT OR ABOVE NORMAL TAKE-OFF SPEED

After positive control of the airplane is established:

6. Secure inoperative engine:

    a. Mixture - IDLE CUT-OFF
    b. Fuel Selector - OFF
    c. Fuel Boost Pump - OFF
    d. Magneto/Start Switch - OFF
    e. Generator Switch - OFF
    f. Cowl Flap - CLOSED

7. Electrical Load - MONITOR (Maximum load of 1.0 on remaining engine)

ENGINE FIRE IN FLIGHT

Shut down the affected engine according to the following procedure and land immediately.

Hands can be on front office by turning valves first

1. Mixture - IDLE CUT-OFF
2. Fuel Selector Valve - OFF
3. Propeller - FEATHERED
4. Pressurization Air Shutoff Control - PULL
5. Fuel Boost Pump - CHECK OFF
6. Magneto/Start Switch - OFF
7. Generator Switch - OFF — close cowl
8. Oxygen - AS REQUIRED

EMERGENCY DESCENT

1. Propeller Controls - 2900 RPM
2. Throttles - CLOSED
3. Airspeed - 200 MPH/174 KTS
4. Landing Gear - DOWN
5. Flaps - APPROACH (15°)
6. Oxygen - AS REQUIRED

MAXIMUM GLIDE (FORCED LANDING)

Feather propellers, retract the wing flaps, landing gear, and cowl flaps. The glide ratio in this configuration is slightly over 2 nautical miles of gliding distance for each 1000 feet of altitude at an airspeed of 127 mph/110 kts.

SINGLE-ENGINE LANDING

On final approach and when it is certain that the field can be reached:

1. Landing Gear - DOWN
2. Flaps - APPROACH
3. Airspeed - NORMAL LANDING APPROACH SPEED
4. Power - AS REQUIRED to maintain 800 ft/min rate of descent

When it is certain there is no possibility of go-around:

5. Flaps - DOWN
6. Execute Normal Landing

SINGLE-ENGINE GO-AROUND

WARNING

Level flight might not be possible for certain combinations of weight, temperature and altitude. In any event, DO NOT attempt a single-engine go-around after flaps have been fully extended.

1. Power - MAXIMUM ALLOWABLE
2. Flaps - UP
3. Landing Gear - UP
4. Airspeed - AT OR ABOVE TAKE-OFF SPEED

LANDING GEAR MANUAL EXTENSION

climb to safe altitude
engage autopilot (130-140 KTS) - slide seat back
slow plane down

1. Airspeed - BELOW 200 MPH/174 KTS (lower airspeeds make landing gear extension easier)
2. Landing Gear Motor Circuit Breaker (right upper side panel) - PULL
3. Landing Gear Position Handle - DOWN
4. Engage handcrank and turn clock wise as far as possible (approximately 50 turns) turn until it won't turn
5. If electrical system is operative, check landing gear position lights and warning horn

WARNING

Do not operate the landing gear electrically with the handcrank engaged, as damage to the mechanism could occur.

After emergency landing gear extension, do not stow handcrank or move any landing gear controls or reset any switches or circuit breakers until airplane is on jacks, as failure may have been in the gear-up circuit and gear might retract with the airplane on the ground.

Do not attempt to retract the landing gear manually.

GEAR-UP LANDING

Make a normal approach and when the landing spot is assured:

1. Cowl Flaps - CLOSED
2. Wing Flaps - DOWN
3. Throttle(s) - CLOSED
4. Mixture(s) - IDLE CUT-OFF
5. Fuel Selector Valves - OFF
6. Battery, Generator and Magneto Switches - OFF
7. Keep wings level during touch-down
8. Evacuate airplane as soon as it stops

Electrical Fire

1. Battery - generators all ~~electrical switches~~ — off
2. Oxygen — if needed
3. all electrical switches, radios — off
4. Turn battery switch — on
5. Turn one generator switch — on
6. Turn panel lights — on
7. Turn avionics Master — on
8. One Comm — on
9. one Nav — on
10. one Transponder (squawk 7700) — on

land when practical

Note:

Do not turn on more than needed to fly plane and Navigate. Do not turn equiptment on to find Fire

EMERGENCY EXIT

The emergency exit door is located at the forward right cabin window with the handle behind the curtain and may be opened as follows:

1. Lift cover and release latch.
2. Pull handle fully down.
3. Pull door into the cabin.

AIR START

CAUTION

The pilot should determine the reason for the engine failure before attempting an air start.

Do not use engine starter above 20,000 feet.

NOTE

The oil cooler may be damaged during an air start after a prolonged shut down, if the temperature is 0°C or below.

For the engine to be started:

1. Mixture - IDLE CUT-OFF
2. Fuel Selector Valve - ON
3. Fuel Boost Pump - ON
4. Magneto/Start Switch - ON
5. Throttle - NORMAL START POSITION (1/2 inch open)
6. Prime - MIXTURE FULL RICH THEN IDLE CUT-OFF
7. Propeller

   a. WITHOUT UNFEATHERING ACCUMULATORS:

      (1) Pressurization Air Shut-off Valve - CLOSE (Pull Red Handle)
      (2) Propeller Control - MOVE FORWARD OF THE FEATHERING DETENT TO MID-RANGE
      (3) Magneto/Start Switch - START
      (4) Mixture - FULL RICH AT 1000 RPM
      (5) Open PRESSURIZATION AIR SHUT-OFF Valve - AFTER ENGINE IS RUNNING SMOOTHLY.

   b. WITH UNFEATHERING ACCUMULATORS:

      (1) Propeller Control - FORWARD OF FEATHERING DETENT UNTIL ENGINE ATTAINS 600 RPM; THEN BACK TO DETENT
      (2) Oil Pressure - STABILIZED

      NOTE

      If propeller does not unfeather or the engine does not turn, return the propeller control to the feather position and secure the engine.

      (3) Mixture - FULL RICH AT 1000 RPM

8. Throttle - AS NECESSARY TO PREVENT OVERSPEED; warm up at 15 inches Hg manifold pressure
9. Oil Pressure, Oil and Cylinder Head Temperatures - NORMAL INDICATION
10. Generator Switch - ON
11. Power - AS REQUIRED

SINGLE-ENGINE OPERATION ON CROSSFEED

Left engine inoperative ~~and fuel being supplied from~~ left side.

1. Left Fuel Boost Pump - ON
2. Left Fuel Selector - OFF
3. Right Fuel Selector - CROSSFEED
4. Left Fuel Boost Pump - OFF

Right engine inoperative and ~~fuel being supplied from right side~~.

1. Right Fuel Boost Pump - ON
2. Right Fuel Selector - OFF
3. Left Fuel Selector - CROSSFEED
4. Right Fuel Boost Pump - OFF

CAUTION

Continuous operation of Fuel Boost Pump may be required if excessive fuel flow fluctuations are encountered.

EMERGENCY STATIC AIR SOURCE (P-247 through P-262)

THE EMERGENCY STATIC AIR SOURCE SHOULD BE USED FOR CONDITIONS WHERE THE NORMAL STATIC SOURCE HAS BEEN OBSTRUCTED. When the aircraft has been exposed to moisture and/or icing conditions (especially on the ground), the possibility of obstructed static ports should be considered. Partial obstructions will result in the rate of climb indication being sluggish during a climb or descent. Verification of suspected obstruction is possible by switching to the alternate system and noting a sudden sustained change in rate of climb. This may be accompanied by abnormal indicated airspeed and altitude changes beyond normal calibration differences.

Whenever any obstruction exists in the normal static air system or, the emergency static air source is desired for use:

1. Alternate Static Air Valve (Red knob) - ROTATE COUNTERCLOCKWISE APPROXIMATELY 9 TURNS TO STOP
2. For Airspeed Calibration and Altimeter Correction, refer to FAA Performance Section

CAUTION

Be certain the Alternate Static Air Valve is in the CLOSED position when system is not needed.

ALTERNATE STATIC AIR SOURCE (P-263 and after and all prior airplanes incorporating Kit 60-5019)

THE ALTERNATE STATIC AIR SOURCE SHOULD BE USED FOR CONDITIONS WHERE THE NORMAL STATIC SOURCE HAS BEEN OBSTRUCTED. When the aircraft has been exposed to moisture and/or icing conditions (especially on the ground), the possibility of obstructed static ports should be considered. Partial obstructions will result in the rate of climb indication being sluggish during a climb or descent. Verification of suspected obstruction is possible by switching to the alternate system and noting a sudden sustained change in rate of climb. This may be accompanied by abnormal indicated airspeed and altitude changes beyond normal calibration differences.

Whenever any obstruction exists in the normal static air system or, the alternate static air source is desired for use:

1. Alternate Static Air Switch - ON.
2. For Airspeed Calibration and Altimeter Correction, refer to FAA Performance Section

CAUTION

Be certain the Pilot's Static Air Source is in the NORMAL position when the alternate system is not needed.

ELECTRICAL SYSTEM FAILURE

GENERATOR INOPERATIVE (GEN OUT ANNUNCIATOR ILLUMINATED)

1. Generator Switch - OFF, then ON

   If generator will not reset:

2. Generator Switch - OFF
3. Operating Generator - DO NOT EXCEED 1.0 LOAD

~~*BATTERY CHARGE ANNUNCIATOR ILLUMINATED (IF INSTALLED)*~~

In Flight:

Inflight illumination of the BATTERY CHARGE annunciator indicates a possible battery malfunction.

1. Battery Switch - OFF
2. BATTERY CHARGE Annunciator - EXTINGUISHED

NOTE

If the BATTERY CHARGE annunciator does not extinguish when the battery ~~control switch is placed in the OFF position, land as soon as practical.~~

SUBPANEL FEEDER CIRCUIT BREAKER TRIPPED (FUEL PANEL BUS FEEDERS AND RIGHT CIRCUIT BREAKER PANEL BUS FEEDERS)

- A short is indicated; DO NOT RESET IN FLIGHT

NOTE

The items that may be inoperative can be determined from the Power Distribution Schematic in Section IX, SYSTEMS.

INVERTER INOPERATIVE (INVERTER OUT ANNUNCIATOR ILLUMINATED)

- Select the other inverter windshield heat won't work using stanby invertor

STARTER ENERGIZED WARNING LIGHT ILLUMINATED (IF INSTALLED)

After engine start, should the starter relay remain engaged, the starter will remain energized and the starter energized warning light will remain illuminated. Continuing to supply power to the starter will result in eventual loss of electrical power.

On The Ground:

1. Battery and both Generator Switches - OFF
2. Do not take off.

In Flight After Air Start:

1. Battery and both Generator Switches - OFF
2. Land as soon as practical

UNSCHEDULED ELECTRIC ELEVATOR TRIM (WITHOUT AUTOPILOT)

1. Airplane Attitude - MAINTAIN using elevator control
2. Actuate Thumb Switch in the opposite direction to open circuit breaker
3. ON-OFF Switch (On Instrument Panel) - OFF
4. Retrim with Manual Trim Wheel

PRESSURIZATION SYSTEM

Any time the differential pressure goes into the red arc, either reschedule the cabin altitude selector or dump all pressure with the DUMP switch.

LOSS OF PRESSURIZATION

1. When operating at Cabin Altitudes below 10,000 feet (Cruise Altitudes up to 25,000 feet), illumination of the CABIN ALT annunciator light indicates a loss of pressurization.
2. When operating at Cabin Altitudes above 10,000 feet (Cruise Altitudes above 25,000 feet), a loss of pressurization is indicated by the Cabin Altitude Indicator.
3. In the event of pressurization loss, USE OXYGEN AND DESCEND AS REQUIRED.

CAUTION

Idle power on both engines will cause a loss of pressurization. Use oxygen masks as required.

The following table sets forth the average time of Useful Consciousness (time from onset of hypoxia until loss of effective performance at various altitudes).

30,000 ft MSL	1 to 2 minutes
28,000 ft MSL	2-1/2 to 3 minutes
25,000 ft MSL	3 to 5 minutes
22,000 ft MSL	5 to 10 minutes
12 - 18,000 ft MSL	30 minutes or more

LANDING GEAR RETRACTION AFTER PRACTICE MANUAL EXTENSION

After a practice manual extension of the landing gear, the gear may be retracted electrically, as follows:

1. Handcrank - CHECK STOWED
2. Landing Gear Motor Circuit Breaker - IN
3. Landing Gear Handle - Up

SIMULATED SINGLE-ENGINE PROCEDURE

ZERO THRUST (Simulated Feather)

Use the following power setting (only on one engine at a time) to establish zero thrust. Use of this power setting avoids the difficulties of starting an engine and preserves availability of engine power.

The following procedure should be accomplished by alternating small reductions of propeller and then throttle, until the desired setting has been reached.

1. Propeller Lever - RETARD TO FEATHER DETENT
2. Throttle Lever - SET 12 in. Hg MANIFOLD PRESSURE

NOTE

This setting will approximate Zero Thrust at low altitudes using recommended Single-Engine Climb Speeds.

ILLUMINATION OF CABIN DOOR WARNING LIGHT

WARNING

If the cabin is pressurized and the door is not completely latched, any movement of the door handle toward the unlocked position may cause loss of pressurization and opening of the door.

1. If the cabin door light on the annunciator panel indicates that the cabin door may not be secure, depressurize the cabin (consider altitude before depressurizing).
2. Do not attempt to check the cabin door for security until the cabin is depressurized.

SPINS

If a spin is entered inadvertently:

Immediately move the control column full forward, apply full rudder opposite to the direction of the spin and reduce power on both engines to idle. These three actions should be done as near simultaneously as possible; then continue to hold this control position until rotation stops, and then neutralize all controls and execute a smooth pullout. Ailerons should be neutral during recovery.

NOTE

Federal Aviation Administration Regulations do not require spin demonstration of airplanes of this weight; therefore no spin tests have been conducted. This recovery technique is based on the best available information.

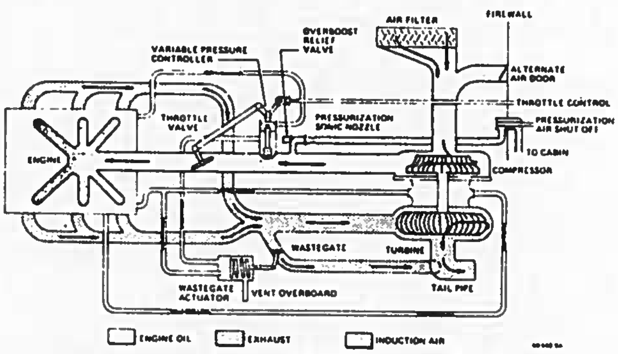
PROPULSION SYSTEM

ENGINES

The BEECHCRAFT Duke is equipped with Lycoming TIO-541-E1A4 and/or TIO-541-E1C4 engines for serials P-4 thru P-522 and two TIO-541-E1C4 engines for serials P-523 and after. They are rated at 380 horsepower at 2900 rpm and 41.5 in. Hg, and are turbocharged for high performance at altitudes to 30,000 feet. The engines drive three-bladed, 74 in. diameter, constant-speed, full-feathering, hydraulically controlled propellers.

TURBOCHARGER

The turbocharger consists of two separate components: a compressor and a turbine connected by a common shaft.



The compressor supplies pressurized air to the engines for high altitude operation, and to the cabin for pressurization. The compressor and its housing are located between the ambient air intake and the induction air manifold. The turbine and its housing are part of the exhaust system and utilize the flow of exhaust gases to drive the compressor.

WASTE GATE AND EXHAUST BYPASS

The waste gate actuator, operated by engine oil pressure, activates a waste gate valve located in the exhaust bypass. Oil pressure closes the waste gate and all the exhaust gas is routed into the turbine side of the turbocharger, giving maximum compression to induction air. When the actuator opens the waste gate a minimum of exhaust gas drives the turbocharger. The balance of the exhaust is dumped directly overboard. Thus, the waste gate position regulates the supercharger air available to the engine.

The following steps describe the operation of the system:

1. Induction air is taken in through the air filter and ducted to the compressor.
2. The induction air is then compressed and ducted to the engine.
3. A portion of the compressed air is bled off for cabin pressurization.
4. As the waste gate opens, some of the exhaust gases are routed around the turbine, through the exhaust bypass and overboard.
5. When the waste gate is closed, all of the exhaust gases pass through and drive the turbine, which, in turn, drives the compressor.
6. The exhaust gases are dumped overboard.

VARIABLE ABSOLUTE PRESSURE CONTROLLER

The control center of the turbocharger system is the variable absolute pressure controller. This device simplifies turbocharging to one control - the throttle. Once the pilot has set the desired manifold pressure, virtually no throttle adjustment is required with changes in altitude. The controller senses manifold pressure requirements for various altitudes and regulates the oil pressure to adjust the waste gate. Thus, the turbocharger maintains only the manifold pressure called for by the throttle setting except for operation above the "critical altitude" or that altitude where the waste gate reaches the fully closed position. For example, at 2900 rpm, the critical altitude is that altitude above which 41.5 in. Hg manifold pressure cannot be obtained at full throttle.

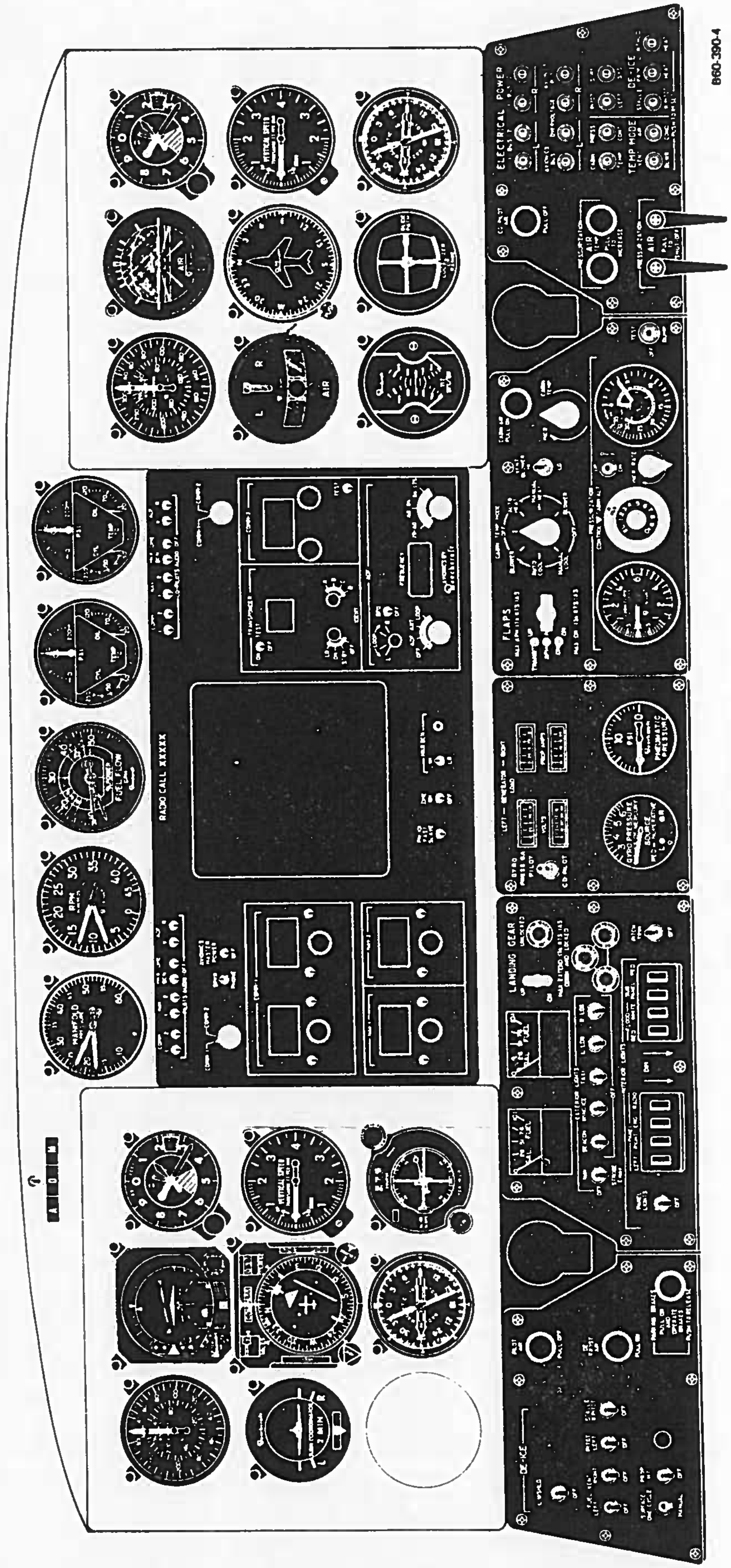
OPERATIONAL CHARACTERISTICS

Aside from the absence of manifold pressure variation with altitude, there is little difference between the turbocharged and the unturbocharged engine when operated below the critical altitude.

Above critical altitude, certain operational characteristics must be understood to fully realize the advantages and capabilities of this turbocharger engine combination. These are as follows:

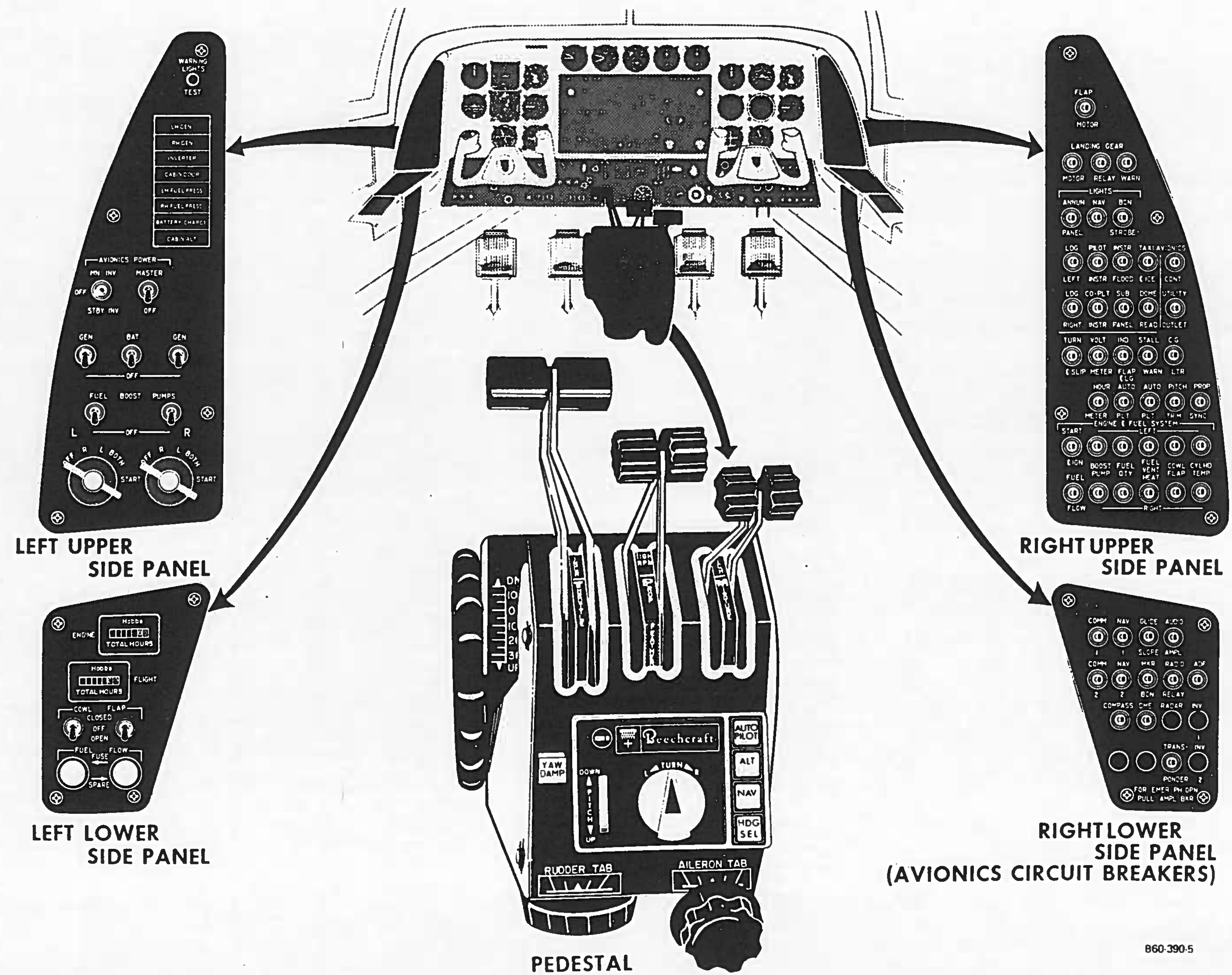
RPM EFFECT ON MANIFOLD PRESSURE

Above the critical altitude, any change in rpm will result in a change in manifold pressure. A decrease in rpm will produce an increase in manifold pressure.



860-390-4

TYPICAL INSTRUMENT PANEL


LEFT UPPER SIDE PANEL
LEFT LOWER SIDE PANEL
PEDESTAL
RIGHT UPPER SIDE PANEL
RIGHT LOWER SIDE PANEL (AVIONICS CIRCUIT BREAKERS)
YAW DAMP
RUDDER TAB
AILERON TAB
AUTO PILOT
ALT
NAV
HDG SEL
Beechcraft
860-390-5

FUEL FLOW EFFECT ON MANIFOLD PRESSURE

Above the critical altitude, with rpm and manifold pressure established for cruise, leaning will cause a slight increase in manifold pressure. When the mixture reaches the recommended fuel flow, a slight reduction in manifold pressure may be necessary.

AIRSPEED EFFECT ON MANIFOLD PRESSURE

Above the critical altitude, an increase in airspeed will result in a corresponding increase in manifold pressure. This is true because the increase in ram air pressure from an increase in airspeed is magnified by the compressor resulting in an increase in manifold pressure. The increase in manifold pressure creates a higher mass flow through the engine, causing higher turbine speeds and thus increasing manifold pressure. This characteristic may be used to best advantage by allowing the aircraft to accelerate to cruise speed after leveling off and prior to reducing power.

ENGINE RESPONSE AT HIGH ALTITUDE

Large, sudden power reductions at altitude with rich mixtures can cause loss of engine power. These power reductions or increases should be made slowly with necessary mixture adjustments in a series of two or three steps.

OVERBOOST CONTROL

The engine incorporates a relief valve in the induction system which is set to relieve the manifold pressure at approximately 44 in. Hg. This valve will open only in the event of a malfunction in the variable absolute pressure control system.

To avoid exceeding normal manifold pressure limits, particularly in cold weather, the last 11/2 inches of throttle travel should be applied slowly while observing manifold pressures. Momentary overboost to the limit of the relief valve (44 in. Hg) will have no detrimental effect on the engine, but is indicative of a malfunctioning variable absolute pressure controller. If overboost is more than momentary, or occurs when engine oil temperature is normal, the controller should be checked by an authorized facility.

POWER PLANT CONTROLS

THROTTLE, PROPELLER AND MIXTURE

The throttle, propeller and mixture control levers are arranged in a conventional manner along the top of the pedestal. Throttle levers are on the left, propeller levers in the center, and mixture levers on the right. An adjustable friction wheel on the upper right side of the console may be turned clockwise to increase friction of the levers to prevent creeping.

INDUCTION AIR

Induction air is available from two sources, filtered ram air or automatic alternate air. Filtered ram air enters from a flush inlet air scoop on the right side of each cowl. Should the filter become obstructed, a spring-loaded door on the firewall will open automatically and the induction system will operate on alternate air taken from a louvered opening on the right side of the nacelle. Above critical altitude, on alternate air, a drop of approximately 8 to 10 in. Hg of manifold pressure will be noted. Below critical altitude, no change of manifold pressure will be indicated. If the manifold pressure drops, it may be regained by advancing the throttles. The mixture should be readjusted after resetting the power.

COWL FLAP

The cowl flap of each engine is controlled by separate switches on the lower left side panel. Each switch has three positions, placarded: CLOSED - OFF - OPEN. The switch allows the cowl flap to be stopped in any position so that the cylinder head temperature can be regulated.

CONTROL LOCK

If it is necessary to park the airplane outside for extended periods, install the control locks and tie down the airplane. Installing control locks may be done as follows:

1. Insert the spring end of the rudder control locking pin into the hole at the top of the pilot's left rudder pedal arm.
2. Neutralize the pedals with the locking pin spring compressed and insert the opposite end of the locking pin into the right pedal arm. The rudder pedals locking pin is placarded RUDDER PEDALS LOCKED.
3. Position the throttle control lock, placarded THROTTLE CONTROLS STOP, forward of the throttle levers in the closed position and secure it to the console with the Dzus fastener.
4. The aileron control locking device, placarded AILERON AND ELEVATOR CONTROLS LOCKED, is installed by inserting the pin through a hole in a flange protruding from the subpanel, and through a matching hole in the lower side of the control column tube. On airplanes P-438 and after, the control wheel is rotated approximately 12 degrees to the right in order to insert the pin. The flag is then rotated over the top of the control column tube.

To lessen the possibility of taxi or take-off with the control locks installed, remove the locking components in the following order: rudder, aileron/elevator and throttle.

ENGINE INSTRUMENTATION

Most of the engine instruments are located in the upper center of the instrument panel above the avionics controls. The standard grouping is the dual manifold pressure, dual tachometer, a dual fuel flow indicator, and a left and right multiple readout indicator for oil pressure, oil temperature, and cylinder head temperature. The left and right loadmeter with the volt meter and propeller ammeter directly below are located in the center subpanel. The fuel quantity indicators are located on the pilot's subpanel and the turbine inlet temperature (TIT) indicator is located on the right floating panel.

ENGINE LUBRICATION

The engines are equipped with a wet sump, pressure type oil system. Each engine sump has a capacity of 13 quarts. The oil system may be checked through access doors in the engine cowling. A calibrated dip stick attached to the filler cap indicates the oil level. Due to the canted position of the engines, the dip sticks are calibrated for either right or left engines, and are not interchangeable.

The oil grades listed in the Approved Oil are general recommendations only, and will vary with individual circumstances. The determining factor for choosing the correct grade of oil is the oil inlet temperature observed during flight; however, inlet temperatures consistently near the maximum allowable indicate a heavier oil is needed.

NOTE

The turbocharged engines are to be operated with ashless dispersant oil conforming to MIL-L-22851 or a Lycoming approved synthetic oil.

PROPELLERS

The engines are equipped with 74 inch Hartzell, three bladed, full feathering, constant speed, air dome propellers. Centrifugal force from the propeller counterweights, assisted by air pressure and a spring in the propeller dome, moves the blades to high pitch. Engine oil under governor-boosted pressure moves the blades to low pitch. Propeller dome air pressure settings are listed in the Servicing Section.

The propellers should be cycled occasionally during high altitude flight and during cold weather operation. This will help maintain warm oil in the propeller hubs so that the oil will not congeal.

PROPELLER SYNCHRONIZER

The propeller synchronizer automatically matches the left "slave" propeller rpm to that of the right "master" propeller. To prevent the left propeller from losing excessive rpm if the right propeller is feathered while the synchronizer is on, the synchronizer operation is limited to approximately ± 30 rpm from the manual governor setting. Normal governor operation is unchanged but the synchronizer will continuously monitor propeller rpm and reset the governor as required.

A magnetic pickup mounted in each propeller governor transmits electric pulses to a transistorized control box installed behind the pedestal. The control box converts any pulse rate differences into correction commands, which are transmitted to a stepping type actuator motor mounted on the left engine compressor mounting bracket. The motor then trims the left propeller governor through a flexible shaft and trimmer assembly to exactly match the right propeller rpm. The trimmer, installed between the governor control arm and the control cable, screws in or out to adjust the governor while leaving the control lever setting constant.

A toggle switch installed on the pedestal turns the system on. With the switch off, the actuator automatically runs to the center of its range of travel before stopping to assure that when next turned on, the control will function normally.

To operate the system, synchronize the propellers in the normal manner and turn the synchronizer on. The left propeller rpm will automatically be adjusted to correspond with the right. To change rpm, adjust both propeller controls at the same time. This will keep the left governor setting within the limiting range of the right propeller. If the synchronizer is on but is unable to adjust the left propeller rpm to match the right, the actuator has reached the end of its travel. Turn the synchronizer switch off (allowing the actuator to run to the center of its range and the left propeller to be governed by the propeller lever), synchronize the propellers manually, and turn the synchronizer switch on.

PROPELLER SYNCHROSCOPE

A propeller synchroscope, located in the tachometer case, operates to give an indication of synchronization of propellers. If the right propeller is operating at a higher rpm than the left, the face of the synchroscope, a black and white cross pattern, spins in a clockwise rotation. Left or counterclockwise, rotation indicates a higher rpm of the left propeller. This instrument aids the pilot in obtaining complete manual synchronization of propellers.

ENGINE ICE PROTECTION

Engine ice protection consists of electrothermal fuel vent heaters controlled by a switch on the left side panel, and an automatic alternate air induction system.

The possibility of induction system icing is reduced by the non-icing characteristics of fuel injection engines and the Duke's automatic alternate air source. The only possible ice accumulation is impact ice at the ram air scoop and filter. Should the ram air scoop or filter become clogged with ice, a spring-loaded door on the firewall will open automatically, and the induction system will operate on alternate air. When operating on alternate air above the critical altitude, approximately 8 to 10 inches of manifold pressure will be lost.

ANNUNCIATOR SYSTEM

The annunciator warning lights system consists of several single channel circuits which are divided into fault warning and indicating channels. When a fault warning signal is sent to an annunciator circuit, it is used to illuminate its respective readout in the annunciator panel, located in the upper left side panel. Illumination of an annunciator light indicates a fault in its respective system. A dimming circuit for the annunciator lights is connected to the navigation light switch. Should an annunciator light illuminate with the NAV light switch in the ON position, the dimming circuit prevents a distracting glare. All warning lights in the annunciator panel can be tested for illumination by pressing the WARNING LIGHTS TEST switch on the annunciator panel above the warning lights.

FUEL SYSTEM

The fuel system is a simple OFF-ON-CROSSFEED arrangement.

FUEL CELLS

A typical wing fuel system installation (see Fuel System Schematics) consists of an inboard leading edge fuel cell, box section fuel cell, nacelle fuel cell, and an optional outboard leading edge fuel cell. Optional wing tip tanks are available, as shown. All fuel cells in each wing plus the tip tanks are interconnected so that all usable fuel in each wing is available to the respective engine when the fuel selector valve is turned ON. All fuel cells are serviced through a single filler in the respective wing; however, the tip tanks have individual filler caps.

FUEL QUANTITY INDICATORS

Fuel quantity is measured by float type transmitter units which transmit the common level indication to a single indicator for each respective wing.

FUEL FLOW INDICATOR

The dual fuel flow indicator on the instrument panel is calibrated in pounds per hour, the green arc indicating fuel flow for normal operating limits. In the cruise power range, on serials P-247 thru P-426, P-430, P-434 thru P-465, the green sectors cover power settings marked 55%, 65% and 75%. On serials P-427 thru P-429, P-431 thru P-433 and P-466 and after, the cruise power range is indicated by the green sectors marked 55%, 65% and 75%, or by referring to the "Cruise Power Tables" in the CRUISE CONTROL section.

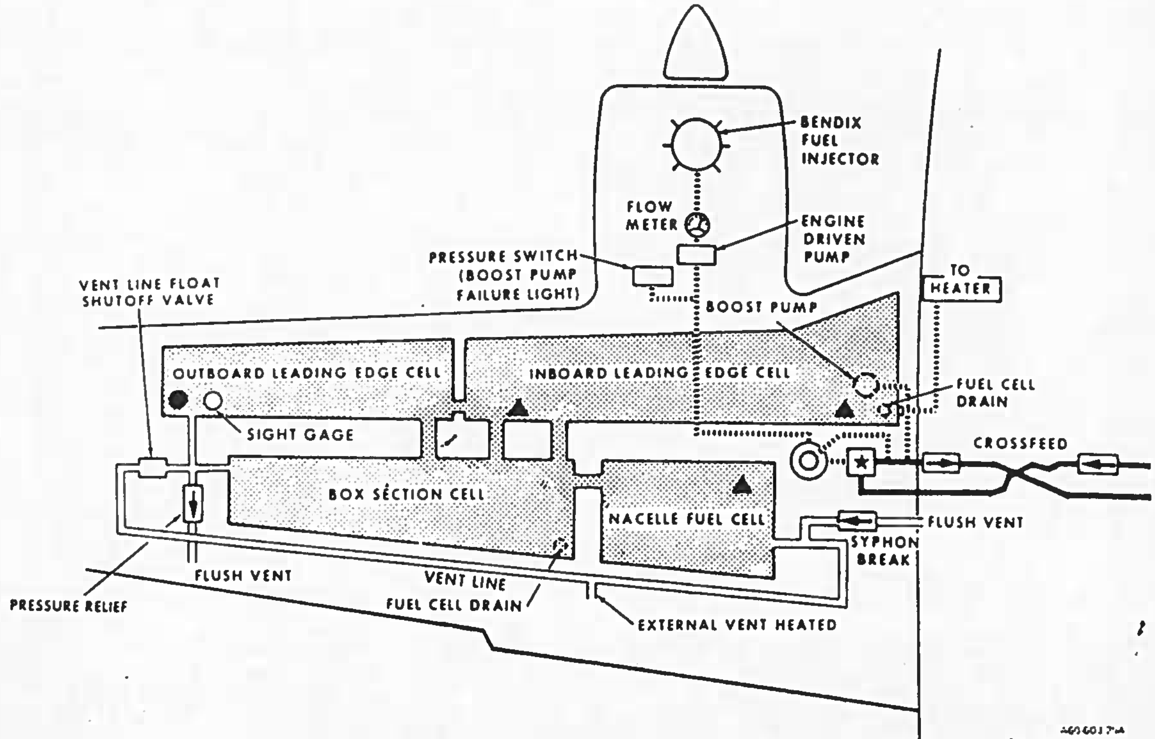
FUEL CROSSFEED

The separate identical fuel supplies for each engine are interconnected by crossfeed lines. During normal operation, each engine uses its own fuel pumps to draw fuel from its respective fuel tank arrangement. However, on crossfeed operations, the entire usable fuel supply of both wings can be consumed by either engine. The procedure for using the crossfeed system is described in the Emergency Procedures Section.

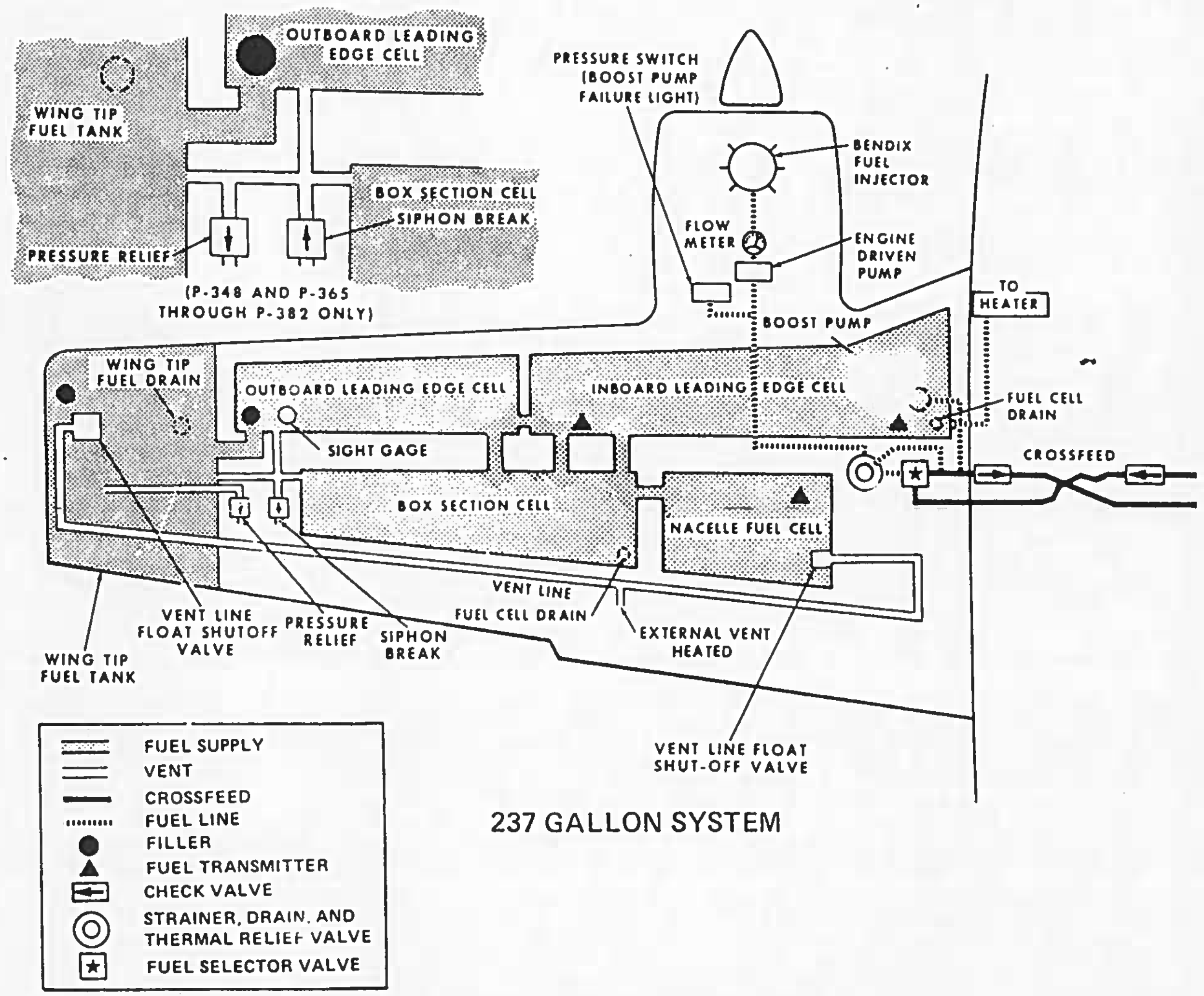
The fuel crossfeed system cannot be employed to transfer fuel from one wing to another during flight.

ANNUNCIATOR PANEL

NOMENCLATURE	*COLOR*	*PROBABLE CAUSE FOR ILLUMINATION*
L.H. GEN	RED	Left generator failure
R.H. GEN	RED	Right generator failure
INVERTER	RED	Loss of Avionics AC power
CABIN DOOR	RED	Cabin door not fully secure
L.H. FUEL PRESS	RED	Left Fuel Boost Pump failure
R.H. FUEL PRESS	RED	Right Fuel Boost Pump failure
BATTERY CHARGE (prior to P-446)	YELLOW	Excessive battery charge current
STARTER ENERGIZE (P-556 and after)	YELLOW	When either starter is engaged
CABIN ALT	YELLOW	Cabin is above 10,000 ft.



207 GALLON SYSTEM



237 GALLON SYSTEM

FUEL SYSTEM SCHEMATICS

FUEL BOOST PUMPS

Submerged, tank-mounted fuel boost pumps are provided for each engine and are located in the inboard leading edge ...ks. They are controlled by separate ON-OFF toggle ...tches located on the pilot's subpanel and should be used for starting, take-off, landing, and any other time fuel flow fluctuations are noted. The fuel boost pumps provide for near maximum engine performance should the engine-driven pump fail. Fuel boost pump failure is indicated by illumination of a FUEL PRESS light on the panel.

FUEL MANAGEMENT

The fuel selector panel, located between the front seats, contains the fuel selector valve for each engine and a schematic diagram of fuel flow. During normal operation, fuel is consumed from the tanks as indicated by the fuel selector valves.

FUEL REQUIRED FOR FLIGHT

Flight planning and fuel loading is facilitated by the use of fuel quantity indicators that have been coordinated with the fuel supply. It is the pilot's responsibility to ascertain that the fuel quantity indicators are functioning and maintaining a reasonable degree of accuracy, and be certain of ample fuel for a flight. A minimum of 25 gallons of fuel is required in each wing before take-off, because an inaccurate indicator could give an erroneous indication. If you as the pilot are not ...re that at least twenty-five gallons are in each wing sys...n, add necessary fuel so that the amount of fuel will not be ...ss than twenty-five gallons per wing at take-off. Plan for an ample margin of fuel for any flight.

PARTIAL FUEL LOADING

A visual fuel level sight gage (P-402 and after), installed in each outboard leading edge cell, can be used for partial filling or off-loading of fuel. This gage should be used only when it reads within the calibrated area.

ELECTRICAL SYSTEM

The direct current, 28-volt, electrical power circuit is energized by a 13 ampere-hour nickel-cadmium battery or two 24 ampere-hour, 12-volt lead-acid batteries connected in series and mounted in the top center of the left nacelle. The nickel-cadmium battery is cooled by an air blast system. When the nickel-cadmium battery is installed, a charge current detector system will illuminate the BATTERY CHARGE annunciator light when the charge current exceeds 3 amperes for more than 6 seconds. The aircraft is equipped with two 125 ampere generators mounted on the lower left side of the engine and are belt driven. An air duct from the upper portion of the nacelle directs a supply of ram air to the generator for cooling. If a generator failure indication appears on the annunciator ...nel, turn the affected generator switch OFF then ON. If ...e condition persists, turn the affected generator off and ...educe electrical power consumption as necessary.

A.C. POWER

Since the major portion of the airplane instrumentation functions on DC power, the AC power requirements are confined to only the fuel flow indicator (serials P-434 through P-465, P-430 and all prior to P-427), windshield heat, and some avionics. The inverter for the fuel flow indicator is a small unit designed to supply power only to this instrument. An inverter is installed for the operation of the left windshield heat and is activated by a switch on the pilot's subpanel marked L. WSHLD - OFF. This inverter is also used as a standby for the avionics inverter (in airplanes prior to P-556).

Avionics power is obtained by two switches mounted on the upper switch panel. One is marked MASTER - OFF and activates power to the avionics equipment. For that equipment requiring AC, current, a three position switch marked MN INV - OFF - STBY INV must be placed in the MN INV position. Should a failure occur in the main inverter, the switch can be placed in the STBY INV position. This opens a relay to direct the current from the windshield heat inverter to the avionics. Power for the operation of both systems cannot be supplied by this inverter at the same time.

CAUTION

Ground use of windshield heat is limited to 10 minutes.

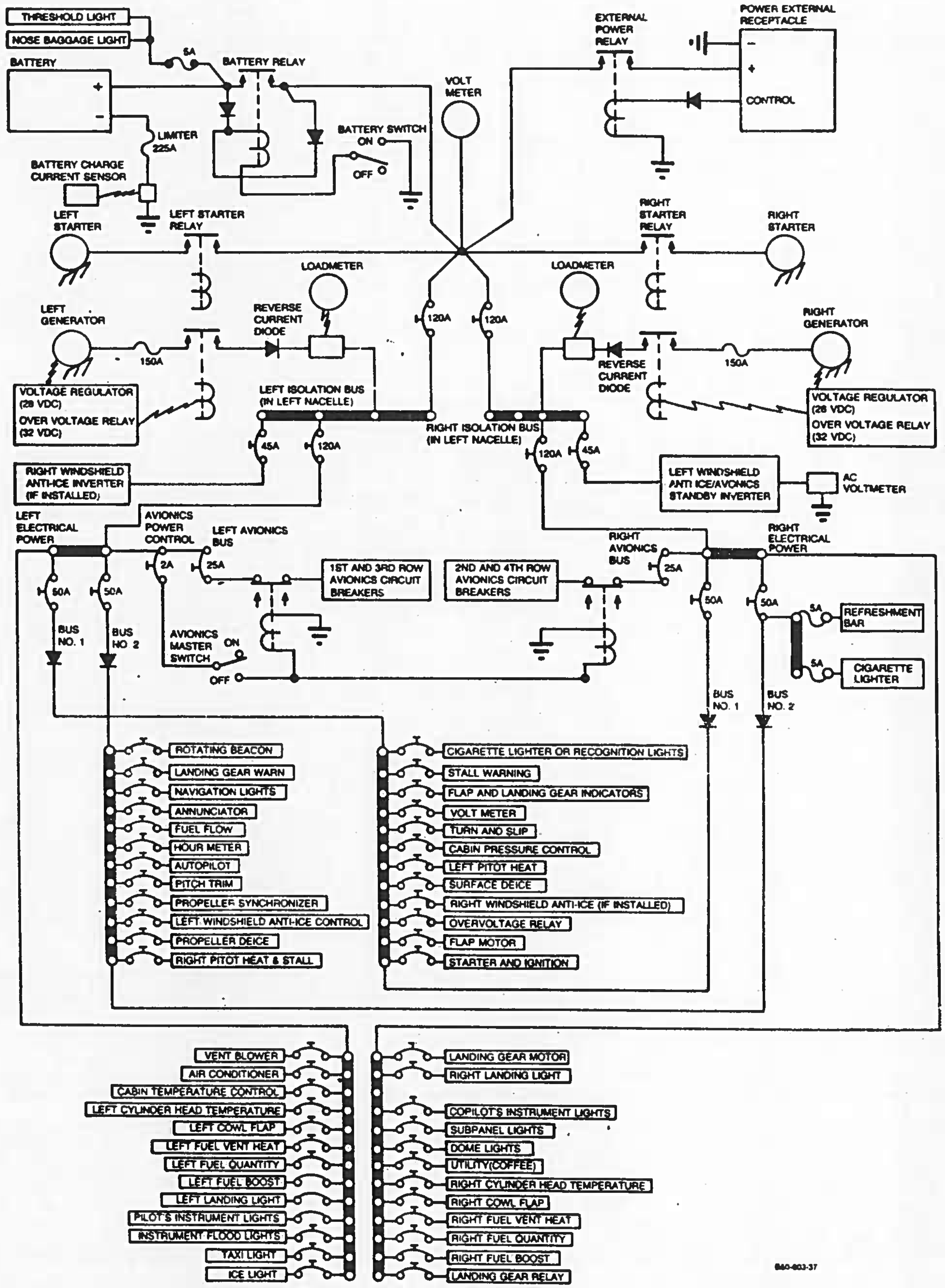
STARTERS

The starters are relay-controlled and are actuated by rotary-type, momentary-on switches incorporated in the magneto/start switches located on the pilot's sidepanel. To energize the starter circuit, hold the magneto/start switch in the START position.

The warning light placarded STARTER ENERGIZED (serials P-556 and after) will illuminate whenever electrical power is being supplied to either the left or right starter. If the light remains illuminated after starting, the starter relay has remained engaged and loss of electrical power may result. The battery and both generator switches should be placed ~~in the~~ OFF position if the light remains illuminated after starting. If the light does not illuminate during starting, the indicator system is inoperative and the loadmeters should be monitored to ensure that the starters do not remain energized after starting. This light can be tested by pressing the WARNING LIGHTS TEST button located above the annunciator panel on the pilot's side panel.

LOADMETERS

Two loadmeters on the subpanel above the console indicate the bus loads of their respective generators. A full needle deflection on a reading of 1.0 on the instrument is an indication of 100% normal amperage output of the generator. A voltmeter, located just below the loadmeters, is provided to monitor voltage increase or decrease from a common bus.



TYPICAL POWER DISTRIBUTION SCHEMATIC

NOTE

If polarity is reversed, the reverse polarity protection relay will not close, thus preventing current from flowing.

AIRFRAME

CABIN APPOINTMENTS

SEATING

Effective on Serials P-511, P-520 and After, the fixed 5th and 6th seat arrangement with folding armrest is installed. The seat backs may be adjusted by depressing the button on each outboard armrest.

To adjust the seats forward or aft, pull up the release bar below the seat front and slide the seat to the desired position. The seat backs of the copilot's seat and the third and fourth seats may be moved from the vertical to the reclined position by actuating a release lever on the inboard side of the seat. The back of the pilot's seat, the aft facing 3rd and 4th seats, and the 5th and 6th seats may be placed in three positions by using the release handle located at the aft end of the inboard seat bottom.

Effective P-388 & after, the 3rd and 4th forward facing and the 5th and 6th seats are equipped with a locking seat back to accommodate the restraint system. To fold these seat backs forward, rotate the handle located on the lower inboard side of the seat back.

For more cabin area, the 5th and 6th seats may be stored by folding the backs forward and sliding the seats aft on the tracks until they are against the aft bulkhead. Ashtrays and cigarette lights are installed in both cabin sidewalls.

SHOULDER HARNESS INSTALLATION (When Installed)

The shoulder harness should be used with the seat back in the upright position. The spring loading at the inertia reel keeps the harness snug but will allow normal movement during flight operations. The inertia reel is designed with a locking device which will secure the harness in the event of sudden forward movement or an impact action.

The strap is worn over the shoulder and down across the body, where it is fastened by a metal loop into the seat belt buckle. For the pilot station seats, the harness strap is contained in an inertia reel attached to the upper side canopy structure of the cockpit. The inertia reel is covered with an escutcheon on the window molding and is located just aft of the pilot station seats. For the 3rd and 4th forward facing seats and for the 5th and 6th seats, the inertia reel is attached into the seat back structure and is covered with the seat back upholstery. The strap runs up the seat back and over the outboard corner of the seat back. When the fixed 5th and 6th seat arrangement with folding armrest is installed, the inertia reel is attached to the fuselage structure.

NOTE

The seat belt is independent of the shoulder harness, but the outboard seat belt and the shoulder harness must be connected for stowage when the seat is not occupied.

CABIN DOOR

The Duke is equipped with a fail safe cabin door latching mechanism. When the door latch bolts are in position, a spring-loaded secondary locking device maintains a safety locked condition. In addition, a pressure lock prevents inadvertent movement of either the secondary system of the door handle itself when pressurized. When the door is closed, the outside cabin door handle is spring loaded to fit into a recess in the door to create a flat, aerodynamically clean surface. The door may be locked with a key.

To open the door from the outside, push the safety release button and lift the handle from its recess and turn it counterclockwise until the door opens. The door will swing out and forward over the center wing section. The door may be closed from the outside by rotating the handle clockwise. The three door latching bolts activate three switches mounted on the bulkhead behind the fuselage door frame, a cabin door warning light on the annunciator panel illuminates when the cabin door is not secure. All door switches must be activated to turn off the annunciator light.

To close the door from the inside, pull the door shut firmly with the handle in the forward position. Rotate the door handle aft in the counterclockwise manner until the safety lock bolt handle moves aft or the safety lock button pops outward.

At this point, the door is securely locked and cannot be opened except by pressing the safety lock button in. If there is residual pressure remaining in the cabin, the red "T" handle, located forward of the cabin door handle, must be pulled to override the pressure locking mechanism before the safety lock bolt or safety lock button will move. Once the safety lock bolt has been pulled aft, or the safety lock button pressed in, the door handle may be rotated forward to open the door.

EMERGENCY EXIT

The emergency exit door is a pressure sealed plug type door that opens into the cabin. It is located on the right side at the forward cabin window. The release is in a covered recess behind the window curtain. To open the door, lift the cover, release the catch and pull the handle down fully. There is no provision made for opening the door from outside the airplane.

At this point, the door is securely locked and cannot be opened except by pressing the safety lock button in. If there is residual pressure remaining in the cabin, the red "T" handle, located forward of the cabin door handle, must be pulled to override the pressure locking mechanism before the safety lock bolt or safety lock button will move. Once the safety lock bolt has been pulled aft, or the safety lock button pressed in, the door handle may be rotated forward to open the door.

EMERGENCY EXIT

The emergency exit door is a pressure sealed plug type door that opens into the cabin. It is located on the right side at the forward cabin window. The release is in a covered recess behind the window curtain. To open the door, lift the cover, release the catch and pull the handle down fully. There is no provision made for opening the door from outside the airplane.

NOSE BAGGAGE COMPARTMENT

The forward baggage compartment is easily accessible through a large door on the left side of the nose. The door, hinged at the top, swings upward, clear of the loading area. This compartment affords accessibility to some of the aircraft avionics as well as storage space for the larger, heavier items, but loading within this area will fall within the limitations according to the WEIGHT AND BALANCE SECTION. The nose baggage compartment incorporates the full width of the fuselage as usable space.

FLIGHT CONTROLS

CONTROLS AND SURFACES

The Duke is equipped with conventional dual controls. Primary flight surfaces are operated through push-pull rods and conventional cable systems, terminating at bell cranks.

Control of the rudder and nose wheel steering is provided by rudder pedals. To adjust the rudder pedals, press the spring-loaded lever on the side of each pedal and move the pedal to its forward or aft position. The adjustment lever can also be used to place the right set of rudder pedals against the floor when not in use.

ELEVATOR TRIM TAB

An elevator trim tab control wheel on the left side of the console, operates in the conventional manner. An indicator placarded DN and UP, is calibrated in 10° increments. Nose-down trimming of the aircraft from 0° to 10° may be effected by rotating the top of the wheel forward. Nose-up trimming, from 0° to 30°, requires the top of the wheel to be moved aft. Make necessary compensations for loading conditions before take-off.

RUDDER TRIM TAB

A wheel, placarded RUDDER TAB, positioned horizontally on the lower aft side of the console, trims the aircraft with the rudder tab. Vertical reference marks to the left and right of the center mark indicate the amount of rudder tab being used. To move the nose of the aircraft to the right, move the protruding edge of the wheel to the right.

AILERON TRIM TAB

To the right of the rudder trim wheel is the aileron trim tab control. It is a vertically mounted knob that may be turned clockwise to lower the right wing and counterclockwise to lower the left wing. The indicator above the knob, placarded AILERON TAB, is identical to that used on the rudder tab installation.

ELECTRICAL ELEVATOR TRIM

A switch on the control wheel actuates the electric elevator trim control. The switch is moved forward for nose down, aft for nose up. When released the switch centers in the OFF position. When the system is not being electrically actuated, the manual trim control wheel may be used. An ON-OFF switch is located on the left subpanel.

WING FLAPS

The wing flaps are controlled by a three position switch located to the right of the control console on the subpanel. The flaps have three positions which are identified by three separate lights located to the left of the flap position switch. All lights are extinguished when the flaps are in the full up position. The top light is placarded TRANSIT and illuminates red when the flaps are in motion to a selected position. The middle (blue) light placarded APH (approach) illuminates when the flaps are stopped in the approach position. The lower light is amber and illuminates when the flaps are in the DN (down) position. To move the flaps from UP to APH, move the switch to the middle detent position. From APH to DN, the switch must be pulled out of the detent and moved downward to the last position.

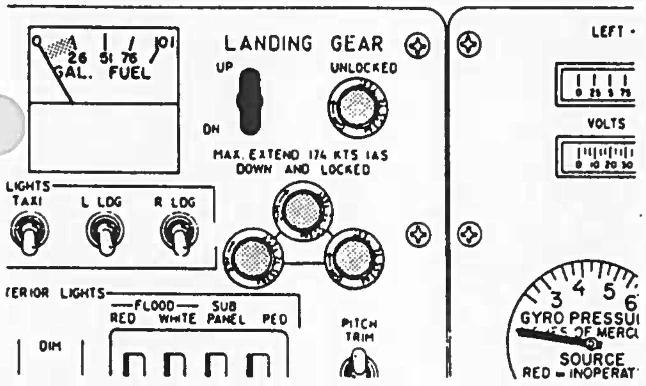
LANDING GEAR SYSTEM

CONTROL SWITCH

A two-position switch on the subpanel to the left of the console controls the landing gear. The switch is operated by moving it upward to retract and downward to extend the gear. From one position to the other, the switch handle must be lifted across a center detent.

POSITION INDICATORS

Landing gear position lights are located on the subpanel adjacent to the control switch. To the right of the switch is a single red light placarded UNLOCKED. This light indicates that the gear is in transit, neither full up or full down. Below the switch are three green lights arranged in a triangle. Each light represents a landing gear, and, when illuminated, indicates that the gear is locked in the extended position. These are placarded DOWN AND LOCKED.



SAFETY SWITCH

A safety switch incorporated in the left main gear strut prevents inadvertent retraction of the landing gear (serials prior to P-446). Later models incorporate a safety switch in both left and right landing gear (serials P-446 and after). When the strut is compressed, the control circuit is open and the gear cannot retract. However, maneuvering over rough ground may allow the gear strut to extend momentarily, closing the circuit long enough to begin retraction. NEVER RELY ON THE SAFETY SWITCH TO KEEP THE GEAR DOWN DURING GROUND MANEUVERING. CHECK TO SEE THAT THE LANDING GEAR SWITCH IS DOWN.

WARNING HORN

\ gear-up warning horn is located behind the panel. Any me either or both throttles are retarded to approximately 12 in. Hg, the horn will sound intermittently if the landing gear is in the retracted position. During single-engine operation, the horn can be silenced by advancing the throttle of the inoperative engine until the throttle warning horn switch opens the circuit.

MANUAL EXTENSION

The landing gear can be manually extended, but not retracted, by operating the handcrank on the rear of the pilot's seat. This procedure is described in the FAA APPROVED EMERGENCY PROCEDURES section of this book. Do not operate the landing gear electrically with the handcrank engaged.

BRAKES

A toe brake is incorporated in each rudder pedal. Either set of pedals will actuate the brakes. The parking brake system, operated from the pilot's controls only, utilizes a parking brake valve to allow buildup of pressure in the landing gear cylinders. To operate, pull out the parking brake knob, placarded PARKING BRAKES, on the subpanel below the pilot's control column and pump the toe pedals. Apply pressure to the pedals then push the control in to release the brakes. This will allow the ressure in the brake system to gradually bleed back into .ie reservoir.

CAUTION

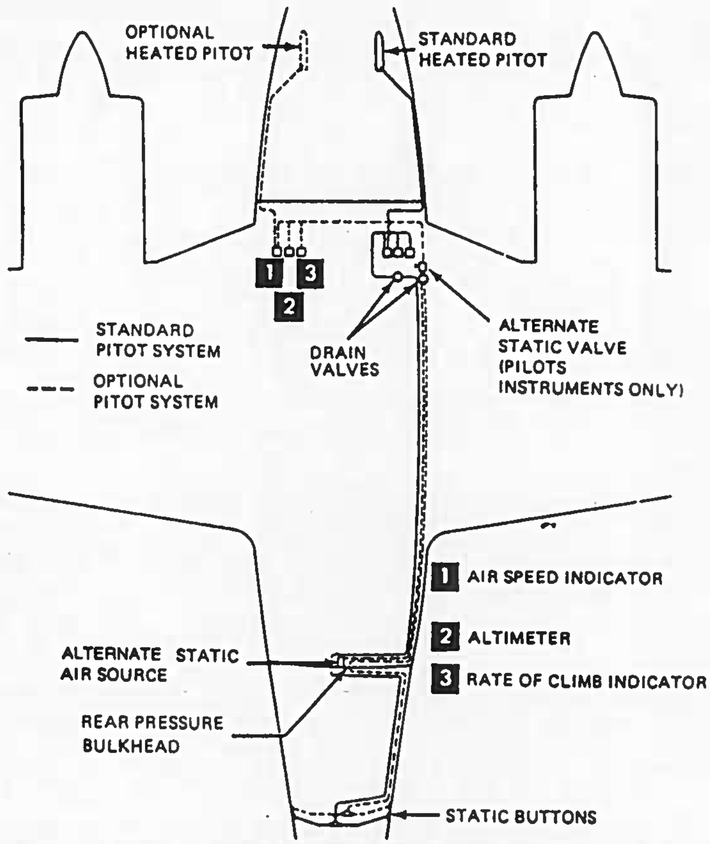
If either the pilot's or the copilot's brake pedals are pumped repeatedly while continuous pressure is being applied to the other set of brake pedals, braking capability from the "continuous-pressure" side may be lost. Normal brake function can be restored by momentarily removing all pressure from the pedals on the "continuous-pressure" side.

NOSE GEAR STEERING

Nose gear steering allows a 15° angle of turn by movement of the rudder pedals. Friction of the nose wheel against the ground while the aircraft is standing still inhibits turning movement. Proper turning may be accomplished smoothly by allowing the aircraft to roll while depressing the appropriate rudder. Sharper turns require light brake pedal on the depressed rudder.

PITOT - STATIC SYSTEM

HEATED PITOT



A standard pitot tube for the pilot's flight instruments is located immediately to the right of the nose gear doors. The optional pitot tube for the copilot's instruments is located to the left of the nose gear doors. Left and right pitot heat switches, supplying heat to the left and right pitot masts respectively, and are located on the pilot's left subpanel.

STATIC AIR

Static buttons on aft fuselage provide static pressure source to the rate of climb indicator, altimeter and airspeed indicator.

The emergency or alternate static air source is located inside the tail cone aft of the pressure bulkhead. It is selected by a valve located in the right side wall adjacent to the copilot's seat.

Refer to FAA Performance Section for calibration and Emergency Procedures for advice on when to use it.

STATIC DRAIN

The pitot system needs no drain because of the location of the components. Static air plumbing is drained by removing the side panel, placarded STATIC AIR LINE DRAIN, on the lower right cockpit wall forward of the copilot's seat and opening the valves provided.

INSTRUMENT PRESSURE SYSTEM

Pressure for the pressure-operated flight instruments is supplied by two engine-driven, dry, pressure pumps, interconnected to form a single system. If either pump fails, check valves automatically close. The remaining pump will continue to operate the gyro instruments. With both engines operating at a minimum of 2200 rpm, the pressure gage on the instrument panel should indicate between 3.5 and 5.5 in. Hg. A pressure pump failure is indicated by the protrusion of a red button on the pressure gage placarded "L" or "R" adjacent to each button indicating which pump has failed.

Some aircraft may be equipped with dual regulators installed in the instrument pressure system. A regulator is located in each pressure line ahead of the pilot's and copilot's instruments to facilitate a check of the pressure to either of the instrument systems. A two-position switch, placarded PILOT - COPILOT, located adjacent to the Gyro Pressure gage on the center subpanel, gives a constant reading of the pressure of the instrument system selected with the switch. An abnormal reading is an indication of probable malfunction of one regulator. Select the other regulator and check the system pressure. If it is normal, operate with the instrument system that is functioning from that regulator.

STALL WARNING INDICATOR

The stall warning system consists of a stall warning horn mounted forward of the instrument panel, a lift transducer on the leading edge of the left wing, a lift transducer vane heater element, a face plate heater element, a landing gear switch, a circuit breaker, and a switch located on the pilot's subpanel marked STALL & R PITOT.

When aerodynamic pressure on the lift transducer vane indicates that a stall is imminent, the transistor switch is actuated to complete the circuit to the stall warning horn. The lift transducer senses the angle of attack and is triggered by reverse air flow.

CAUTION

The heater element protects the lift transducer from ice; however, a buildup of ice on the wing may disrupt the airflow and prevent the system from accurately indicating an incipient stall.

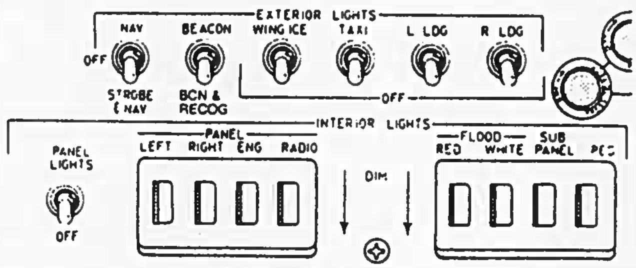
LIGHTING

INTERIOR LIGHTING

The cockpit dome light is operated by a push button switch, adjacent to the light. The switches for the individual reading lights above the rear seats are located adjacent to the lights. All other interior lights are controlled from the interior light switch group on the pilot's right subpanel. A master PANEL LIGHTS switch activates the group and the individual lights are regulated by thumb wheel switches.

A courtesy light illuminates the doorway and will be turned off by closing the door. If the door is to remain open for extended periods, the light may be turned off with a pushbutton switch inside the cabin just forward of the light.

A baggage compartment light and light switch are located just inside at the top of the nose compartment door for illumination of baggage and avionics space. The courtesy light and the baggage compartment light receive power directly from the battery.



Light Switches

EXTERIOR LIGHTING

The switches for the navigation lights, landing lights, and rotating beacons, plus the switches for the nose taxi light and wing ice lights, are grouped on the left subpanel. On airplanes P-386, P-401 and after the beacon light switch also operates the wing tip recognition lights. The landing lights in the leading edge of each wing tip or on each main landing gear strut are operated by separate switches. For longer battery and lamp service life, use the landing lights only when necessary. Avoid prolonged operation during ground maneuvering to prevent overheating.

ENVIRONMENTAL SYSTEM

An environmental control section on the right subpanel provides for automatic or manual control of the system. This section, just to the right of the flap control lever, contains all the major controls of the environmental function: the mode selector switch for selecting manual or automatic heating or cooling, a vent blower control switch, and a cabin temperature level control. Directly below these controls are the pressurization controls. To the right of the copilot's control column, are the pressurization Air Temp controls and pressurization Air Shut-Off controls.

PRESSURIZATION

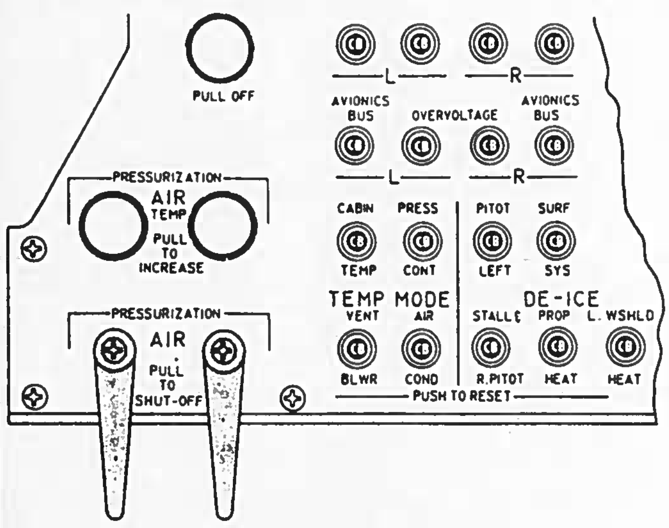
DESCRIPTION

The pressurization system consists of a cabin altitude controller, a combination test/dump switch, a cabin vertical speed indicator, a combination pressure differential and cabin altitude indicator, and a pressurization air shut-off valve for each engine.

Pressurized air for the cabin is taken from the turbocharger compressor of each engine and reduced to a usable flow by sonic nozzles located in-line, forward of the turbocharger compressor. The air then passes through a firewall shut-off and through an intercooler. The intercooler reduces the heat acquired by the air during pressurization with a flow of ram air from a scoop at the leading edge wing root. The air is then routed into the cabin through oneway check valves beneath the pilot and copilot floorboards. After entering the pressure vessel, the air is drawn into the conditioning plenums where it is either heated or cooled, according to the selected mode, and distributed throughout the cabin. Located on the aft cabin bulkhead are two valves: the outflow control valve and the safety valve. The controller pneumatically regulates the outflow control valve to maintain the selected altitude. The safety valve is connected to the test/dump switch, and to the landing gear safety switch. If either of these switches is closed, the safety valve will open to atmosphere and the cabin will depressurize.

CONTROLS

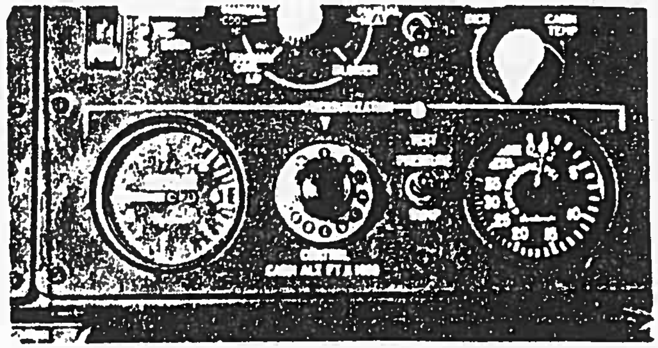
The pressurization air shut-off controls stop the flow of pressurized air to the cabin when placed in the PULL TO SHUT-OFF position.



Pressurization Controls

MANUAL CABIN ALTITUDE CONTROLLER (P-247 through P-307)

The manual cabin altitude controller is located on the right subpanel between the cabin climb indicator and the cabin differential pressure gage. The cabin altitude is maintained with the control anywhere from zero pressure to the maximum differential pressure.



Manual Cabin Altitude Controller

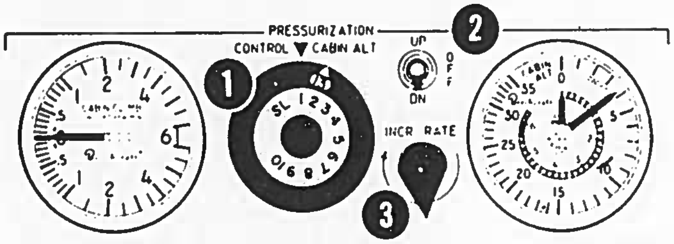
The controller is rotated until the desired cabin altitude for flight is at the 12 o'clock position under the index mark. Any selected cabin altitude will be maintained during the flight, provided the cabin pressure is at or below the maximum differential pressure. If the cabin reaches the maximum differential and the airplane is still climbing, the cabin altitude will climb with the airplane.

If a cabin altitude change is required in flight it can be accomplished with a minimum of abrupt cabin pressure change by turning the selector dial very slowly and monitoring the rate of change on the cabin pressure indicator. A time lapse of approximately two minutes for each thousand-foot increment change on the dial will effect a comfortable change of pressure. Rapid cabin pressure changes will be experienced if the altitude selector is moved quickly before reaching the maximum differential pressure.

MOTORIZED CABIN ALTITUDE CONTROLLER (P-247 through P-307)

The motorized controller is similar to the manual controller except in the method of changing cabin altitude up or down. The unit is best described as an adjustable isobaric controller incorporating a variable speed drive motor with automatic shut-off. The additional controls for the unit are the Red Altitude Selector Ring, the Motor Rate Rheostat and the Directional Toggle Switch. The inner cabin altitude selector is normally operated with the directional toggle switch. The control can be moved to override the motor drive, but under normal operation all movement should be made with the toggle switch. The inner scale shows the cabin altitude when read at the index mark (12 o'clock position). The outer scale under the window shows the selected airplane altitude. The inner scale adjacent to the window shows what the cabin altitude will be when maximum differential pressure is reached.

To ready the unit for operation, place the rate rheostat knob in the midrange and insure that the directional toggle switch is in the OFF position. Manually set the cabin altitude controller (inner scale) to approximately 1000 feet above the take-off field elevation. (The red altitude selector ring will turn with the inner scale when this adjustment is made.) Now set the window on the red altitude selector ring to 500 feet above the planned airplane cruise altitude. This will avoid reaching maximum differential pressure in the cabin prior to achieving cruise altitude.



1 Red Altitude Selector Ring.

2 Directional Toggle Switch.

3 Drive Motor Rate Rheostat.

Motorized Cabin Altitude Controller

After take-off and during the climb when the cabin rate of climb has returned to zero, move the directional toggle switch to the UP position. This gradually climbs the cabin to the altitude which is opposite the altitude in the window on the red selector ring. The controller should be driven at a rate to arrive at the cabin altitude shortly before the airplane arrives at the cruise altitude. This can be accomplished by increasing or decreasing the rate rheostat knob. A few seconds lag time must be allowed for the pressurization controls to respond and stabilize before reading the cabin altitude rate of climb indicator. The controller will automatically turn off when the window in the red selector ring reaches the 12 o'clock position. However, the directional toggle switch should be placed in the OFF position.

NOTE

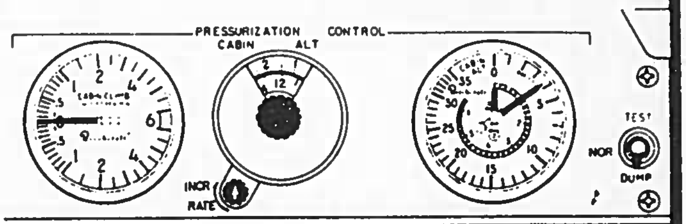
In the event the directional toggle switch is positioned improperly, the controller will drive to the end of the scale, and damage to the slip clutch may result.

For normal descent turn the red selector ring until the window is opposite the altitude which is 1000 feet above the landing altitude. After departing the original altitude, place the directional toggle switch in the DN position. If a rapid descent rate is required, set the rate rheostat for an increased rate of descent to maintain a higher airplane altitude than cabin altitude throughout the descent.

If the cruise altitude selected is less than 11,000 feet or corresponding cabin altitude (below the window) is less than the take-off altitude, then the controller need not be moved. However, if the landing altitude is less than the field elevation, then the controller can be driven down to the selected cruise altitude.

CABIN ALTITUDE CONTROLLER (P-308 and after)

The controller contains a visual display of the selected altitude, an altitude selector, and a rate control. The altitude outer scale indicates the selected cabin altitude and the inner scale indicates the corresponding airplane altitude where the maximum differential pressure would occur.



1 Altitude Selector

2 Rate Control

3 TEST/NOR/DUMP Switch

Cabin Altitude Controller

Before take-off, the altitude may be set either to the desired cabin altitude (outer scale) or to the planned cruising altitude (inner scale) plus 500 feet. Before descent to landing, the outer scale should be set to the field elevation plus 500 feet.

The rate control regulates the rate at which cabin pressure ascends or descends to the selected altitude. The pointer set to the vertical position results in a rate of approximatly 500 ft/min.

If the cabin differential pressure reaches the maximum and the airplane is still climbing, the cabin altitude will climb with the airplane altitude.

CABIN ALTITUDE WARNING SYSTEM

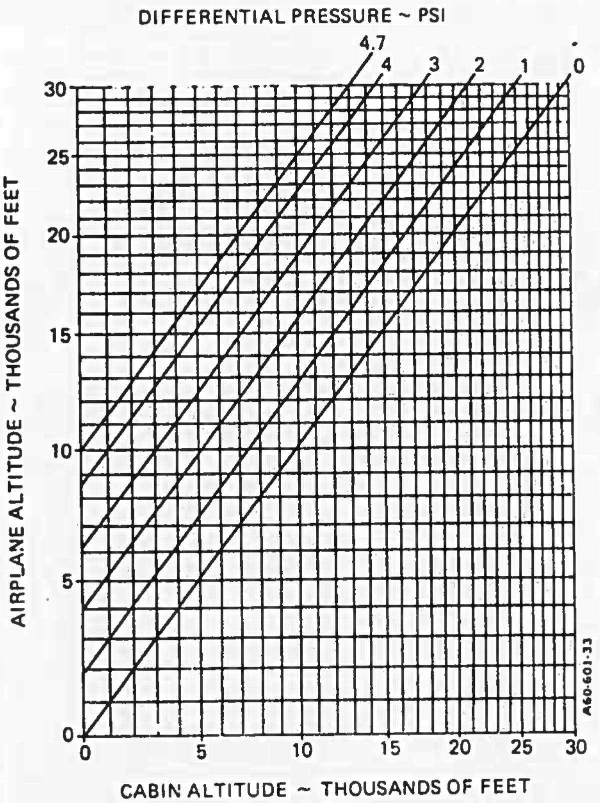
The cabin altitude warning system consists of an annunciator placarded CABIN ALT mounted on the left upper side panel and a preset barometric pressure switch mounted on the pressure bulkhead.

The system is designed to function while the cabin is either pressurized or unpressurized. In the unpressurized mode any time the cabin altitude reaches 10,000 feet, the barometric pressure switch completes a circuit and illuminates the CABIN ALT annunciator. When operating in the pressurized mode at cabin altitudes below 10,000 feet, a loss of pressurization is indicated by the illumination of the CABIN

ALT annunciator light. When operating at cabin altitudes between 10,000 feet and 12,500 feet, the annunciator will be illuminated. Loss of pressurization can then be detected by monitoring the cabin altitude indicator for an increase in cabin altitude. When pressurization is lost the use of oxygen is recommended to be in accordance with current FAA operating rules, or descent should be made to a lower cabin altitude.

DIFFERENTIAL PRESSURE

The following graph provides information to determine the



relationship between cruise altitude, cabin altitude, and differential pressure. The zero differential pressure line indicates that the cruise altitude and the cabin altitude are identical (unpressurized). The 4.7 psi line indicates the maximum differential pressure obtainable in the cabin. To determine the lowest cabin altitude which can be maintained for a given cruise altitude enter the graph at the desired cruise altitude and read right to the 4.7 psi differential pressure line, then read down the graph to the altitude which can be maintained in the cabin.

AIR CONDITIONING SYSTEM

DESCRIPTION

A 45,000 BTU combustion heater and a 14,000 BTU, refrigerative air cooler work through a cabin temperature control system to maintain cabin comfort. The air conditioning is selected on the TEMP MODE selector on the right subpanel. Fresh air is taken into the system at the nose ram air vent opening for unpressurized flight, and from the pressurization air inlets beneath the cockpit floor for pressurized flight. From either source, the air is collected in a plenum ahead of the cockpit, heated or cooled according to the selected mode, and forced through ducts for distribution throughout the cabin. Air is ducted to individual overhead outlets and/or sidewall outlets. These outlets can be swiveled in any direction and the volume of air may be regulated by rotating the fitting.

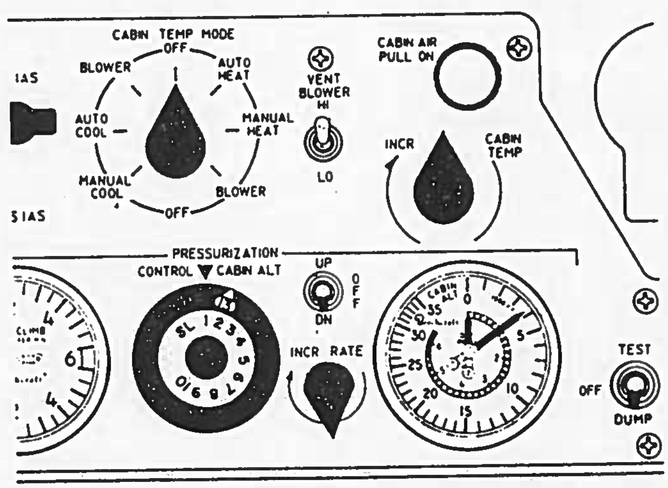
Conditioned air (or ventilation air) is ducted along each wall of the cabin. Small holes in the console direct the air out into the cabin/cockpit.

Other air outlets are: defroster outlets above the glare shield, individual pilot and copilot air outlets.

Exchanging the cabin air is accomplished by exhausting a controlled amount of air through the isobaric control valve on the aft pressure bulkhead.

VENT BLOWER

Velocity of the air from the cabin air outlets may be controlled by the VENT BLOWER switch, located on the right subpanel. Either the HI or LO position may be selected.

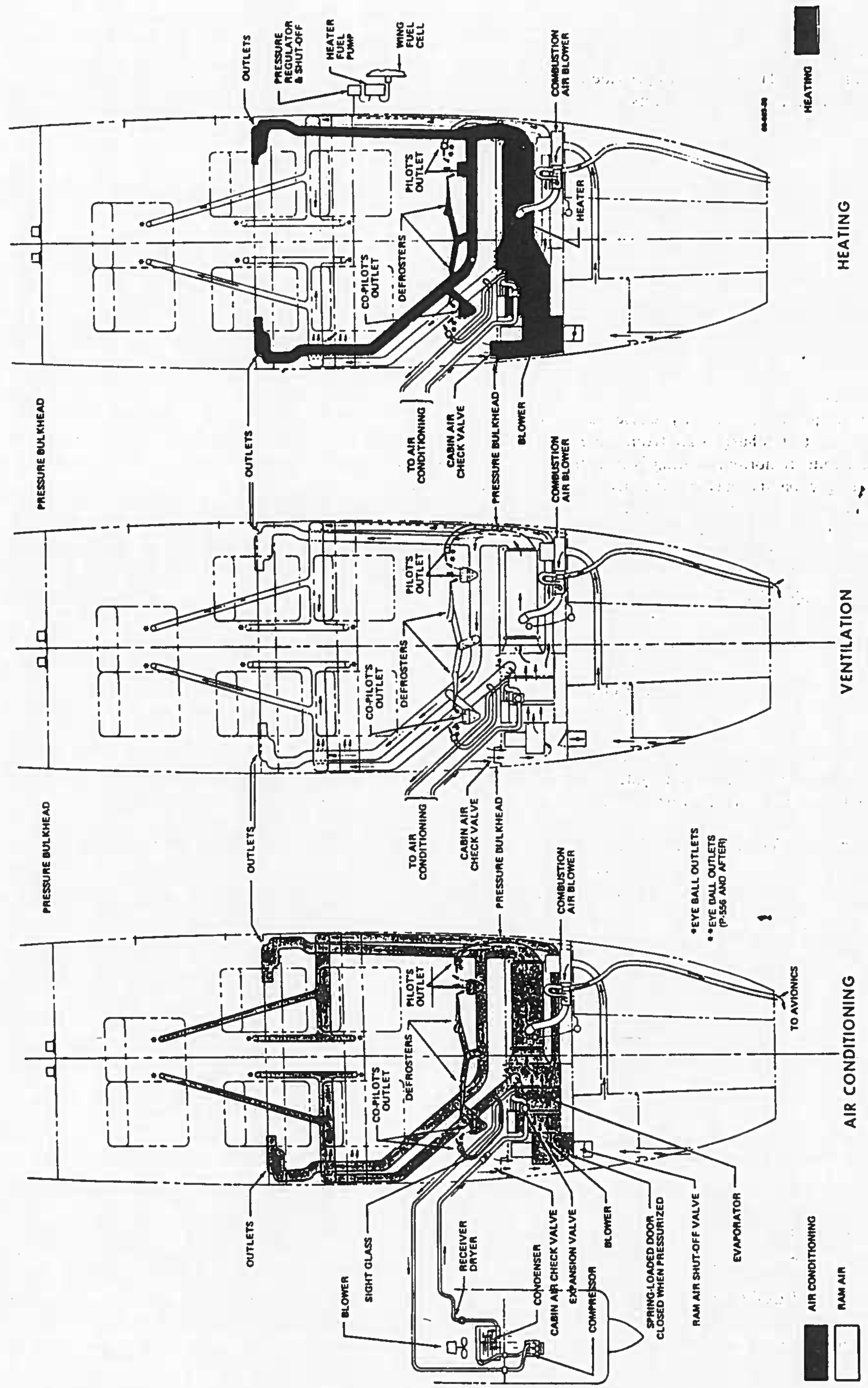


Vent Control

HEATING MODE

PRESSURIZED OPERATION

Heating may be accomplished in either the manual or automatic position. For manual heating, select MANUAL HEAT using the CABIN TEMP MODE selector on the right subpanel. The heater will then operate continuously. For faster heating at the pilot and the copilot positions, place the vent controls (placarded PILOT AIR - PULL OFF and COPILOT AIR - PULL OFF) in the "on" position by pushing them in. For maximum windshield defrosting (in addition to the electrically heated windshield) the individual vents for



ENVIRONMENTAL SCHEMATIC

the pilot and copilot may be turned off and the heater blower placed inthe HI position to provide a greater flow of warm air through the defroster ducts.

Automatic heating is achieved in the same manner as manual heating except the selector is set on AUTO HEAT and the CABIN TEMP knob is adjusted for a comfortable temperature. A temperature controller, located on the forward side of the pedestal between the pilot's and copilot's rudder pedals, makes possible the regulation of the cabin temperature by monitoring temperature variations at the temperature sensing units. These sensing units are located: (1) in the ram air inlet (2) on the cabin sidewall aft of the pilot's chair, and (3) in the heater outlet duct.

Ambient air, from the ram air inlets at the leading edges of the wing roots, normally passes over the intercoolers to cool the turbocharged air from the engines before it enters the cabin. If normal heating is insufficient, an even greater heating capacity may be attained by turning off the intercoolers. This is done by pulling out the controls on the right subpanel, placarded PRESSURIZATION AIR TEMP - PULL TO INCREASE.

COOLING MODE

For the cooling mode, the Duke is equipped with a refrigerant-type cooling system. The compressor is located in the right nacelle just aft of the engine, and the evaporator just ahead of the forward pressure bulkhead adjacent to the heater unit. The air is circulated through the same ductwork as for heating. Cold air coming through the evaporator enters the duct system, goes to the duct outlets and to the individual overhead and/or sidewall outlets.

When the selector is placed in the AUTO COOL position, the temperature is automatically controlled through the thermostat. The temperature sensing units monitor the cabin temperature variations, as in the heating mode. Regulate the temperature with the CABIN TEMP adjustment knob. Automatic cooling may be over-ridden by placing the selector in MANUAL COOL; in this position the system will continue to cool regardless of the cabin temperature.

While operating in the heating mode, the intercoolers may be turned off to allow warm, pressurized air to enter the vessel, but the opposite is true for the cooling mode; the intercoolers may be turned on by pushing in the intercooler controls so the incoming air will be as cool as possible before reaching the evaporator.

For cabin ventilation, a portion of the air is automatically exhausted through the isobaric control valve on the aft pressure bulkhead, just as in the heating mode.

VENTILATION MODE

With the airplane unpressurized, open the ram air vent inlet (CABIN AIR) and move the mode selector to BLOWER. Choose HI or LO as desired on the vent blower switch. In this mode the isobaric and safety dump valves are open (with the pressurization switch in DUMP position), to exhaust the cabin air. If the ambient air is cool and no vent blower is desired, move the temperature mode selector to OFF.

OXYGEN SYSTEM

WARNING

> Proper safety measures must be employed while using oxygen, or a serious fire hazard will be created. NO SMOKING PERMITTED.

DESCRIPTION

Oxygen masks provided with the oxygen system are of the Scott continuous-flow type. They are easily adjusted to fit the average person comfortably with a minimum leakage of oxygen, and are considered adequate for a continuous use up to either 27,000 or 30,000 feet.

The oxygen cylinder is located in the aft fuselage. An oxygen console on the pilot's sidewall regulates flow to the six cabin outlets. When use of the oxygen is discontinued, it is absolutely necessary that the system be turned off by closing the control valve on the console. An oxygen pressure gage on the console indicates the supply of oxygen available. 1850 psi is normal pressure for a full supply in the bottle. The pressure gage does not indicate whether the system is on or off.

ICE PROTECTION

EQUIPMENT

For standard ice protection equipment, the Duke has heated pitot, stall warning, and fuel vents. Optional icing equipment includes pneumatically operated surface deice boots and electrically heated propellers and windshield. In addition, an alternate static air source backs up the normal static air source buttons.

SURFACE DEICE SYSTEM

Deice boots on the wing and empennage leading edges are inflated by the two engine-driven pressure pumps. A venturi, operated from the pressure pumps, supplies vacuum for boot hold-down at all times except during the inflation mode. Through an electric timer, solenoid-operated control valves cause all the boots to be inflated simultaneously. The timer is controlled by a three-position switch: SURFACE ONE CYCLE, and MANUAL with off position centered. This switch is located on the left subpanel. ONE CYCLE and MANUAL switch positions are momentary. A gage is provided to indicate system pressure. Momentary engagement of the ONE CYCLE position will cause the boots to inflate for five to eight seconds, then deflate to the vacuum hold-down condition. The MANUAL position will inflate the boots only as long as the switch is held in engagement; when the switch is released, the boots deflate. Leave the deicing system off until 1/2 to 1 inch of ice is accumulated. During inflation, the deice system pressure gage should register approximately 15 to 18 psi. Sufficient pressure for proper operation of the system is available with one engine inoperative.

When the surface deice system is operated with the cabin pressure switch in the DUMP position, cabin pressure oscillations will occur. This is caused by a momentary loss of vacuum to the outlfow valve while the boots are pressurizing. This vacuum loss allows the outflow valve to close and create a small residual cabin pressure. After a small increase, this pressure is then dumped by the safety valve.

The cabin pressurization shut off controls should be pulled during this mode to divert cabin pressurizing air overboard and prevent excessive cabin pressure oscillations. Cabin ventilation may be obtained by pulling out the cabin air control. In this mode pressure oscillations will be small.

For night operation, a wing ice light is provided on the outboard side of the left nacelle. The switch, placarded WING ICE, is on the left subpanel.

PROPELLER ELECTROTHERMAL DEICE
(Serials P-247 to P-578)

Electrothermal deice boots, cemented to the propeller blades, remove ice from the propellers. Each boot, consisting of one outboard and one inboard heating element, receives its electrical power through a deice timer. The timer directs current to the propeller boots alternately in a 30-second cycle. The PROP HT switch is located on the left subpanel. The propeller deice ammeter (prop amp) will indicate 14 to 18 amperes with minor fluctuations about every 30 seconds during normal operation. For deviations from the normal indications, and the procedures to be followed, see the Flight in Known Icing Conditions in the FAA FLIGHT MANUAL SUPPLEMENTS Section.

(Serials P-579 and after)

Electrothermal deice boots, cemented to the propeller blades, remove ice from the propellers. The timer directs current to the single-element boot on each blade in the following sequence: right propeller all elements, then left propeller all elements. Loss of one heating element circuit on one side does not mean that the entire system must be turned off. The PROP HT switch is located on the left subpanel. The propeller deice ammeter (prop amp) will indicate 14 to 18 amperes with minor fluctuations every 90 seconds during normal operation. For deviations from the normal indications, and the procedures to be followed, see the Flight in Known Icing Conditions in the FAA FLIGHT MANUAL SUPPLEMENTS Section.

WINDSHIELD ANTI-ICE

The pilot's electrically-heated windishield is controlled by a switch, placarded WSHLD HT, located on the left subpanel. Windshield heat, designed for continuous use, should be applied prior to, or upon first encountering, icing conditions. This system is also beneficial as an aid in preventing frost and fogging due to rapid descents from higher altitudes into warm, moist air.

Operation of the windshield heat will cause the standby compass to become erratic; therefore, windshield heat should be turned off for a period of 15 seconds to allow a stable reading of the standby compass.

CAUTION

Ground use of windshield heat is limited to 10 minutes.

ADDITIONAL ICE PROTECTION

The right pitot heat element (and the left pitot heat element if installed) is turned on by moving the respective PITOT HEAT switch to the ON position. Stall warning heat is installed in conjunction with right pitot heat, and is controlled by the STALL & R. PITOT HEAT switch. Fuel vent heat is controlled by two switches, placarded FUEL VENT - LEFT - RIGHT.

COMFORT FEATURES

CHEMICAL TOILET

The optional chemical toilet is of the standard dry chemical type and is located under the 6th (right) seat cushion in the aft section of the passenger cabin. The 6th seat cushion must be removed and set aside to permit use of the toilet. Tissue and chemicals may be stored in the forward side of the seat cabinet. Privacy is afforded by an optional pull-curtain between the 5th and 6th seats.