Cessna

# Information Manual

1982

# Chancellor

Model 414A

MODEL **414A**

# PERFORMANCE AND SPECIFICATIONS

| | |
|---|---|
| MAXIMUM WEIGHT: | |
| Ramp | 6785 Pounds |
| Takeoff | 6750 Pounds |
| Landing | 6750 Pounds |
| Zero Fuel | 6515 Pounds |
| *SPEED, BEST POWER MIXTURE: | |
| Maximum - 20,000 Feet | 235 KTAS |
| Maximum Recommended Cruise | |
| 74.8% Power at 10,000 Feet | 193 KTAS |
| 74.8% Power at 24,500 Feet | 224 KTAS |
| *RANGE, RECOMMENDED LEAN MIXTURE: | |
| Maximum Recommended Cruise | |
| 74.8% Power at 10,000 Feet (600 Pounds Usable Fuel) | 382 Nautical Miles, 2.06 Hours and 191 KTAS |
| 74.8% Power at 10,000 Feet (900 Pounds Usable Fuel) | 665 Nautical Miles, 3.53 Hours and 191 KTAS |
| 74.8% Power at 10,000 Feet (1236 Pounds Usable Fuel) | 984 Nautical Miles, 5.18 Hours and 192 KTAS |
| 74.8% Power at 24,500 Feet (600 Pounds Usable Fuel) | 404 Nautical Miles, 2.03 Hours and 219 KTAS |
| 74.8% Power at 24,500 Feet (900 Pounds Usable Fuel) | 730 Nautical Miles, 3.50 Hours and 220 KTAS |
| 74.8% Power at 24,500 Feet (1236 Pounds Usable Fuel) | 1099 Nautical Miles, 5.15 Hours and 221 KTAS |
| Maximum Range | |
| 10,000 Feet (600 Pounds Usable Fuel) | 532 Nautical Miles, 3.69 Hours and 143 KTAS |
| 10,000 Feet (900 Pounds Usable Fuel) | 899 Nautical Miles, 6.27 Hours and 143 KTAS |
| 10,000 Feet (1236 Pounds Usable Fuel) | 1327 Nautical Miles, 9.34 Hours and 141 KTAS |
| 25,000 Feet (600 Pounds Usable Fuel) | 482 Nautical Miles, 2.70 Hours and 181 KTAS |
| 25,000 Feet (900 Pounds Usable Fuel) | 855 Nautical Miles, 4.73 Hours and 183 KTAS |
| 25,000 Feet (1236 Pounds Usable Fuel) | 1293 Nautical Miles, 7.20 Hours and 181 KTAS |
| RATE-OF-CLIMB AT SEA LEVEL: | |
| All Engines | 1520 Feet Per Minute |
| Single-Engine | 290 Feet Per Minute |
| SERVICE CEILING: | |
| All Engines | 30,800 Feet |
| Single-Engine | 19,850 Feet |
| TAKEOFF PERFORMANCE: (98 KIAS, 0° Wing Flaps And 6750 Pounds Weight) | |
| Ground Roll | 2185 Feet |
| Total Distance Over 50-Foot Obstacle | 2595 Feet |
| LANDING PERFORMANCE: (94 KIAS, 45° Wing Flaps And 6750 Pounds Weight) | |
| Ground Roll | 1013 Feet |
| Total Distance (Over 50-Foot Obstacle) | 2393 Feet |
| STANDARD EMPTY WEIGHTS: (Approximate) | |
| 414A Chancellor | 4359 Pounds |
| 414A Chancellor II | 4533 Pounds |
| 414A Chancellor III | 4767 Pounds |
| BAGGAGE ALLOWANCE: | 1500 Pounds |
| WING LOADING: | 29.89 Pounds Per Square Foot |
| POWER LOADING: | 10.89 Pounds Per Horsepower |
| FUEL CAPACITY: (Total) | |
| Standard (206 Gallons Usable) | 213.4 Gallons |
| OIL CAPACITY: (Total) | 26 Quarts |
| ENGINES: | |
| Continental Six-Cylinder, Turbocharged, Fuel-Injected Engines | TSIO-520-NB |

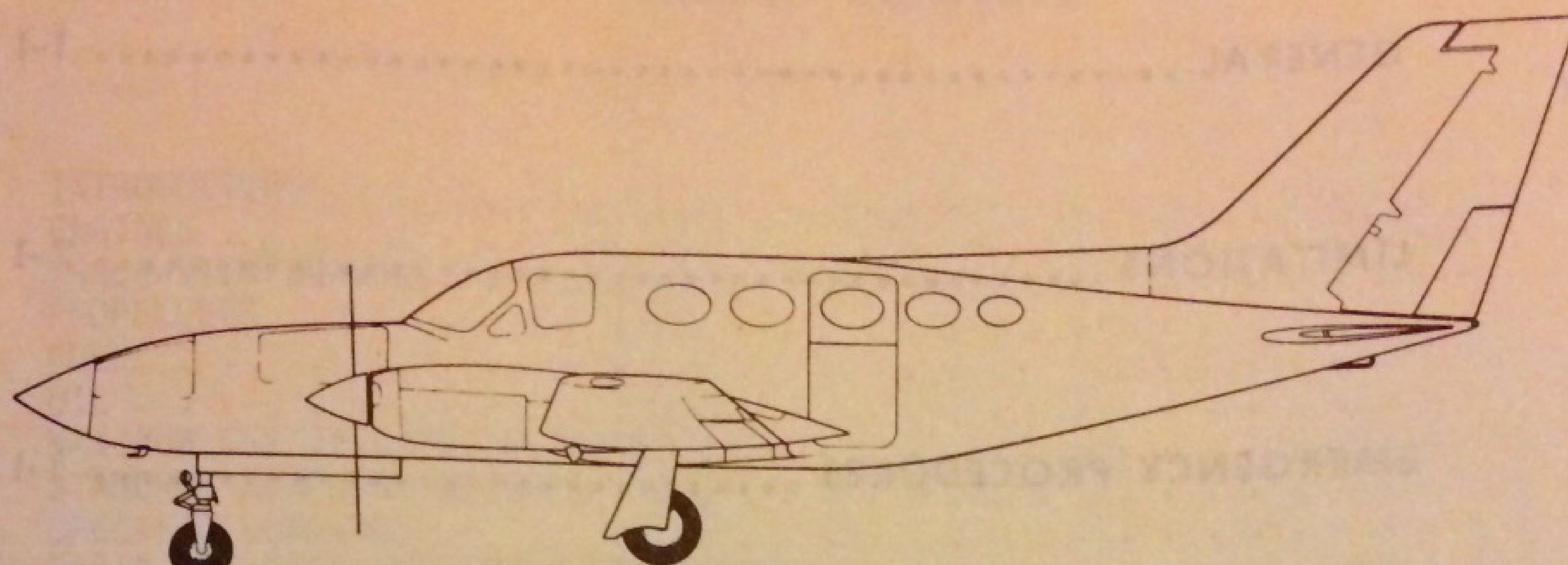
310 Rated Horsepower At 2700 Propeller RPM And 38.0 Inches Hg. Manifold Pressure To 20,000 Feet (For Takeoff and Single-Engine Operation), 298 Horsepower at 2600 RPM and 38.0 Inches Hg. Manifold Pressure to 20,000 Feet (Normal Operating Power.

| | |
|---|---|
| PROPELLERS: | |
| Constant Speed, Full Feathering, Three-Bladed 6'4.5" Diameter | 0850334-38 |

*Range data includes allowances for start, taxi, takeoff, climb, descent and 45-minute reserve at the particular cruise power and altitude. Speeds shown are based on estimated mid-cruise weight.

The above performance figures are based on the indicated weights, standard atmospheric conditions, level hard-surface dry runways and no wind. They are calculated values derived from flight tests conducted by the Cessna Aircraft Company under carefully documented conditions and will vary with individual airplanes and numerous factors affecting flight performance.

# INFORMATION MANUAL



**CESSNA AIRCRAFT COMPANY**

**1982 MODEL 414A**

THIS MANUAL INCORPORATES INFORMATION ISSUED IN THE ORIGINAL PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL DATED 2 NOVEMBER 1981



CESSNA AIRCRAFT COMPANY
Wallace Division
Wichita, Kansas

Member of GAMA

D1600-13-RPC-200-5/83

# SECTION 1
# GENERAL

## TABLE OF CONTENTS



## INTRODUCTION

This handbook consists of 9 sections and an alphabetical index as shown on the Contents page. This handbook includes the material required to be furnished to the pilot by CAR Part 3. It also contains supplemental data supplied by Cessna Aircraft Company. Specific information can be rapidly found by referring to the Contents page for the appropriate section, then referring to the Table Of Contents on the first page of the appropriate section, or by the use of the Alphabetical Index.

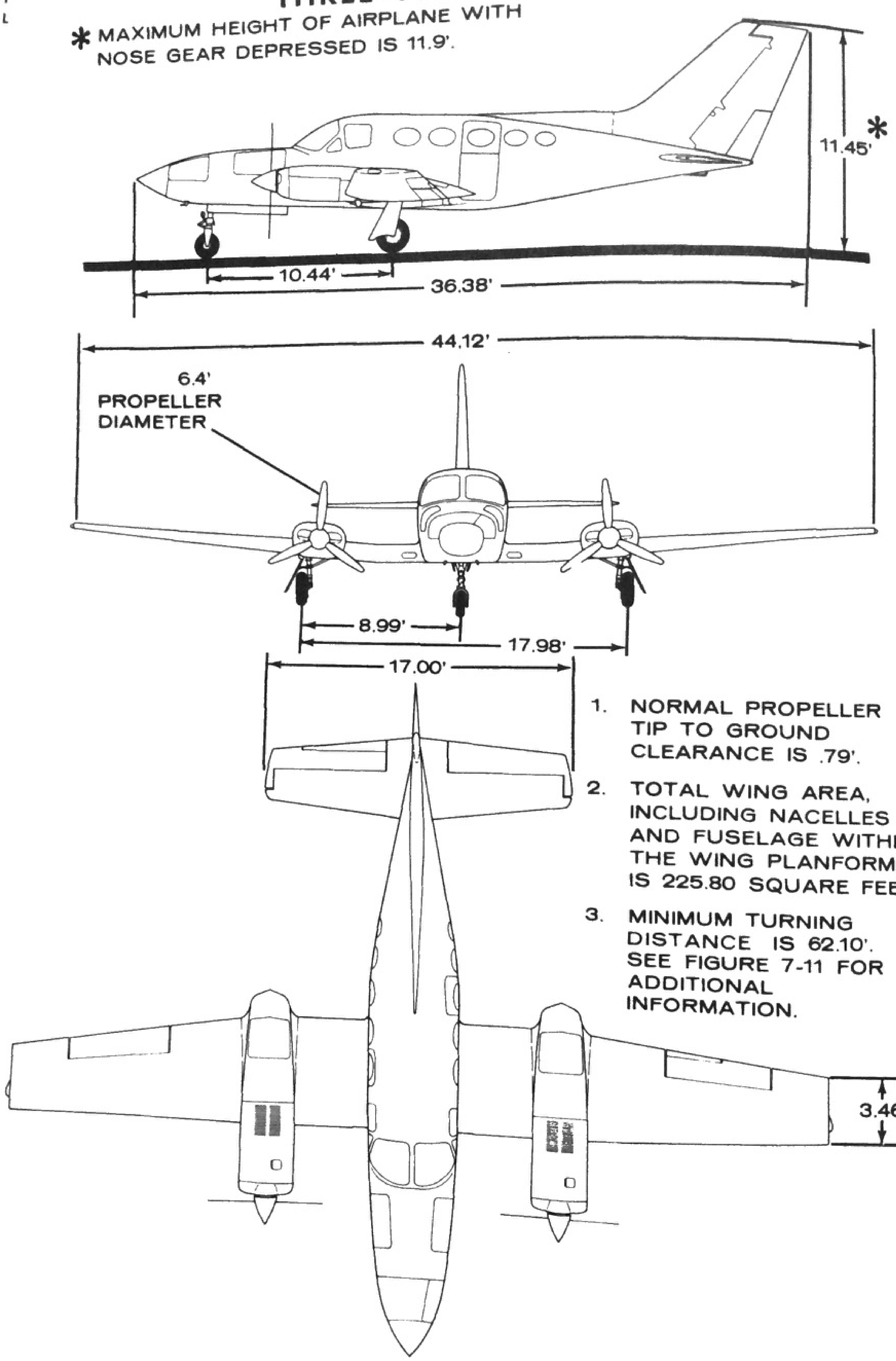
Section 1 of this handbook presents basic airplane data and general information which will be of value to the pilot.

## ENGINES

Number of Engines: 2

| | |
|---|---|
| Manufacturer: | Teledyne Continental Motors |
| Engine Model Number: | TSIO-520-NB |
| Engine Type: | Turbocharged, fuel-injected, direct drive, air cooled, horizontally opposed, six-cylinder, 520 cubic-inch displacement. |
| Horsepower: | 310 rated horsepower at 2700 propeller RPM and 38.0 inches Hg. manifold pressure to the critical altitude of 20,000 feet. |

# THREE-VIEW DRAWING




1. NORMAL PROPELLER TIP TO GROUND CLEARANCE IS .79'.
2. TOTAL WING AREA, INCLUDING NACELLES AND FUSELAGE WITHIN THE WING PLANFORM, IS 225.80 SQUARE FEET.
3. MINIMUM TURNING DISTANCE IS 62.10'. SEE FIGURE 7-11 FOR ADDITIONAL INFORMATION.

Figure 1-1

## PROPELLERS

Number of Propellers: 2

Manufacturer: McCauley Accessory Division, Cessna Aircraft Company

Propeller Part Number: 0850334-38

Number of Blades: 3

Propeller Diameter: 6'4.5"

Propeller Type: Constant speed, full feathering, nonreversible hydraulically actuated

Blade Range: (At 30-Inch Station)
a. Low Pitch 14.9° ±0.2°
b. Feather 81.2° ±0.3°

## FUEL (Approved Fuel Grades And Colors)*

PRIMARY - 100 (Formerly 100/130) Grade Aviation Fuel (Green).
ALTERNATE - 100LL Grade Aviation Fuel (Blue).

*Isopropyl alcohol or ethylene glycol monomethyl ether may be added to the fuel supply. Additive concentrations shall not exceed 1% for isopropyl alcohol or .15% for ethylene glycol monomethyl ether. Refer to Section 8 for additional information.

Total Fuel Capacity (U.S. Gallons) - 213.4

Usable Fuel (U.S. Gallons) - 206.0

## OIL

Grade: Aviation grade engine oil. Refer to Section 8 for additional information.

Viscosity:

| SAE Rating | Ambient Temperature - °C (°F) |
| --- | --- |
| 50 | Above 4.4 (40) |
| 30 | Below 4.4 (40) |
| Multiviscosity | Unrestricted - After 25 Hours |

Total Sump Capacity: 12 quarts per engine

2 November 1981

Drain and Refill Quantity: 13 quarts per engine including one quart for oil filter.

Oil Quantity Operating Range: Do not operate engine on less than 9 quarts. To minimize loss of oil through breather, fill to 10-quart level for normal flights of less than 3 hours. For extended flight, fill to capacity.

NOTE

Dip stick indicates the quantity of oil in the engine and does not account for the 1 quart of oil in the oil filter.

## MAXIMUM CERTIFICATED WEIGHTS

Maximum Ramp Weight: 6785 pounds

Maximum Takeoff Weight: 6750 pounds

Maximum Landing Weight: 6750 pounds

Maximum Zero Fuel Weight: 6515 pounds

Maximum Weights in Baggage Compartments:

a. Left and Right Wing Lockers - 200 pounds each.

b. Avionics Bay - 250 pounds less installed optional equipment. Refer to the loading placard in the airplane avionics baggage bay.

c. Nose Bay - 350 pounds less installed optional equipment. Refer to the loading placard in the airplane nose baggage bay.

d. Aft Cabin (Bay A) See Figure 1-2 - 400 pounds (200 Pounds Per Side).

e. Aft Cabin (Bay B) See Figure 1-2 - 100 pounds (50 Pounds Per Side).

## STANDARD AIRPLANE WEIGHTS

Standard Empty Weight: 4368 pounds for 414A Chancellor (4543 pounds for 414A Chancellor II) (4769 pounds for 414A Chancellor III)

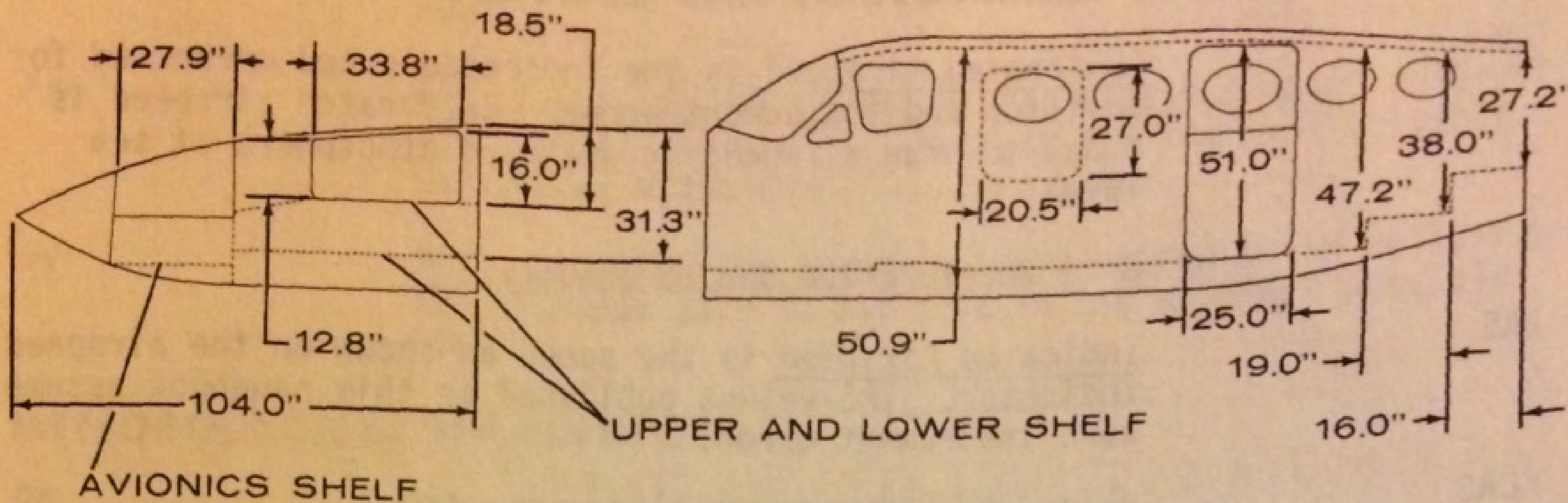
Maximum Useful Load: 2429 pounds for 414A Chancellor (2259 pounds for 414A Chancellor II) (2022 pounds for 414A Chancellor III)

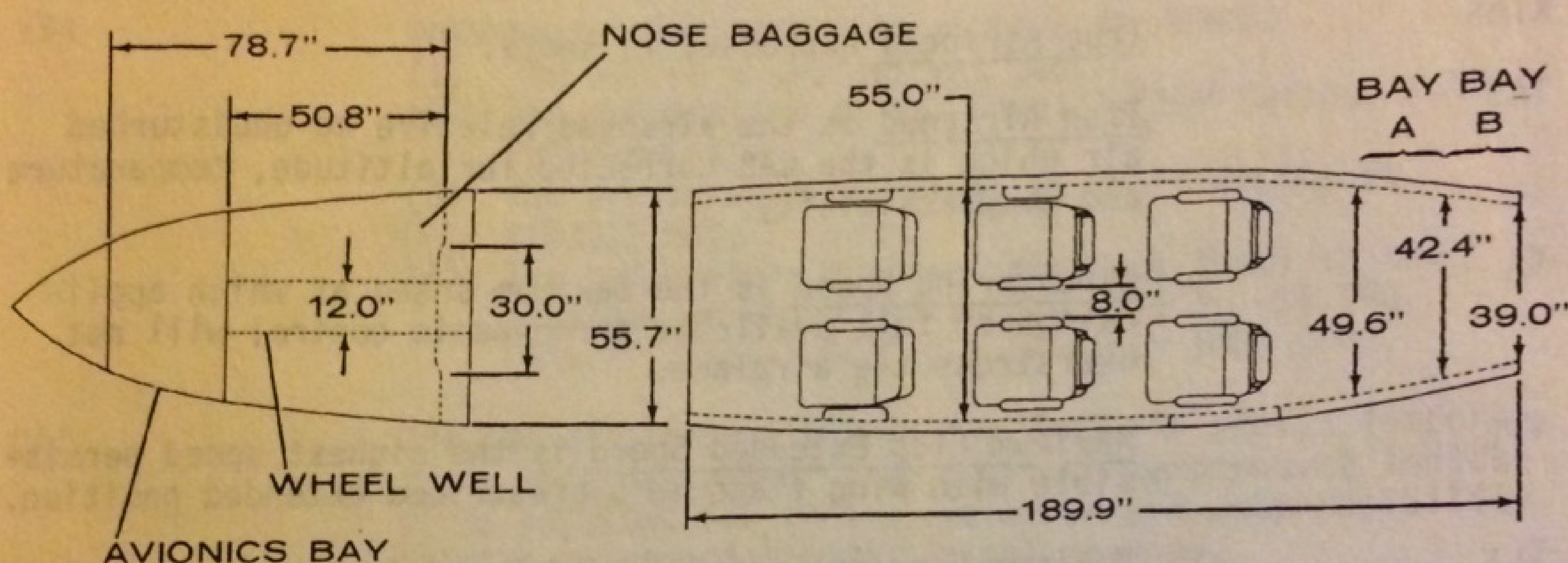
## SPECIFIC LOADINGS

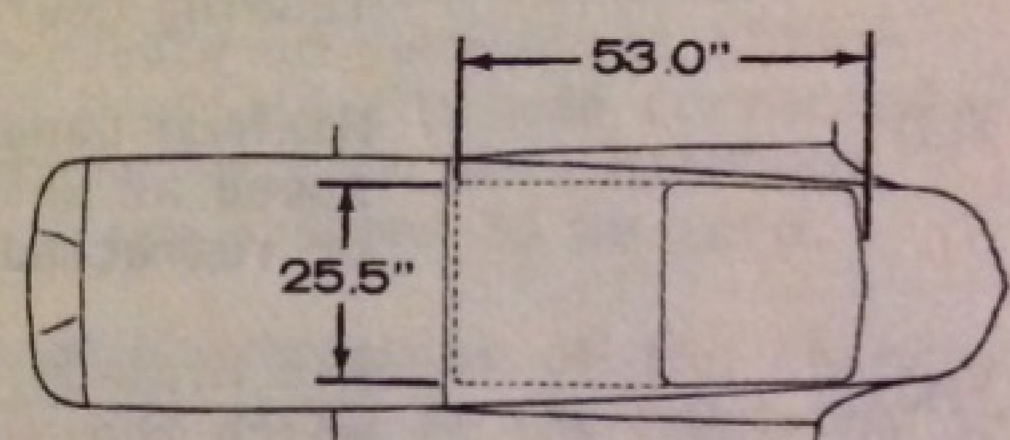
Wing Loading: 29.89 pounds per square foot

Power Loading: 10.89 pounds per horsepower

# CABIN, BAGGAGE AND ENTRY DIMENSIONS




| BAGGAGE COMPARTMENT VOLUME - CUBIC FEET | |
|---|---|
| AVIONICS BAY | 11.0 |
| NOSE | 25.0 |
| WING LOCKER EACH (STD) | 9.25 |
| AFT CABIN (BAY A AND B) | 30.6 |

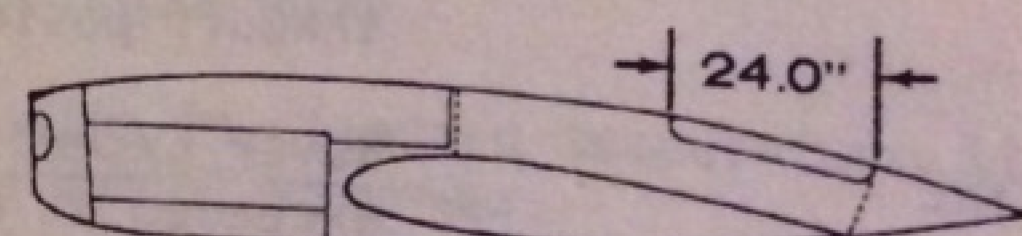



Figure 1-2

## AIRSPEED LIMITATIONS (See Figure 2-1)

### AIRSPEED LIMITATIONS TABLE

| SPEED | KIAS | KCAS | REMARKS |
|---|---|---|---|
| Maneuvering Speed $V_A$ (Knots) | 145 | 144 | Do not make abrupt control movements above this speed. |
| Maximum Flap Extended Speed $V_{FE}$ (Knots) 15° / 45° | 177 / 146 | 175 / 145 | Do not exceed this speed with the given flap setting. |
| Maximum Gear Operating Speed $V_{LO}$ (Knots) | 177 | 175 | Do not extend or retract landing gear above this speed. |
| Maximum Gear Extended Speed $V_{LE}$ (Knots) | 177 | 175 | Do not exceed this speed with landing gear extended. |
| Air Minimum Control Speed - $V_{MC_A}$ (Knots) | 79 | 79 | This is the minimum flight speed at which the airplane is controllable with one engine inoperative and with a 5° bank towards the operative engine. |
| One Engine Inoperative Best Rate-of-Climb Speed $V_Y$ (Knots) | 108 | 108 | This speed delivers the greatest gain in altitude in the shortest possible time with one engine inoperative at sea level, standard day conditions and 6750 pounds weight. |
| Never Exceed Speed $V_{NE}$ (Knots) | 237 | 232 | Do not exceed this speed in any operation. |
| Maximum Structural Cruising Speed $V_{NO}$ (Knots) | 203 | 200 | Do not exceed this speed except in smooth air and then only with caution. |

Figure 2-1

Airspeed Indicator Markings: See Figure 2-2

## AIRSPEED INDICATOR TABLE

| MARKING | KIAS VALUE OR RANGE | SIGNIFICANCE |
|---|---|---|
| Red Radial | 79 | Air minimum control speed. |
| White Arc | 71 to 146 | Operating speed range with 45° wing flaps. Lower limit is maximum weight stalling speed in landing configuration. Upper limit is maximum speed permissible with wing flaps extended 45°. |
| Green Arc | 81 to 203 | Normal operating range. Lower limit is maximum weight stalling speed with flaps and landing gear retracted. Upper limit is maximum structural cruising speed. |
| Blue Radial | 108 | One engine inoperative best rate-of-climb speed at sea level standard day conditions and 6750 pounds weight. |
| Yellow Arc | 203 to 237 | Caution range. Operations must be conducted with caution and only in smooth air. |
| Red Radial | 237 | Maximum speed for all operations. |

Figure 2-2

## ENGINE LIMITATIONS

Number of Engines: 2

Engine Manufacturer: Teledyne Continental Motors

Engine Model Number: TSIO-520-NB

Engine Operating Limits:

a. Maximum power for takeoff and single engine operation.

| Altitude - Feet | Allowable Manifold Pressure - Inches Hg. | Engine RPM | Rated Horse-power | Time | Max. Head Temp. oF | Max. Oil Temp. oF |
|---|---|---|---|---|---|---|
| S.L. to 20,000 | 38.0 | 2700 | 310 | Continuous | 460 | 240 |
| 22,000 | 35.2 | 2700 | 285 | Continuous | 460 | 240 |
| 24,000 | 32.3 | 2700 | 264 | Continuous | 460 | 240 |
| 26,000 | 29.8 | 2700 | 242 | Continuous | 460 | 240 |
| 28,000 | 27.4 | 2700 | 219 | Continuous | 460 | 240 |
| 30,000 | 25.0 | 2700 | 197 | Continuous | 460 | 240 |

b. Maximum normal operating power.

| Altitude - Feet | Allowable Manifold Pressure - Inches Hg. | Engine RPM | Rated Horse-power | Time | Max. Head Temp. °F | Max. Oil Temp. °F |
|---|---|---|---|---|---|---|
| S.L. to 20,000 | 38.0 | 2600 | 298 | Continuous | 460 | 240 |
| 22,000 | 35.2 | 2600 | 282 | Continuous | 460 | 240 |
| 24,000 | 32.3 | 2600 | 260 | Continuous | 460 | 240 |
| 26,000 | 29.8 | 2600 | 240 | Continuous | 460 | 240 |
| 28,000 | 27.4 | 2600 | 216 | Continuous | 460 | 240 |
| 30,000 | 25.0 | 2600 | 195 | Continuous | 460 | 240 |

Oil Pressure:

a. Minimum: 10 PSI (Idle Power)

b. Maximum: 100 PSI

Oil Viscosity:

| SAE Rating | Ambient Temperature - °C (°F) |
|---|---|
| 50<br>30<br>Multiviscosity | Above 4.4 (40)<br>Below 4.4 (40)<br>Unrestricted - After 25 Hours |

Propellers:

a. Number of Propellers: 2

b. Manufacturer: McCauley Accessory Division, Cessna Aircraft Company

c. Part Number: 0850334-38

d. Number of Blades: 3

e. Diameter: 6'4.5"

f. Blade Range: (At 30-Inch Station)

(1) Low Pitch 14.9° ±0.2°

(2) Feather 81.2° ±0.3°

g. Operating Limits: 2700 RPM maximum speed

Engine Instrument Markings:

a. Tachometer:

(1) Normal Operating 2100 to 2450 RPM (Green Arc)

(2) Takeoff and engine inoperative 2600 to 2700 RPM (Yellow Arc).

(3) Maximum 2700 RPM (Red Radial)

b. Manifold Pressure:

(1) Normal Operating 17.0 to 31.5 Inches Hg. Manifold Pressure (Green Arc)

(2) Conditional Normal Operating 31.5 to 34.0 Inches Hg. Manifold Pressure at 2200 to 2300 RPM (Narrow Green Arc)

(a) 2450 RPM Mark at 31.5 Inches Hg. Manifold Pressure

(b) 2300 RPM Mark at 34.0 Inches Hg. Manifold Pressure

(3) Maximum 38.0 Inches Hg. Manifold Pressure (Red Radial)

c. Oil Temperature:

(1) Normal Operating 75 to 240°F (Green Arc)

(2) Maximum 240°F (Red Radial)

d. Oil Pressure:

(1) Minimum Operating 10 PSI (Red Radial)

(2) Normal Operating 30 to 60 PSI (Green Arc)

(3) Maximum 100 PSI (Red Radial)

e. Cylinder Head Temperature:

(1) Normal Operating 200 to 460°F (Green Arc)

(2) Maximum 460°F (Red Radial)

f. Fuel Flow:

(1) Minimum Operating 0 Pounds per hour (3.0 PSI) (Red Radial)

(2) Normal Operating 10.0 Pounds per hour (3.5 PSI) to 186.0 Pounds per hour (21.1 PSI) (Green Arc)

(a) Green Dots
45% Power - 64.5 Pounds per hour (5.9 PSI)
55% Power - 77.0 Pounds per hour (6.9 PSI)
65% Power - 89.0 Pounds per hour (7.9 PSI)
75% Power - 102.0 Pounds per hour (9.3 PSI)

(b) Blue Arc - Takeoff and Engine Inoperative Climb
28,000 Feet - 129.0 Pounds per hour (12.6 PSI)
26,000 Feet - 141.0 Pounds per hour (14.2 PSI)
24,000 Feet - 154.3 Pounds per hour (16.1 PSI)
22,000 Feet - 169.3 Pounds per hour (18.4 PSI)

(c) Blue Triangle (77.5% Power) - 120.0 Pounds per hour (11.4 PSI) (Cruise Climb and Best Power)

(d) White Triangle (Maximum Normal Operating Power) 170 Pounds per hour (18.5 PSI)

(e) White Arc - Takeoff and Engine Inoperative Power to 21,000 Feet 180.0 Pounds per hour (20.1 PSI) to 186.0 Pounds per hour (21.1 PSI)

(3) Maximum Operating 195.0 Pounds per hour (22.5 PSI) (Red Radial)

(4) On Face of Indicator: FUEL FLOW LBS/HR T.O. & ENG. INOP MAX CLIMB 77.5% CLIMB CRUISE POWER

## MISCELLANEOUS INSTRUMENT MARKINGS

Instrument Vacuum:

a. Red Line: 4.75 Inches Hg.
b. Green Arc: 4.75 to 5.25 Inches Hg.

Oxygen Pressure:

a. Yellow Arc: 0 to 300
b. Green Arc: 1550 to 1850
c. Red Line: 2000
d. The Cubic Foot Capacity Of The Bottles Installed Will Be Indicated On The Face Of The Gage.

## WEIGHT LIMITS

Maximum Ramp Weight: 6785 Pounds

Maximum Takeoff Weight: 6750 Pounds

Maximum Landing Weight: 6750 Pounds

Maximum Zero Fuel Weight: 6515 Pounds

Maximum Weights in Baggage Compartments:

a. Left and Right Wing Lockers - 200 pounds each.
b. Avionics Bay - 250 pounds less installed optional equipment.
c. Nose Bay - 350 pounds less installed optional equipment.
d. Aft Cabin (Bay A) - 400 pounds (200 Pounds Per Side).
e. Aft Cabin (Bay B) - 100 pounds (50 Pounds Per Side).

Center of Gravity Limits (Gear Extended):

a. Aft Limit: 160.04 inches aft of reference datum (33% MAC) at 6750 pounds or less.
b. Forward Limit: 151.27 inches aft of reference datum (19.0% MAC) at 6750 pounds or less and 147.82 inches aft of reference datum (13.5% MAC) at 5800 pounds or less with straight line variation between these points.
c. See Weight and Balance Data in Section 6 for loading schedule. The reference datum is 100 inches forward of the forward face of the fuselage bulkhead forward of the rudder pedals. The mean aerodynamic chord (MAC) is 62.65 inches in length. The leading edge of the MAC is 139.37 inches aft of the reference datum.

## MANEUVER LIMITS

This is a normal category airplane. Aerobatic maneuvers, including spins, are prohibited.

## FLIGHT LOAD FACTOR LIMITS

The design load factors are 150% of the following, and in all cases the structure exceeds design loads.

At Design Takeoff Weight of 6750 Pounds:

a. Landing gear up, wing flaps 0° +3.6G to -1.44G
b. Landing gear down, wing flaps 45° 0.0G to +2.0G

## FLIGHT CREW LIMITS

Minimum Flight Crew for FAR 91 operations is one pilot.

## OPERATION LIMITS

The standard airplane is approved for day and night operation under VFR conditions. With the proper optional equipment installed, the airplane is approved for day and night IFR operations and flight into icing conditions as defined by the FAA.

## FUEL LIMITATIONS (See Figure 2-3)

Fuel Pressure:

a. Minimum: 3.0 PSI (0 Pounds Per Hour)
b. Maximum: 22.5 PSI (195.0 Pounds Per Hour)

Fuel Quantity:

a. Minimum fuel for takeoff is 20 gallons in each main tank.

Maneuvering Fuel:

a. Maximum side slip duration time is 30 seconds. The airplane is considered in a side slip anytime the turn and bank "ball" is more than one half ball out of the center (coordinated flight) position.

Fuel (Approved Fuel Grades And Colors):

PRIMARY - 100 (Formerly 100/130) Grade Aviation Fuel (Green).
ALTERNATE - 100LL Grade Aviation Fuel (Blue).

Total Fuel Capacity (U.S. Gallons) - 213.4

Usable Fuel (U.S. Gallons) - 206.0

## MAXIMUM OPERATING ALTITUDE LIMIT

Without Oxygen Equipment: 25,000 Feet
With Oxygen Equipment: 30,000 Feet

## CABIN PRESSURIZATION LIMIT

Maximum: 5.3 PSI
Normal: 0.0 to 5.0 PSI

Cabin Shall Be Depressurized During:

a. Takeoff.
b. Landing.
c. In flight when both engines are operating on hot alternate air.
d. All ground operations.





## REQUIRED PLACARDS

On Emergency Exit Window Trim:

EMERGENCY EXIT
1. TURN HANDLE OPEN
2. PULL DOOR INBD & DOWN

On Emergency Exit Window Trim (With Optional Right Aft Facing Seat):

EMERGENCY EXIT
1. TURN HANDLE OPEN
2. PULL DOOR INBD & DOWN

AFT FACING SEAT MUST BE
FULL FWD WITH BACK ERECT
FOR TAKEOFF & LANDING
5300181 82

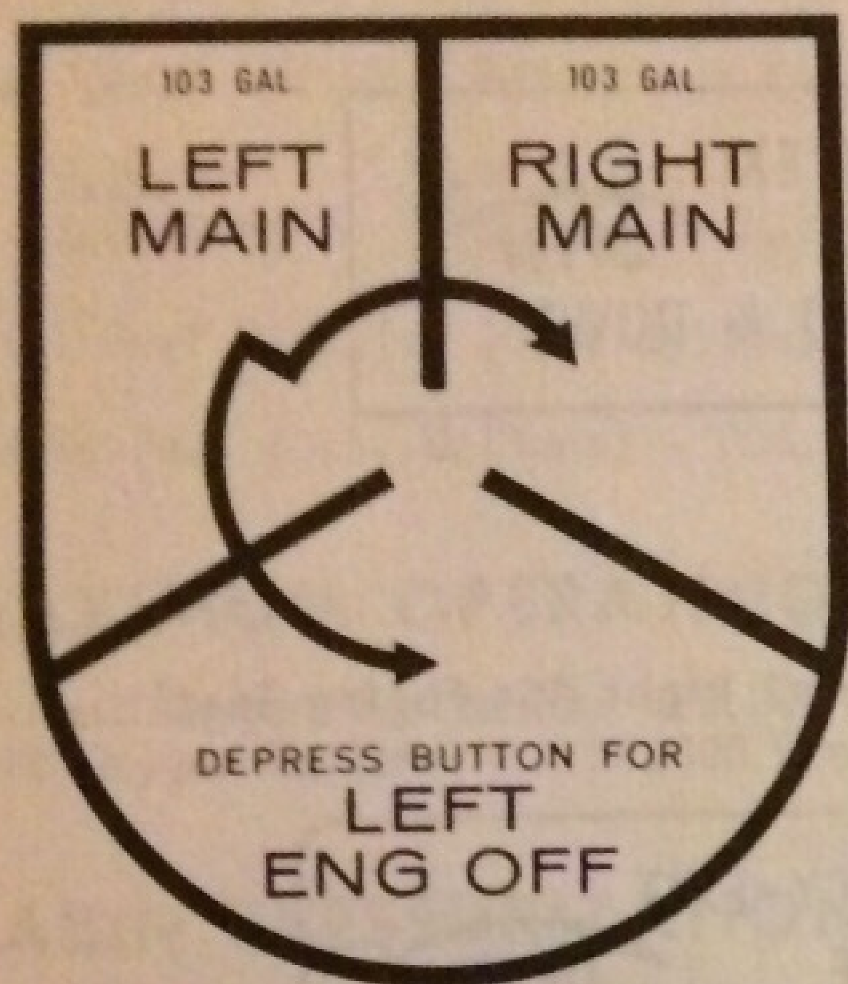
On Executive Table Top And Writing Desk Top:

TABLE MUST BE STOWED
DURING TAKE-OFF AND
LANDING

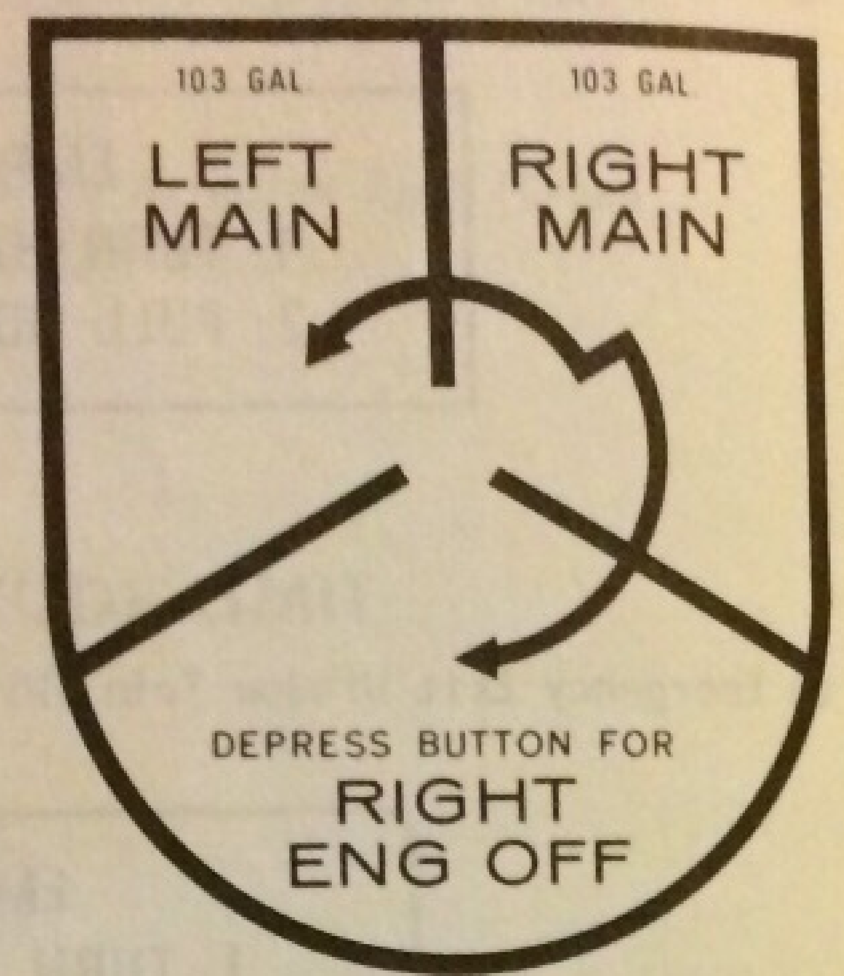
On Wall Opposite Emergency Exit Window:

AFT FACING SEAT BACK MUST BE
ERECT FOR TAKEOFF & LANDING

Left Left Engine Fuel Selector:




On Right Engine Fuel Selector:




On Floor Forward of Fuel Selectors:

SET FUEL SELECTOR VALVES TO LEFT MAIN FOR LEFT ENGINE AND RIGHT MAIN FOR RIGHT ENGINE FOR TAKEOFF, DESCENT, LANDING, AND ALL NORMAL OPERATIONS.

TAKEOFF AND LAND WITH AUXILIARY FUEL PUMPS ON.

EMERGENCY CROSSFEED SHUTOFF VALVE MUST BE OPEN FOR ALL NORMAL OPERATIONS.

100 GRADE AVIATION FUEL MINIMUM.





On Floor Forward of Fuel Emergency Crossfeed Shutoff Valve:

EMERGENCY CROSSFEED
SHUTOFF VALVE
PULL
TO SHUT OFF

In Recess on Fuel Emergency Crossfeed Shutoff Valve Bezel (Visible When Lever is Up):

LEVER UP
CROSSFEED
OFF

On Pilot's Sun Visor:

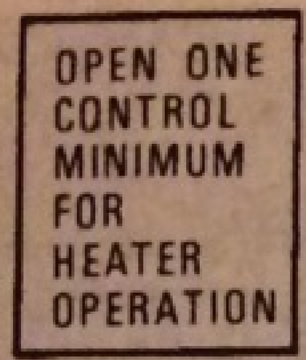
OPERATIONAL LIMITS

THE MARKINGS AND PLACARDS INSTALLED IN THIS AIRPLANE CONTAIN OPERATING LIMITATIONS WHICH MUST BE COMPLIED WITH WHEN OPERATING THIS AIRPLANE IN THE NORMAL CATEGORY. OTHER OPERATING LIMITATIONS WHICH MUST BE COMPLIED WITH WHEN OPERATING THIS AIRPLANE IN THE NORMAL CATEGORY ARE CONTAINED IN THE "PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL".
NO ACROBATIC MANEUVERS, INCLUDING SPINS, APPROVED.

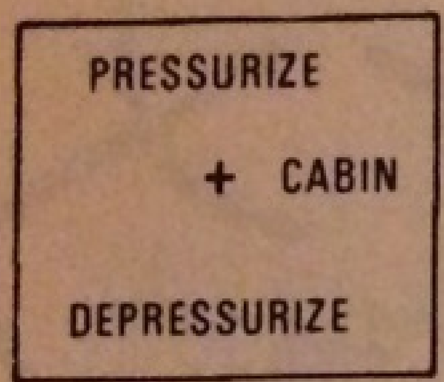
| | |
|---|---|
| AIR MINIMUM CONTROL SPEED | 79 KIAS |
| MAXIMUM GEAR OPERATING SPEED | 177 KIAS |
| MAXIMUM GEAR EXTENDED SPEED | 177 KIAS |
| MAXIMUM FLAP EXTENDED SPEED, 15° FLAP | 177 KIAS |
| MAXIMUM FLAP EXTENDED SPEED, 45° FLAP | 146 KIAS |
| MAXIMUM MANEUVERING SPEED | 145 KIAS |

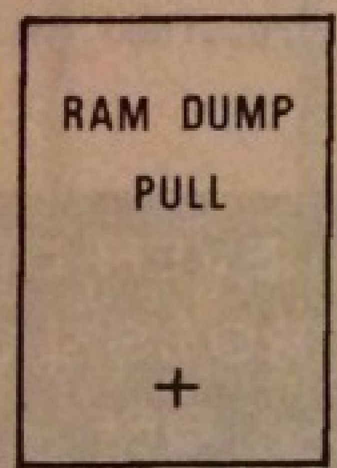
LANDING WITH CABIN PRESSURIZED PROHIBITED.
THIS AIRPLANE IS APPROVED FOR DAY-NIGHT VFR CONDITIONS. IT IS APPROVED FOR DAY-NIGHT IFR CONDITIONS AND FLIGHTS INTO ICING CONDITIONS IF THE PROPER EQUIPMENT IS INSTALLED AND OPERATIONAL.

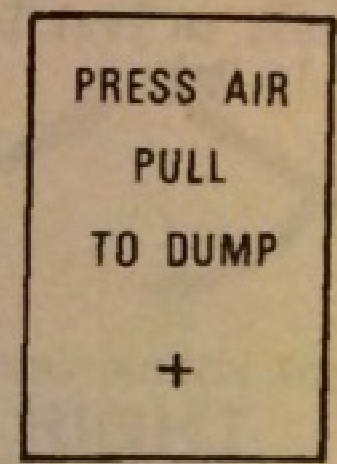
Near Heater and Pressurization Heat Exchanger Controls:



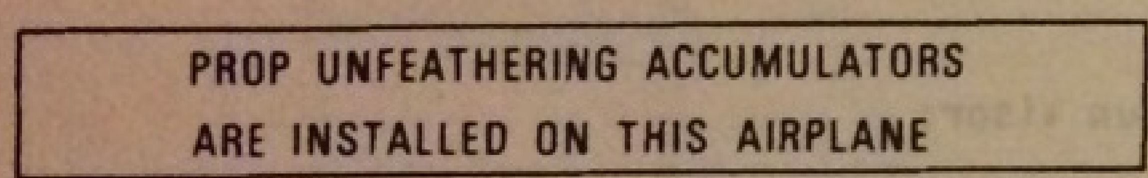

Near Pressurization Controls:



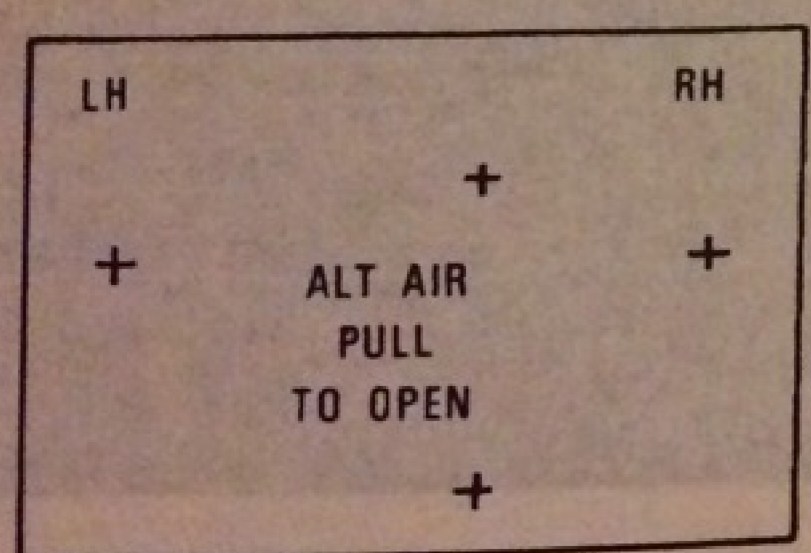




If Optional Unfeathering Accumulators Are Installed:



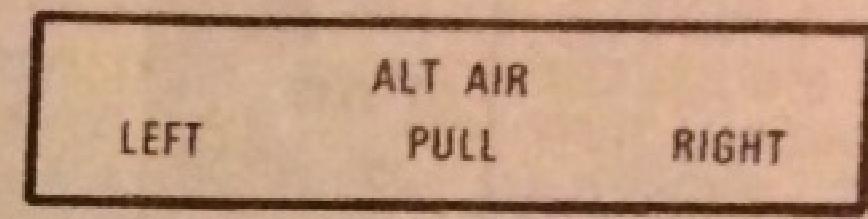

Near Engine Induction Alternate Air Controls:



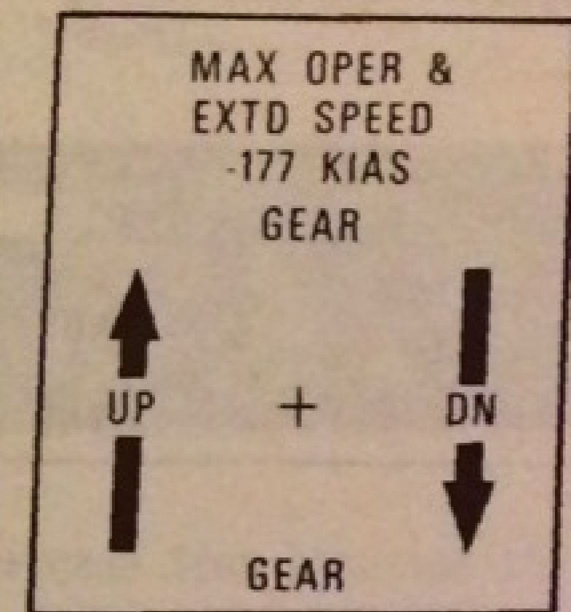




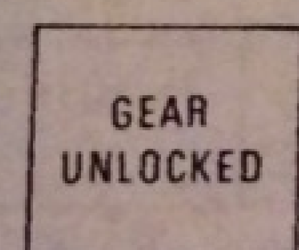

Induction Air Controls (Optional EL Panel Installed):

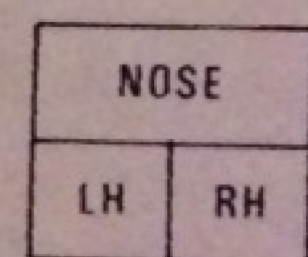



Around Landing Gear Selector Switches:

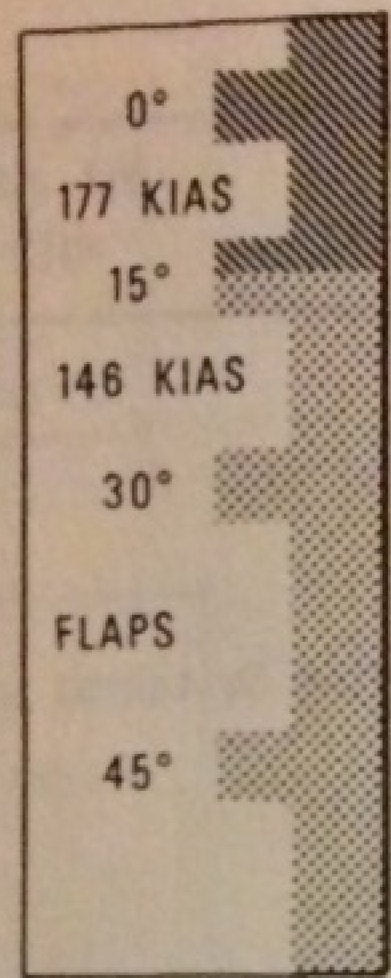



On Landing Gear Indicator Lights:

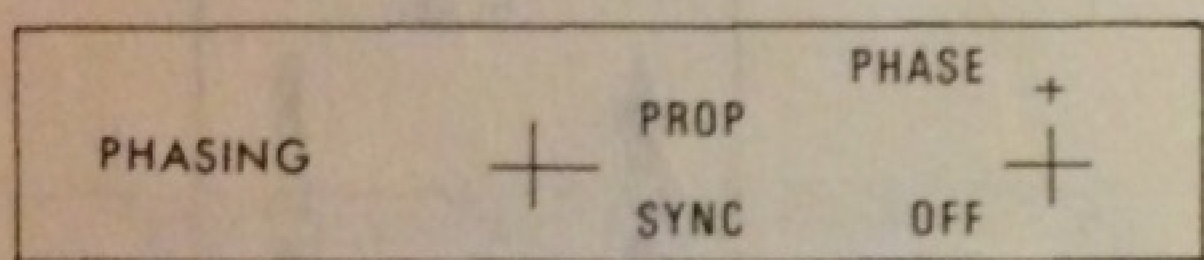


Adjacent to Wing Flap Position Switch:

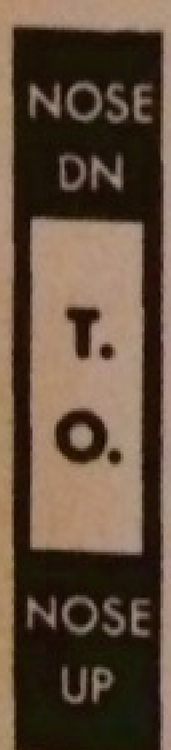



Near Propeller Synchrophaser Switch, If Optional Propeller Synchrophaser is Installed:

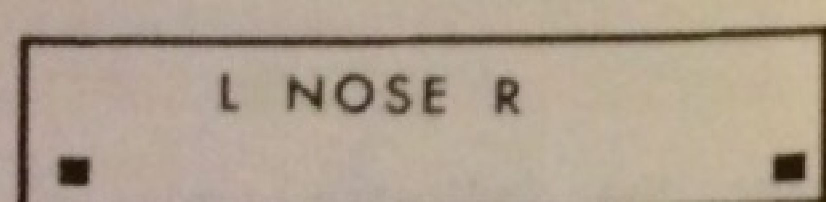



On Engine Control Pedestal:

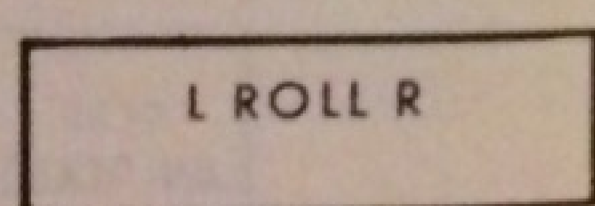
T.O. Range on Elevator Trim Tab Indicator 2° Nose Down to 8° Nose Up:




Rudder Trim Indicator:



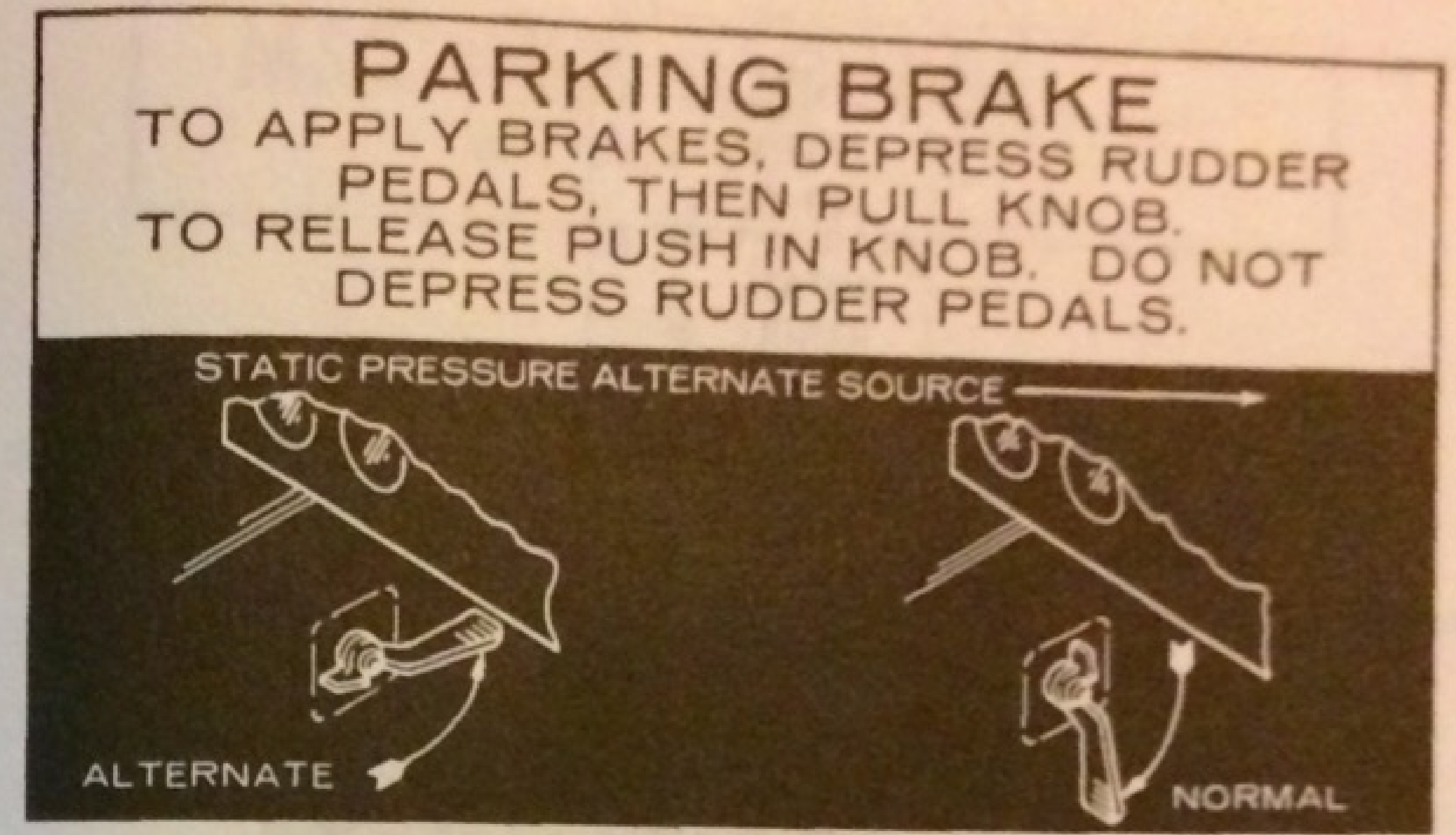

Aileron Trim Indicator:



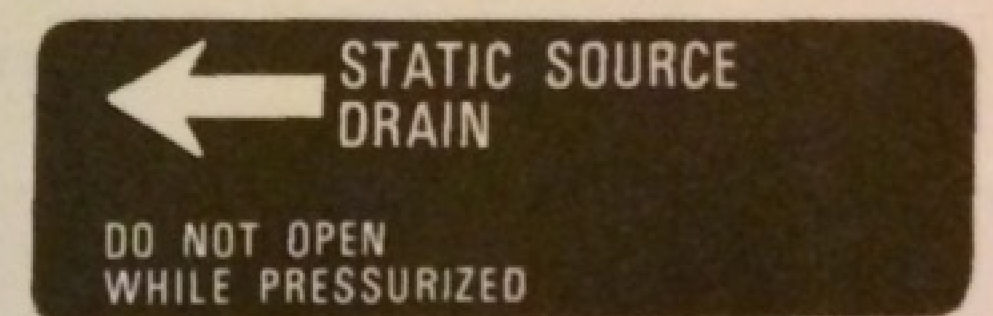




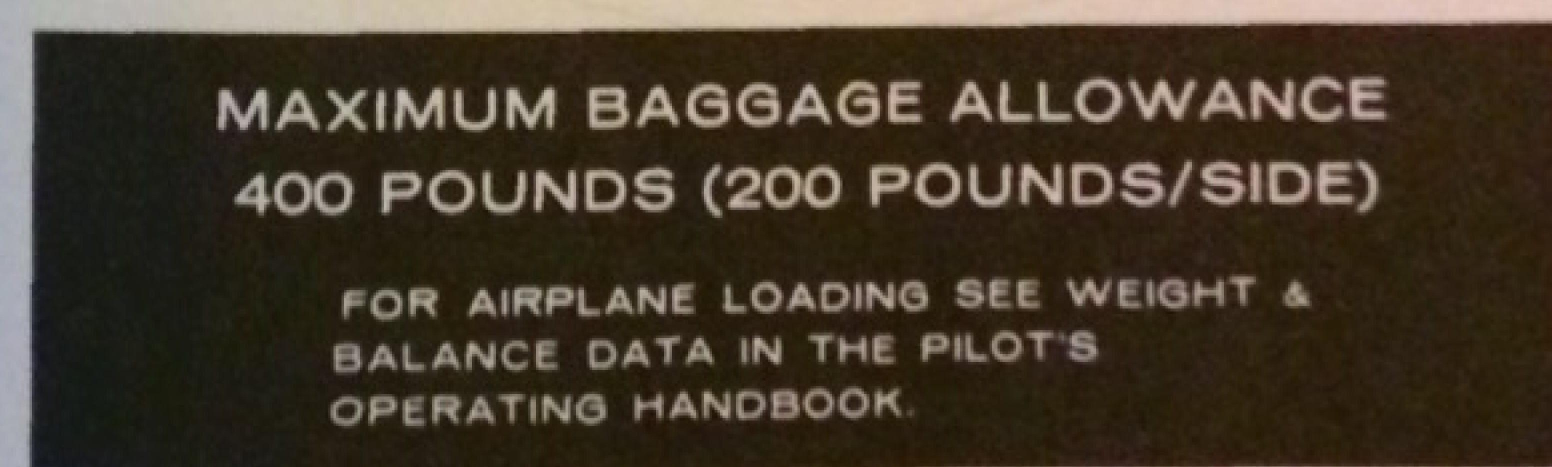

Adjacent to Static Source in Pilot's Compartment:



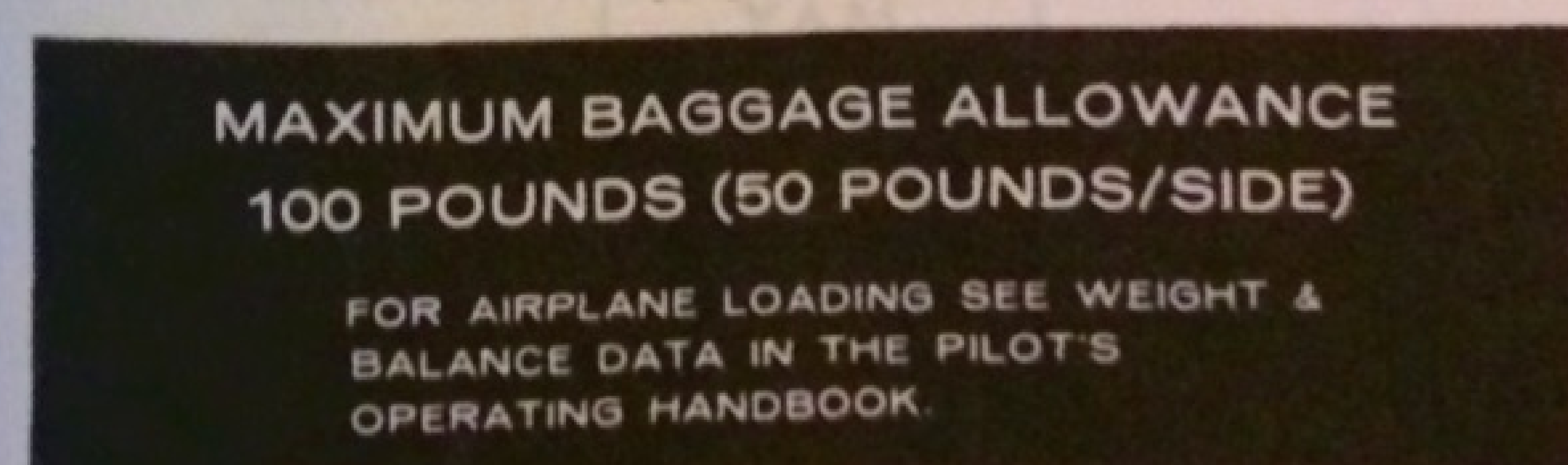

On Pilot's Compartment Right Sidewall:




On Horizontal Part of First Baggage Step (Station 257):




On Horizontal Part of Second Baggage Step (Station 276):

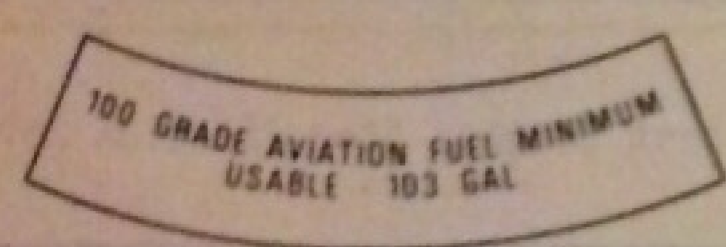


Near Upper Cabin Door Latch Mechanism:

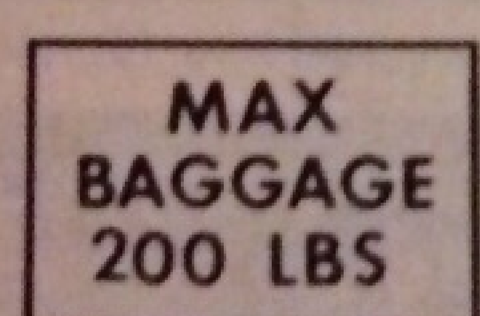
External:


Internal:


Near Main Tank Filler Cap:




On Wing Locker Doors:

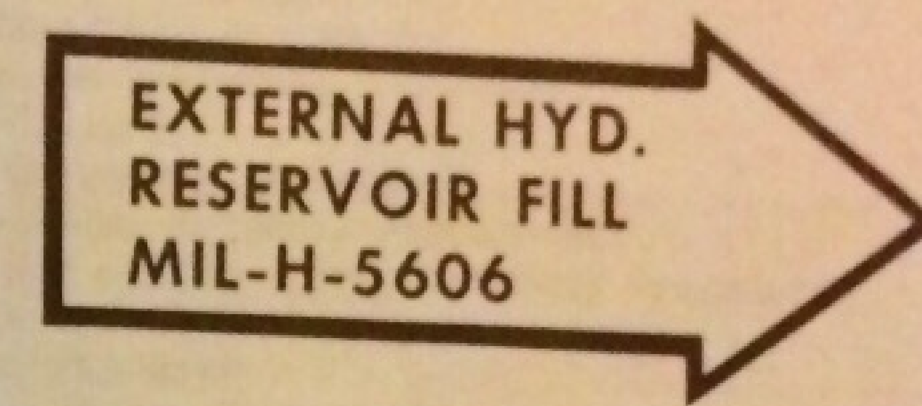




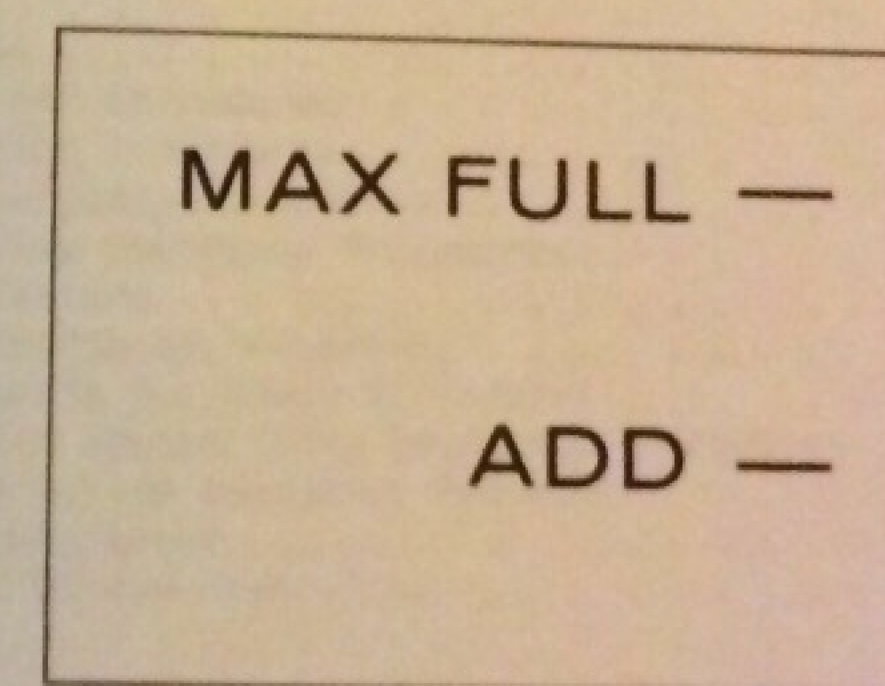



Inside Nose Baggage Doors:


Inside Left Nose Baggage Door:




On Hydraulic Reservoir:




On Avionics Bay Door Forward Partition:

# SECTION 3
# EMERGENCY PROCEDURES

## TABLE OF CONTENTS



## INTRODUCTION

Section 3 of this handbook describes the recommended procedures for emergency situations. The first part of this section provides emergency procedural action required in an abbreviated checklist form. Amplification of the abbreviated checklist is presented in the second part of this section.

**NOTE**

> Refer to Section 9 of this handbook for amended operating limitations, operating procedures, performance data and other necessary information for airplanes equipped with specific options.

# EMERGENCY PROCEDURES ABBREVIATED CHECKLIST

NOTE

This Abbreviated Emergency Procedures Checklist is included as a supplement to the Amplified Emergency Procedures Checklist. Use of the Abbreviated Emergency Procedures Checklist should not be used until the flight crew has become familiar with the airplane and systems. All amplified emergency procedure items must be accomplished regardless of which checklist is used.

Procedures in the Abbreviated Checklist portion of this section outlined in black ▭ are immediate-action items and should be committed to memory.

## SINGLE-ENGINE AIRSPEEDS FOR SAFE OPERATION

Conditions:
1. Takeoff Weight 6750 Pounds
2. Landing Weight 6750 Pounds
3. Standard Day, Sea Level

(1) Air Minimum Control Speed . . . . . . . . . . . . . 79 KIAS
(2) Intentional One Engine Inoperative Speed . . . . . . 98 KIAS
(3) One Engine Inoperative Best Angle-of-Climb Speed . . 100 KIAS
(4) One Engine Inoperative Best Rate-of-Climb Speed (Wing Flaps UP) . . . . . . . . . . . . . 108 KIAS

Figure 3-1

## ENGINE INOPERATIVE PROCEDURES

### ENGINE SECURING PROCEDURE

1. Throttle - CLOSE.
2. Propeller - FEATHER.
3. Mixture - IDLE CUT-OFF.
4. Fuel Selector - OFF (Feel For Detent).
5. Auxiliary Fuel Pump - OFF.
6. Magneto Switches - OFF.
7. Propeller Synchrophaser (if installed) - OFF.
8. Alternator - OFF.
9. Cowl Flap - CLOSE.

### ENGINE FAILURE DURING TAKEOFF (Speed Below 98 KIAS Or Gear Down)

1. Throttles - CLOSE IMMEDIATELY.
2. Brake Or Land And Brake - AS REQUIRED.

## ENGINE FAILURE AFTER TAKEOFF (Speed Above 98 KIAS With Gear Up Or In Transit)

1. Mixtures - FULL RICH.
2. Propellers - FULL FORWARD.
3. Throttles - FULL FORWARD (38.0 Inches Hg.).
4. Landing Gear - CHECK UP.
5. Inoperative Engine:
   a. Throttle - CLOSE.
   b. Propeller - FEATHER.
   c. Mixture - IDLE CUT-OFF.
6. Establish Bank - 5° toward operative engine.
7. Climb To Clear 50-Foot Obstacle - 98 KIAS.
8. Climb At One Engine Inoperative Best Rate-of-Climb Speed - 108 KIAS.
9. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.
10. Cowl Flap - CLOSE (Inoperative Engine).
11. Inoperative Engine - SECURE as follows:
    a. Fuel Selector - OFF (Feel For Detent).
    b. Auxiliary Fuel Pump - OFF.
    c. Magneto Switches - OFF.
    d. Alternator - OFF.
12. As Soon As Practical - LAND.

## ENGINE FAILURE DURING FLIGHT (Speed Above $V_{MCA}$)

1. Inoperative Engine - DETERMINE.
2. Operative Engine - ADJUST as required.

Before Securing Inoperative Engine:

3. Fuel Flow - CHECK. If deficient, position auxiliary fuel pump to ON.
4. Fuel Selectors - MAIN TANKS (Feel For Detent).
5. Fuel Quantity - CHECK.
6. Oil Pressure and Oil Temperature - CHECK.
7. Magneto Switches - CHECK ON.
8. Mixture - ADJUST. Lean until manifold pressure begins to increase, then enrichen as power increases.

If Engine Does Not Start, Secure As Follows:

9. Inoperative Engine - SECURE.
   a. Throttle - CLOSE.
   b. Propeller - FEATHER.
   c. Mixture - IDLE CUT-OFF.
   d. Fuel Selector - OFF (Feel For Detent).
   e. Auxiliary Fuel Pump - OFF.
   f. Magneto Switches - OFF.
   g. Propeller Synchrophaser (if installed) - OFF.
   h. Alternator - OFF.
   i. Cowl Flap - CLOSE.
10. Operative Engine - ADJUST.
    a. Power - AS REQUIRED.
    b. Mixture - ADJUST for power.
    c. Fuel Selector - AS REQUIRED (Feel For Detent).
    d. Auxiliary Fuel Pump - ON.
    e. Cowl Flap - AS REQUIRED.

11. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.
12. Electrical Load - DECREASE to minimum required.
13. As Soon As Practical - LAND.

## ENGINE FAILURE DURING FLIGHT (Speed Below $V_{MC_A}$)

1. Rudder - APPLY towards operative engine.
2. Power - REDUCE to stop turn.
3. Pitch Attitude - LOWER NOSE to accelerate above $V_{MC_A}$.
4. Inoperative Engine Propeller - FEATHER.
5. Operative Engine - INCREASE POWER as airspeed increases above $V_{MC_A}$.
6. Inoperative Engine - SECURE.
7. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.
8. Operative Engine Cowl Flap - AS REQUIRED.

## ENGINE INOPERATIVE LANDING

1. Fuel Selector - MAIN TANK (Feel For Detent).
2. Auxiliary Fuel Pump - ON (Operative Engine).
3. Alternate Air Control - IN.
4. Mixture - FULL RICH or lean as required for smooth operation.
5. Propeller Synchrophaser - OFF (Optional System).
6. Propeller - FULL FORWARD.
7. Approach - 108 KIAS with excessive altitude.
8. Landing Gear - DOWN within gliding distance of field.
9. Wing Flaps - DOWN when landing is assured.
10. Speed - DECREASE below 94 KIAS only if landing is assured.
11. Air Minimum Control Speed - 79 KIAS.

## ENGINE INOPERATIVE GO-AROUND (Speed Above 98 KIAS)

1. Throttle - FULL FORWARD (38.0 Inches Hg.).
2. Wing Flaps - UP (If Extended).
3. Positive Rate-of-Climb - ESTABLISH.
4. Landing Gear - UP.
5. Cowl Flap - OPEN.
6. Climb at One Engine Inoperative Best Rate-of-Climb Speed - 108 KIAS.
7. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.

## AIRSTART

Airplane Without Optional Propeller Unfeathering System:

1. Auxiliary Fuel Pump - CHECK OFF. If ON or LOW, purge engine by turning OFF auxiliary fuel pump, mixture to IDLE CUT-OFF, throttle full open, magneto switches OFF, and rotating engine 15 revolutions with starter.
2. Magneto Switches - ON.
3. Fuel Selector - MAIN TANK (Feel For Detent).
4. Throttle - FORWARD approximately one and one-half inches.
5. Mixture - FULL RICH then retard approximately two inches.
6. Propeller - FORWARD of detent.
7. Starter Button - PRESS.
8. Primer Switch - ACTIVATE.
9. Starter and Primer Switch - RELEASE when engine fires.
10. Auxiliary Fuel Pump - LOW.
11. Mixture - ADJUST for smooth engine operation.
12. Power - INCREASE after cylinder head temperature reaches 200°F with gradual mixture enrichment as power increases.
13. Cowl Flap - AS REQUIRED.
14. Alternator - ON.

Airplane With Optional Propeller Unfeathering System:

1. Auxiliary Fuel Pump - CHECK OFF. If ON or LOW, purge engine by turning OFF auxiliary fuel pump, mixture to IDLE CUT-OFF, throttle full open, magneto switches OFF, and rotating engine 15 revolutions with starter.
2. Magneto Switches - ON.
3. Fuel Selector - MAIN TANK (Feel For Detent).
4. Throttle - FORWARD approximately one and one-half inches.
5. Mixture - FULL RICH then retard approximately two inches.
6. Propeller - FULL FORWARD.
7. Propeller - RETARD to detent when propeller reaches 1000 RPM.
8. Auxiliary Fuel Pump - LOW.
9. Mixture - ADJUST for smooth engine operation.
10. Power - INCREASE after cylinder head temperature reaches 200°F with gradual mixture enrichment as power increases.
11. Cowl Flap - AS REQUIRED.
12. Alternator - ON.

## BOTH ENGINES FAILURE DURING CRUISE FLIGHT

1. Wing Flaps - UP.
2. Landing Gear - UP.
3. Propellers - FEATHER.
4. Cowl Flaps - CLOSE.
5. Airspeed - 120 KIAS (See Figure 3-3).
6. Landing - Refer to FORCED LANDING (Complete Power Loss) in this section.

# FIRE PROCEDURES

## FIRE ON THE GROUND (Engine Start, Taxi And Takeoff With Sufficient Distance Remaining To Stop)

1. Throttles - CLOSE.
2. Brakes - AS REQUIRED.
3. Mixtures - IDLE CUT-OFF.
4. Battery - OFF (Use Gang Bar).
5. Magnetos - OFF (Use Gang Bar).
6. Evacuate airplane as soon as practical.

## FLIGHT WING OR ENGINE FIRE

1. Both Auxiliary Fuel Pumps - OFF.
2. Operative Engine Fuel Selector - MAIN TANK (Feel For Detent).
3. Emergency Crossfeed Shutoff - OFF (Pull Up).
4. Appropriate Engine - SECURE.
   a. Throttle - CLOSE.
   b. Propeller - FEATHER.
   c. Mixture - IDLE CUT-OFF.
   d. Fuel Selector - OFF (Feel For Detent).
   e. Magnetos - OFF.
   f. Propeller Synchrophaser (if installed) - OFF.
   g. Alternator - OFF.
   h. Cowl Flap - CLOSE.
5. Cabin Heater - OFF.
6. Land and evacuate airplane as soon as practical.

## INFLIGHT CABIN ELECTRICAL FIRE OR SMOKE

1. Electrical Load - REDUCE to minimum required.
2. Fuel Selectors - MAIN TANK (Feel For Detent).
3. Emergency Crossfeed Shutoff - OFF (Pull Up).
4. Attempt to isolate the source of fire or smoke.
5. Cabin Air Controls - OPEN all vents including windshield defrost. CLOSE if intensity of smoke increases.
6. Pressurization Air Contamination Procedure - INITIATE if required.
7. Land and evacuate airplane as soon as practical.

# EMERGENCY DESCENT PROCEDURES

## PREFERRED PROCEDURE

1. Throttles - IDLE.
2. Propellers - FULL FORWARD.
3. Mixtures - ADJUST for smooth engine operation.
4. Wing Flaps - UP.
5. Landing Gear - UP.
6. Moderate Bank - INITIATE.
7. Airspeed - 235 KIAS.

## IN TURBULENT ATMOSPHERIC CONDITIONS

1. Throttles - IDLE.
2. Propellers - FULL FORWARD.
3. Mixtures - ADJUST for smooth engine operation.
4. Wing Flaps - DOWN 45°.
5. Landing Gear - DOWN.
6. Moderate Bank - INITIATE.
7. Airspeed - 146 KIAS.

# EMERGENCY LANDING PROCEDURES

## FORCED LANDING (With Power)

1. Landing Site - CHECK. Overfly site at 105 KIAS and 15° wing flaps.
2. Landing Gear - DOWN if surface is smooth and hard.
   a. Normal Landing - INITIATE. Keep nosewheel off ground as long as practical.
3. Landing Gear - UP if surface is rough or soft.
   a. Approach - 105 KIAS with 15° wing flaps.
   b. Pressurization Air Controls - PULL.
   c. All Switches Except Magnetos - OFF.
   d. Mixtures - IDLE CUT-OFF.
   e. Magneto Switches - OFF.
   f. Fuel Selectors - OFF (Feel For Detent).
   g. Emergency Crossfeed Shutoff - OFF (Pull Up).
   h. Landing Attitude - NOSE HIGH.

## FORCED LANDING (Complete Power Loss)

1. Mixtures - IDLE CUT-OFF.
2. Propellers - FEATHER.
3. Fuel Selectors - OFF (Feel For Detent).
4. Emergency Crossfeed Shutoff - OFF (Pull Up).
5. All Switches Except Battery - OFF.
6. Approach - 120 KIAS.
7. If Smooth and Hard Surface:
   a. Landing Gear - DOWN within gliding distance of field.
      (1) Landing Gear Switch - DOWN.
      (2) GEAR HYD Circuit Breaker - PULL.
      (3) Emergency Gear Extension T-Handle - PULL.
      (4) Gear Down Lights - ON; Unlocked Light - OFF.
      (5) Gear Warning Horn - CHECK.
   b. Wing Flaps - AS REQUIRED.
   c. Approach - 105 KIAS.
   d. Battery Switch - OFF.
   e. Normal Landing - INITIATE. Keep nosewheel off ground as long as practical.
8. If Rough or Soft Surface:
   a. Landing Gear - UP.
   b. Wing Flaps - DOWN 15°.
   c. Approach - 105 KIAS.
   d. Battery Switch - OFF.
   e. Landing Attitude - NOSE HIGH.

## LANDING WITH FLAT MAIN GEAR TIRE

1. Landing Gear - Leave DOWN.
2. Fuel Selectors - SELECT main tank on same side as defective tire; feel for detent.
3. Fuel Selectors - MAIN TANKS (Feel For Detent) before landing.
4. Wind should be headwind or crosswind opposite the defective tire.
5. Wing Flaps - DOWN 45°.
6. In approach, align airplane with edge of runway opposite the defective tire, allowing room for a mild turn in the landing roll.
7. Land slightly wing low on the side of the inflated tire and lower the nosewheel to the ground immediately for positive steering.
8. Use full aileron in landing roll to lighten the load on the defective tire.
9. Apply brakes only on the inflated tire to minimize landing roll and maintain directional control.
10. Stop airplane to avoid further damage unless active runway must be cleared for other traffic.

## LANDING WITH DEFECTIVE MAIN GEAR

1. Fuel Selectors - SELECT main tank on the same side as defective gear; feel for detent.
2. Fuel Selectors - MAIN TANKS (Feel For Detent) before landing.
3. Emergency Crossfeed Shutoff - OFF (Pull Up).
4. Wind - HEADWIND or crosswind opposite defective gear.
5. Landing Gear - DOWN.
6. Wing Flaps - DOWN 45°.
7. Approach - ALIGN AIRPLANE with the edge of runway opposite the defective landing gear.
8. Battery Switch - OFF.
9. Land wing low toward operative landing gear. Lower nosewheel immediately for positive steering.
10. Ground Loop - INITIATE into defective landing gear.
11. Mixtures - IDLE CUT-OFF.
12. Use full aileron in landing roll to lighten the load on the defective gear.
13. Apply brakes only on the operative landing gear to hold desired rate of turn and shorten landing roll.
14. Fuel Selectors - OFF (Feel For Detent).
15. Airplane - EVACUATE.

## LANDING WITH FLAT NOSE GEAR TIRE

1. Landing Gear - Leave DOWN.
2. Passengers and Baggage - MOVE AFT.
3. Approach - 105 KIAS with 15° wing flaps.
4. Landing Attitude - NOSE HIGH.
5. Nose - HOLD OFF during landing roll.
6. Brakes - MINIMUM in landing roll.
7. Throttles - RETARD in landing roll.
8. Control Wheel - FULL AFT until airplane stops.
9. Minimize additional taxiing to prevent further damage.

## LANDING WITH DEFECTIVE NOSE GEAR

1. If Smooth and Hard Surface:
   a. Baggage and Passengers - MOVE AFT.
   b. Landing Gear - DOWN.
   c. Approach - 105 KIAS with 15° wing flaps.
   d. All Switches Except Magnetos - OFF.
   e. Landing Attitude - NOSE HIGH.
   f. Mixtures - IDLE CUT-OFF.
   g. Magneto Switches - OFF.
   h. Nose - LOWER as speed dissipates.
2. If Rough or Sod Surface:
   a. Landing Gear - UP.
   b. Approach - 105 KIAS with 15° wing flaps.
   c. All Switches Except Magnetos - OFF.
   d. Landing Attitude - NOSE HIGH.
   e. Mixtures - IDLE CUT-OFF.
   f. Magneto Switches - OFF.
   g. Fuel Selectors - OFF (Feel For Detent).
   h. Emergency Crossfeed Shutoff - OFF (Pull Up).

## LANDING WITHOUT FLAPS (0° Extension)

1. Mixtures - FULL RICH or lean as required for smooth operation.
2. Propellers - FULL FORWARD.
3. Fuel Selectors - MAIN TANKS (Feel For Detent).
4. Minimum Approach Speed - 107 KIAS (See Figure 5-25).
5. Landing Gear - DOWN.

## DITCHING

1. Landing Gear - UP.
2. Approach - HEADWIND if high winds.
   PARALLEL to SWELLS if light wind and heavy swells.
3. Wing Flaps - DOWN 45°.
4. Power - AS REQUIRED. (300 Feet Per Minute Descent).
5. Airspeed - 105 KIAS minimum.
6. Attitude - DESCENT ATTITUDE through touchdown.

# FUEL SYSTEM EMERGENCY PROCEDURES

## ENGINE-DRIVEN FUEL PUMP FAILURE

1. Fuel Selector - MAIN TANK (Feel For Detent).
2. Auxiliary Fuel Pump - ON.
3. Cowl Flap - AS REQUIRED.
4. Mixture - FULL RICH. Adjust fuel flow to coincide with power setting.
5. As Soon As Practical - LAND.
6. Crossfeed is unusable if the other engine is operating.

# ELECTRICAL SYSTEM EMERGENCY PROCEDURES

## ALTERNATOR FAILURE (Single)

1. Electrical Load - REDUCE.
2. If Circuit Breaker is tripped:
   a. Turn off affected alternator.
   b. Reset affected alternator circuit breaker.
   c. Turn on affected alternator switch.
   d. If circuit breaker reopens, turn off alternator.
3. If Circuit Breaker does not trip:
   a. Select affected alternator on voltammeter and monitor output.
   b. If output is normal and failure light remains on, disregard fail indication and have indicator checked after landing.
   c. If output is insufficient, turn off alternator and reduce electrical load to one alternator capacity.
   d. If complete loss of alternator output occurs, check field fuse and replace if necessary.
   e. If an intermittent light indication accompanied by voltammeter fluctuation is observed, turn off affected alternator and
   f. Restrict load on remaining alternator to 80% of rated load.

## ALTERNATOR FAILURE (Dual)

1. Electrical Load - REDUCE.
2. If Circuit Breakers are tripped:
   a. Turn off alternators.
   b. Reset circuit breakers.
   c. Turn on left alternator and monitor output on voltammeter.
   d. If alternator is charging, leave it on. Disregard failure light if still illuminated.
   e. If still inoperative, turn off left alternator.
   f. Repeat steps c through e for right alternator.
   g. If circuit breakers reopen, prepare to terminate flight.
3. If Circuit Breakers have not tripped:
   a. Turn off alternators.
   b. Check field fuses and replace as required.
   c. Turn on left alternator and monitor output on voltammeter.
   d. If alternator is charging, leave it on. Disregard failure light if still illuminated.
   e. If still inoperative, turn off left alternator.
   f. Repeat steps c through e for right alternator.
   g. If both still inoperative, turn off alternators and turn on emergency power alternator field switch.
   h. Repeat steps c through e for each alternator.
   i. If still inoperative, turn off alternators, nonessential electrical items and prepare to terminate flight.

# AVIONICS BUS FAILURE

1. Avionics Bus Switch - OFF.
2. Emergency Power Avionics Bus Switch - ON.

# LANDING GEAR EMERGENCY PROCEDURES

## HYD PRESS LIGHT ILLUMINATED AFTER GEAR CYCLE

1. Landing Gear Switch - RAPIDLY RECYCLE.
2. If HYD PRESS light still illuminated:
   a. Landing Gear - DOWN.
   b. GEAR HYD Circuit Breaker - PULL.
   c. If HYD PRESS light remains illuminated - LAND as soon as practical.

## LANDING GEAR DOWN AND LOCKED LIGHT ILLUMINATED WITH GEAR HANDLE UP AND HYD PRESS LIGHT OUT

1. Perform "LANDING GEAR WILL NOT EXTEND HYDRAULICALLY" Checklist.

## LANDING GEAR WILL NOT EXTEND HYDRAULICALLY

1. Airspeed - 130 KIAS or less.
2. Landing Gear Switch - DOWN.
3. GEAR HYD Circuit Breaker - PULL.
4. Emergency Gear Extension T-Handle - PULL.
5. Gear Down Lights - ON; Unlocked Light - OFF.
6. If Main Gear Does Not Lock Down - YAW AIRPLANE. Airloads will lock main gear down if up locks have released.
7. Gear Warning Horn - CHECK.
8. As Soon As Practical - LAND.

## LANDING GEAR WILL NOT RETRACT HYDRAULICALLY

1. Landing Gear Switch - DOWN.
2. Gear Down Lights - ON; Unlocked Light - OFF.
3. Gear Warning Horn - CHECK.
4. As Soon As Practical - LAND.

# FLIGHT INSTRUMENTS EMERGENCY PROCEDURES

## VACUUM PUMP FAILURE (Attitude And Directional Gyros)

1. Failure indicated by left or right red failure button exposed on vacuum gage.
2. Automatic valve will select operative source.
3. Vacuum Pressure - CHECK proper vacuum from operative source.

## OBSTRUCTION OR ICING OF STATIC SOURCE

1. Static Source - ALTERNATE.
2. Excess Altitude and Airspeed - MAINTAIN to compensate for change in calibration (See Figures 5-2 and 5-4).

# ENGINE INLET AIR SYSTEM ICING EMERGENCY PROCEDURES

## AIR INLET OR FILTER ICING

1. Alternate Air Control(s) - PULL OUT.
2. Propeller(s) - INCREASE (2550 RPM For Normal Cruise).
3. Mixture(s) - LEAN as required.
4. Pressurization Air Control(s) - PULL LH and/or RH as necessary.
   a. With Both Pressurization Air Sources Dumped:
      (1) Cabin Vent Control - PULL.
      (2) Cabin Pressurization Switch - DEPRESSURIZE.
   b. Above 10,000 Feet with both pressurization air sources dumped:
      (1) If Supplementary Oxygen is Not Available - EMERGENCY DESCENT TO 10,000 FEET.
      (2) If Supplementary Oxygen is Available:
         (a) Oxygen Knob - PULL ON.
         (b) Assure each occupant is using oxygen.
         (c) Descend as soon as practical to 10,000 Feet.

# PRESSURIZATION SYSTEM EMERGENCY PROCEDURES

## IMPENDING SKIN PANEL OR WINDOW FAILURE

1. Cabin Pressurization Switch - DEPRESSURIZE.
2. Cabin Vent Control - PULL.
3. Pressurization Air Controls - PULL.
4. If Above 10,000 Feet and Supplementary Oxygen is Not Available - EMERGENCY DESCENT TO 10,000 FEET.
5. If Above 10,000 Feet and Supplementary Oxygen is Available:
   a. Oxygen Knob - PULL ON.
   b. Assure each occupant is using oxygen.
   c. Descend as soon as practical to 10,000 Feet.

### CABIN OVERPRESSURE (Over 5.3 PSI)

1. Pressurization Air Controls - PULL.
2. If Above 10,000 Feet and Supplementary Oxygen is Not Available - EMERGENCY DESCENT TO 10,000 FEET.
3. If Above 10,000 Feet and Supplementary Oxygen is Available:
   a. Oxygen Knob - PULL ON.
   b. Assure each occupant is using oxygen.
   c. Descend as soon as practical to 10,000 Feet.

### LOSS OF PRESSURIZATION ABOVE 10,000 FEET

1. Without Supplementary Oxygen - EMERGENCY DESCENT TO 10,000 FEET.
2. With Supplementary Oxygen:
   a. Oxygen Knob - PULL ON.
   b. Assure each occupant is using oxygen.
   c. Descend as soon as practical to 10,000 Feet.

### PRESSURIZATION AIR CONTAMINATION

1. Pressurization Air Control(s) - PULL LH and/or RH as necessary.
   a. With Both Air Sources Dumped:
      (1) Cabin Vent Control - PULL.
      (2) Cabin Pressurization Switch - DEPRESSURIZE.
2. Above 10,000 Feet with Both Air Sources Dumped:
   a. If Supplementary Oxygen is Not Available - EMERGENCY DESCENT TO 10,000 FEET.
   b. If Supplementary Oxygen is Available:
      (1) Oxygen Knob - PULL ON.
      (2) Assure each occupant is using oxygen.
      (3) Descend as soon as practical to 10,000 Feet.

## PROPELLER SYNCHROPHASER

### ENGINE INOPERATIVE PROCEDURES

1. Propeller Synchrophaser (if installed) - OFF.

### SYNCHROPHASER FAILURE

1. Propeller Synchrophaser (if installed) - OFF.
2. Propeller Synchrophaser Circuit Breaker (if installed) - PULL.

## EMERGENCY EXIT WINDOW REMOVAL

1. Emergency Release Handle Plastic Cover - PULL OFF.
2. Side Table (If Installed) - PULL UP and INBOARD.
3. Release Handle - TURN COUNTERCLOCKWISE.
4. Emergency Exit Window - PULL IN and DOWN.

## SPINS

1. Throttles - CLOSE IMMEDIATELY.
2. Ailerons - NEUTRALIZE.
3. Rudder - HOLD FULL RUDDER opposite the direction of rotation.
4. Control Wheel - FORWARD BRISKLY, 1/2 turn after applying full rudder.
5. Inboard Engine - INCREASE POWER to slow rotation. (If Necessary).

After rotation has stopped:

6. Rudder - NEUTRALIZE.
7. Inboard Engine (If used) - DECREASE POWER to equalize engines.
8. Control Wheel - PULL to recover from resultant dive. Apply smooth steady control pressure.

# AMPLIFIED EMERGENCY PROCEDURES

NOTE

A complete knowledge of the procedures set forth in this section will enable the pilot to cope with various emergencies that can be encountered; however, this does not diminish the fact that the primary responsibility of the pilot is to maintain control at all times. Good judgment and precise action are essential and can only be developed through frequent practice of emergency and simulated single-engine procedures. The pilot must have a thorough knowledge of all emergency procedures so that in the event of an emergency, reaction will be precise and done with confidence. This is required so the pilot can cope with the demands of an emergency situation.

## ENGINE INOPERATIVE AIRSPEEDS FOR SAFE OPERATION

The most critical time for an engine failure condition in a multi-engine airplane is during a two or three second period late in the takeoff run while the airplane is accelerating to a safe engine failure speed. A detailed knowledge of recommended engine inoperative airspeeds is essential for safe operation of the airplane.

The airspeed indicator is marked with a red radial at the air minimum control speed and a blue radial at the one engine inoperative best rate-of-climb speed to facilitate instant recognition. The following paragraphs present a detailed discussion of the problems associated with engine failures during takeoff.

### AIR MINIMUM CONTROL SPEED

The multi-engine airplane must reach the air minimum control speed (79 KIAS) before full control deflections can counteract the adverse rolling and yawing tendencies associated with one engine inoperative and full power operation on the other engine. This speed is indicated by a red radial on the airspeed indicator.

### INTENTIONAL ONE ENGINE INOPERATIVE SPEED

Although the airplane is controllable at the air minimum control speed, the airplane performance is so far below optimum that continued flight near the ground is improbable. A more suitable intentional one engine inoperative speed is 98 KIAS. At this speed, altitude can be maintained more easily while the landing gear is being retracted and the propeller is being feathered.

### ONE ENGINE INOPERATIVE BEST ANGLE-OF-CLIMB SPEED

The one engine inoperative best angle-of-climb speed becomes important when there are obstacles ahead on takeoff. Once the one engine inoperative best angle-of-climb speed is reached, altitude becomes more important than airspeed until the obstacle is cleared. The one engine inoperative best angle-of-climb speed is approximately 100 KIAS with wing flaps and landing gear up.

## ONE ENGINE INOPERATIVE BEST RATE-OF-CLIMB SPEED

The one engine inoperative best rate-of-climb speed becomes important when there are no obstacles ahead on takeoff, or when it is difficult to maintain or gain altitude in single-engine emergencies. The one engine inoperative best rate-of-climb speed is 108 KIAS with wing flaps and landing gear up. This speed is indicated by a blue radial on the airspeed indicator.

The variations of wing flaps up one engine inoperative best rate-of-climb speed with altitude are shown in Section 5. For one engine inoperative best climb performance, the wings should be banked 5° toward the operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.

Procedures in the amplified portion of this section outlined in black [box] are immediate-action items and should be committed to memory.

# ENGINE INOPERATIVE PROCEDURES

## ENGINE SECURING PROCEDURE

1. Throttle - CLOSE.
2. Propeller - FEATHER.
3. Mixture - IDLE CUT-OFF.
4. Fuel Selector - OFF (Feel For Detent).
5. Auxiliary Fuel Pump - OFF.
6. Magneto Switches - OFF.
7. Propeller Synchrophaser (if installed) - OFF.
8. Alternator - OFF.
9. Cowl Flap - CLOSE.

## ENGINE FAILURE DURING TAKEOFF (Speed Below 98 KIAS Or Gear Down)

1. Throttles - CLOSE IMMEDIATELY.
2. Brake Or Land And Brake - AS REQUIRED.

**NOTE**

The distance required for the airplane to be accelerated from a standing start to 98 KIAS on the ground, and to decelerate to a stop with heavy braking, is presented in the Accelerate Stop Distance Chart in Section 5 for various combinations of conditions.

## ENGINE FAILURE AFTER TAKEOFF (Speed Above 98 KIAS With Gear Up Or In Transit)

1. Mixtures - FULL RICH.
2. Propellers - FULL FORWARD.
3. Throttles - FULL FORWARD (38.0 Inches Hg.).
4. Landing Gear - CHECK UP.
5. Inoperative Engine:
   a. Throttle - CLOSE.
   b. Propeller - FEATHER.
   c. Mixture - IDLE CUT-OFF.





6. Establish Bank - 5° toward operative engine.
7. Climb to Clear 50-Foot Obstacle - 98 KIAS.
8. Climb at One Engine Inoperative Best Rate-of-Climb Speed - 108 KIAS.
9. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.
10. Cowl Flap - CLOSE (Inoperative Engine).
11. Inoperative Engine - SECURE as follows:
    a. Fuel Selector - OFF (Feel For Detent).
    b. Auxiliary Fuel Pump - OFF.
    c. Magneto Switches - OFF.
    d. Alternator Switch - OFF.
12. As Soon As Practical - LAND.

Upon engine failure after reaching 98 KIAS on takeoff, the multi-engine pilot has a significant advantage over a single-engine pilot, for he has a choice of stopping or continuing the takeoff. This would be similar to the choice facing a single-engine pilot who has suddenly lost slightly more than half of his takeoff power. In this situation, the single-engine pilot would be extremely reluctant to continue the takeoff if he had to climb over obstructions. However, if the failure occurred at an altitude as high or higher than surrounding obstructions, he would feel free to maneuver for a landing back at the airport.

Fortunately, the airplane accelerates through this "area of decision" in just a few seconds. However, to make an intelligent decision in this type of emergency, one must consider the field length, obstruction height, field elevation, air temperature, headwind, and takeoff weight. The flight paths illustrated in Figure 3-2 indicate that the "go no-go area of decision" is bounded by: (1) the point at which 98 KIAS is reached and (2) the point where the obstruction altitude is reached. An engine failure in this area requires an immediate decision. Beyond this area, the airplane, within the limitations of single-engine climb performance shown in Section 5, may be maneuvered to a landing back at the airport.

## ENGINE FAILURE DURING TAKEOFF GO NO-GO DECISION

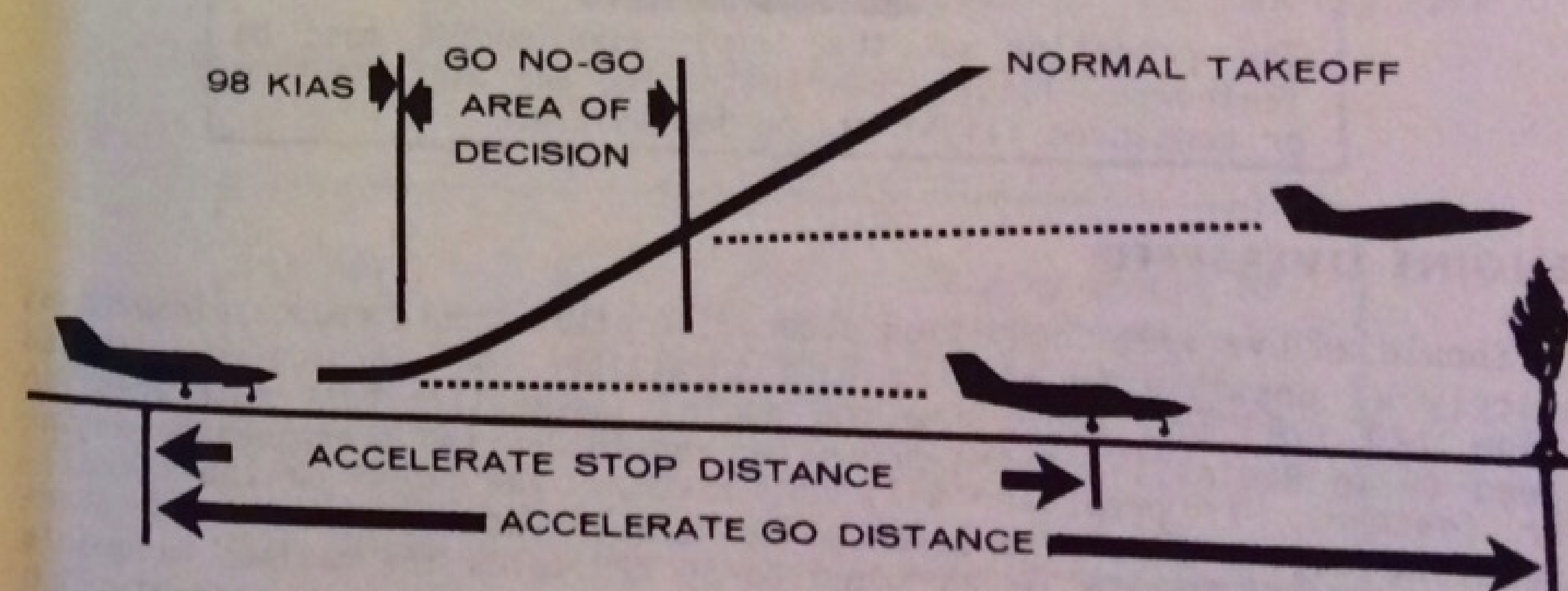



Figure 3-2

At sea level standard day, with zero wind and 6750 pounds weight, the distance to accelerate to 98 KIAS and stop is 4245 feet, while the total unobstructed distance required to takeoff and climb over a 50-foot obstacle after an engine failure at 98 KIAS is 3885 feet. This total distance over an obstacle can be reduced slightly under more favorable conditions of weight, headwind, or obstruction height. However, it is recommended that in most cases it would be better to discontinue the takeoff, since any slight mismanagement of single-engine procedure would more than offset the small distance advantage offered by continuing the takeoff. Still higher field elevations will cause the engine failure takeoff distance to lengthen disproportionately until the altitude is reached where a successful takeoff is improbable unless the airspeed and height above the runway at engine failure are great enough to allow a slight deceleration and altitude loss while the airplane is being prepared for an engine inoperative climb.

During engine inoperative takeoff procedures over an obstacle, only one condition presents any appreciable advantage; this is headwind. A decrease of approximately 6% in ground distance required to clear a 50-foot obstacle can be gained for each 10 knots of headwind. Excessive speed above one engine inoperative best rate-of-climb speed at engine failure is not nearly as advantageous as one might expect since deceleration is rapid and ground distance is used up quickly at higher speeds while the airplane is being cleaned up for climb. However, the extra speed is important for controllability.

The following facts should be used as a guide at the time of engine failure during takeoff: (1) discontinuing a takeoff upon engine failure is advisable under most circumstances; (2) altitude is more valuable to safety after takeoff than is airspeed in excess of the one engine inoperative best rate-of-climb speed since excess airspeed is lost much more rapidly than is altitude; (3) climb or continued level flight at moderate altitude is improbable with the landing gear extended and the propeller windmilling; (4) in no case should the airspeed be allowed to fall below the intentional one engine inoperative speed, even though altitude is lost, since this speed will always provide a better chance of climb, or a smaller altitude loss, than any lesser speed; and (5) if the requirement for an immediate climb is not present, allow the airplane to accelerate to the one engine inoperative best rate-of-climb speed as this is the optimum climb speed and will always provide the best chance of climb or least altitude loss.

**WARNING**

The propeller on the inoperative engine must be feathered, landing gear retracted and wing flaps up or continued flight may be impossible.

## ENGINE OVERSPEED

Should an overspeed condition occur, the pilot should reduce airspeed as quickly as possible by closing both throttles. On reaching an airspeed below 120 KIAS and above the one engine inoperative best rate-of-climb speed (Blue Radial), set the propeller control on the overspeeding engine for feather. If propeller will not feather, the power on the normally operating engine should be advanced to maximum and the power on the overspeeding engine should be advanced to 50 RPM below the maximum allowable RPM (Red Line). Maintain the one engine inoperative best rate-of-climb speed (Blue Radial) and land as soon as practical. This will provide more than zero thrust at altitudes up to approximately 10,000 feet. During landing, the application of partial throttle on the malfunctioning engine (within limits of the tachometer red line) will minimize asymmetrical thrust.





## ENGINE FAILURE DURING FLIGHT (Speed Above Air Minimum Control Speed)

1. Inoperative Engine - DETERMINE. Idle engine same side as idle foot.
2. Operative Engine - ADJUST as required.

Before Securing Inoperative Engine:

3. Fuel Flow - CHECK. If deficient, position auxiliary fuel pump switch to ON.
4. Fuel Selectors - MAIN TANKS (Feel For Detent).
5. Fuel Quantity - CHECK. Switch to opposite MAIN TANK if necessary.
6. Oil Pressure and Oil Temperature - CHECK. Shutdown engine if oil pressure is low.
7. Magneto Switches - CHECK ON.
8. Mixture - ADJUST. Lean until manifold pressure begins to increase, then enrichen as power increases.

If Engine Does Not Start, Secure As Follows:

9. Inoperative Engine - SECURE.
   a. Throttle - CLOSE.
   b. Mixture - IDLE CUT-OFF.
   c. Propeller - FEATHER.
   d. Fuel Selector - OFF (Feel For Detent).
   e. Auxiliary Fuel Pump - OFF.
   f. Magneto Switches - OFF.
   g. Propeller Synchrophaser (if installed) - OFF.
   h. Alternator Switch - OFF.
   i. Cowl Flap - CLOSE.
10. Operative Engine - ADJUST.
    a. Power - AS REQUIRED.
    b. Mixture - ADJUST for power.
    c. Fuel Selector - AS REQUIRED (Feel For Detent).
    d. Auxiliary Fuel Pump - ON.
    e. Cowl Flap - AS REQUIRED.
11. Trim Tabs - ADJUST $5^{\circ}$ bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.
12. Electrical Load - DECREASE to minimum required.
13. As Soon As Practical - LAND.

**NOTE**

Schedule fuel use such that an adequate amount of fuel is available in the operative engine main tank for landing. Crossfeed as required to maintain lateral balance within 120 pounds per side. When crossfeeding, maintain level flight, maintain altitude greater than 1000 feet AGL and position inoperative engine auxiliary fuel pump to LOW.

## ENGINE FAILURE DURING FLIGHT (Speed Below Air Minimum Control Speed)

1. Rudder - APPLY towards operative engine.
2. Power - REDUCE to stop turn.
3. Pitch Attitude - LOWER NOSE to accelerate above air minimum control speed.
4. Inoperative Engine Propeller - FEATHER.
5. Operative Engine - INCREASE POWER as airspeed increases above air minimum control speed.
6. Inoperative Engine - SECURE.
7. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.
8. Operative Engine Cowl Flap - AS REQUIRED.

## ENGINE INOPERATIVE LANDING

1. Fuel Selector - MAIN TANK (Feel For Detent).
2. Auxiliary Fuel Pump - ON (Operative Engine).
3. Alternate Air Control - IN.
4. Mixture - FULL RICH or lean as required for smooth operation.
5. Propeller Synchrophaser (if installed) - OFF.
6. Propeller - FULL FORWARD.
7. Approach at 108 KIAS with excessive altitude.
8. Landing Gear - DOWN within gliding distance of field.
9. Wing Flaps - DOWN when landing is assured.
10. Decrease speed below 94 KIAS only if landing is assured.
11. Air Minimum Control Speed - 79 KIAS.

## ENGINE INOPERATIVE GO-AROUND (Speed Above 98 KIAS)

**WARNING**

Level flight may not be possible for certain combinations of weight, temperature and altitude. In any event, do not attempt an engine inoperative go-around after wing flaps have been extended beyond 15°.

1. If absolutely necessary and speed is above 98 KIAS, increase engine speed to 2700 RPM and apply full throttle.
2. Wing Flaps - UP (If Extended).
3. Positive Rate-of-Climb - ESTABLISH.
4. Landing Gear - UP.
5. Cowl Flap - OPEN.
6. Climb at 108 KIAS (99 KIAS With Obstacles Directly Ahead).
7. Trim Tabs - ADJUST 5° bank toward operative engine with approximately 1/2 ball slip indicated on the turn and bank indicator.

## AIRSTART (After Feathering)

Airplane Without Optional Propeller Unfeathering System:

1. Auxiliary Fuel Pump - CHECK OFF. If ON or LOW, purge engine by turning OFF auxiliary fuel pump, mixture to IDLE CUT-OFF, throttle full open, magneto switches OFF, and rotating engine 15 revolutions with starter.





2. Magneto Switches - ON.
3. Fuel Selector - MAIN TANK (Feel For Detent).
4. Throttle - FORWARD approximately one and one-half inches.
5. Mixture - FULL RICH then retard approximately two inches.
6. Propeller - FORWARD of detent.
7. Starter Button - PRESS.
8. Primer Switch - ACTIVATE.
9. Starter and Primer Switch - RELEASE when engine fires.
10. Auxiliary Fuel Pump - LOW.
11. Mixture - ADJUST for smooth engine operation.
12. Power - INCREASE after cylinder head temperature reaches 200°F with gradual mixture enrichment as power increases.
13. Cowl Flap - AS REQUIRED.
14. Alternator - ON.

Airplane With Optional Propeller Unfeathering System:

1. Auxiliary Fuel Pump - CHECK OFF. If ON or LOW, purge engine by turning OFF auxiliary fuel pump, mixture to IDLE CUT-OFF, throttle full open, magneto switches OFF, and rotating engine 15 revolutions with starter.
2. Magneto Switches - ON.
3. Fuel Selector - MAIN TANK (Feel For Detent).
4. Throttle - FORWARD approximately one and one-half inches.
5. Mixture - FULL RICH then retard approximately two inches.
6. Propeller - FULL FORWARD.

**NOTE**

The propeller will automatically windmill when the propeller lever is moved out of the FEATHER position.

7. Propeller - RETARD to detent when propeller reaches 1000 RPM.
8. Auxiliary Fuel Pump - LOW.
9. Mixture - ADJUST for smooth engine operation.
10. Power - INCREASE after cylinder head temperature reaches 200°F with gradual mixture enrichment as power increases.
11. Cowl Flap - AS REQUIRED.
12. Alternator - ON.

## BOTH ENGINES FAILURE DURING CRUISE FLIGHT

1. Wing Flaps - UP.
2. Landing Gear - UP.
3. Propellers - FEATHER.
4. Cowl Flaps - CLOSE.
5. Airspeed - 120 KIAS (See Figure 3-3).

**NOTE**

Vacuum instruments will be inoperative. Electrical power available will be limited to the amount of energy contained in the battery.

6. Landing - Refer to FORCED LANDING (Complete Power Loss) in this section.

## MAXIMUM GLIDE

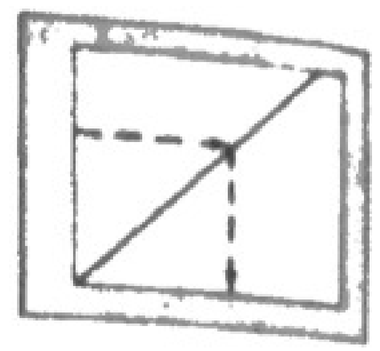
In the event of an all engines failure condition, maximum gliding distance can be obtained by feathering both propellers, and maintaining approximately 120 KIAS with landing gear and wing flaps up. The speed which provides the "absolute maximum" glide distance varies with weight as shown in Figure 3-3.

### MAXIMUM GLIDE

CONDITIONS:
1. Landing Gear - UP.
2. Wing Flaps - UP.
3. Propellers - FEATHERED.
4. Cowl Flaps - CLOSED.
5. Best Glide Speed.
6. Zero Wind.

BEST GLIDE SPEED

| WEIGHT POUNDS | KIAS |
|---|---|
| 6750 | 120 |
| 6200 | 115 |
| 5700 | 110 |
| 5200 | 105 |



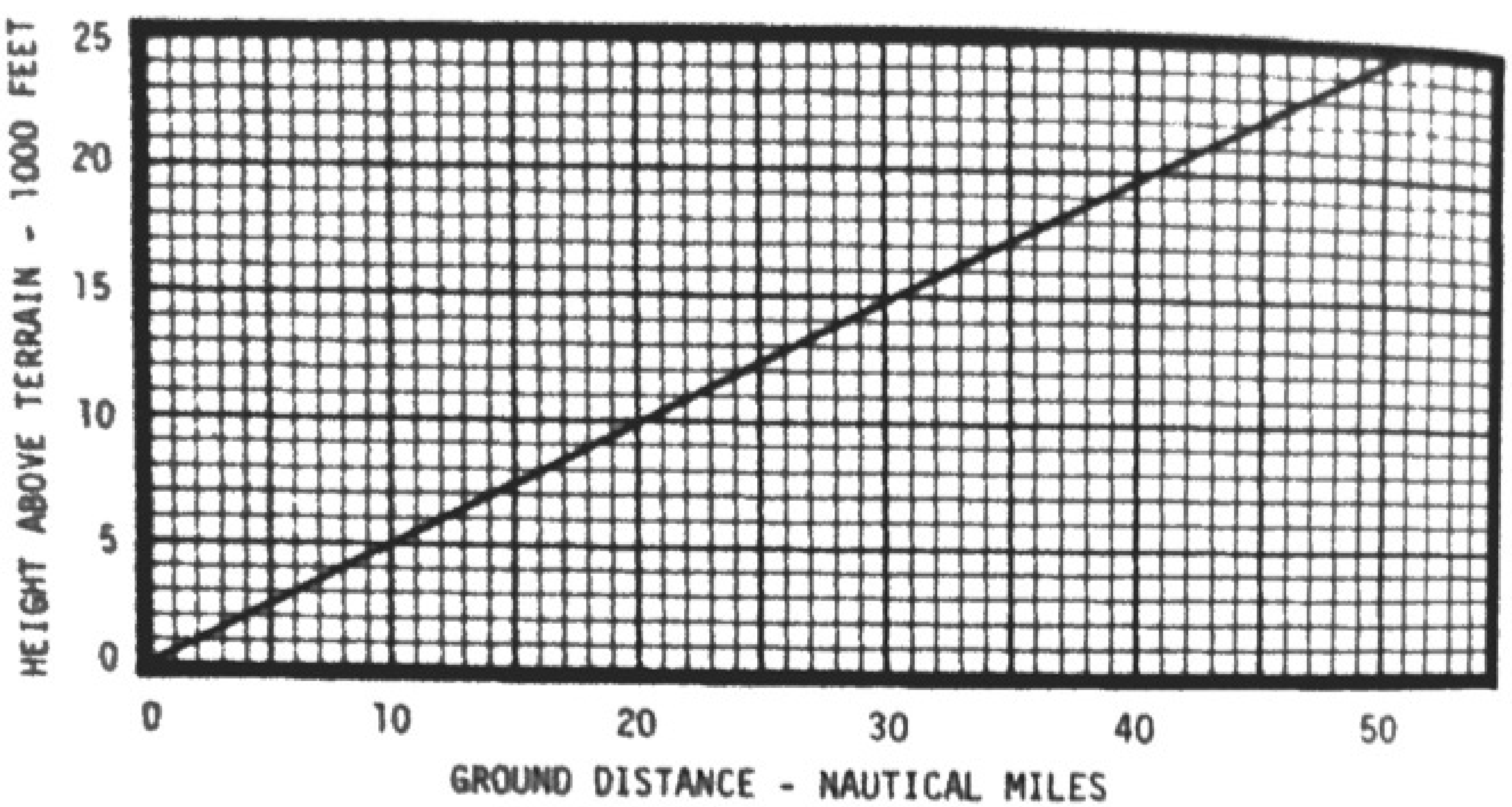



Figure 3-3

## FIRE PROCEDURES

Refer to Section 9 if Fire Detection and Extinguishing System is installed.

### FIRE ON THE GROUND (Engine Start, Taxi And Takeoff With Sufficient Distance Remaining To Stop)

1. Throttles - CLOSE.
2. Brakes - AS REQUIRED.
3. Mixtures - IDLE CUT-OFF.
4. Battery - OFF (Use Gang Bar).
5. Magnetos - OFF (Use Gang Bar).
6. Evacuate airplane as soon as practical.





### INFLIGHT WING OR ENGINE FIRE

1. Both Auxiliary Fuel Pumps - OFF.
2. Operative Engine Fuel Selector - MAIN TANK (Feel For Detent).
3. Emergency Crossfeed Shutoff - OFF (Pull Up).
4. Appropriate Engine - SECURE.
   a. Throttle - CLOSE.
   b. Propeller - FEATHER.
   c. Mixture - IDLE CUT-OFF.
   d. Fuel Selector - OFF (Feel For Detent).
   e. Magnetos - OFF.
   f. Propeller Synchrophaser (if installed) - OFF.
   g. Alternator - OFF.
   h. Cowl Flap - CLOSE.
5. Cabin Heater - OFF.
6. Land and evacuate airplane as soon as practical.

### INFLIGHT CABIN ELECTRICAL FIRE OR SMOKE

1. Electrical Load - REDUCE to minimum required.
2. Fuel Selectors - MAIN TANK (Feel For Detent).
3. Emergency Crossfeed Shutoff - OFF (Pull Up).
4. Attempt to isolate the source of fire or smoke.
5. Cabin Air Controls - OPEN all vents including windshield defrost. CLOSE if intensity of smoke increases.
6. Pressurization Air Contamination Procedure - INITIATE if required.

**CAUTION**

Opening the foul weather windows or emergency exit window will create a draft in the cabin and may intensify a fire.

7. Land and evacuate airplane as soon as practical.

### SUPPLEMENTARY INFORMATION CONCERNING AIRPLANE FIRES

With the use of modern installation techniques and material, the probability of an airplane fire occurring in your airplane is extremely remote. However, in the event a fire is encountered, the following information will be helpful in dealing with the emergency as quickly and safely as possible.

The preflight checklist is provided to aid the pilot in detecting conditions which could contribute to an airplane fire. As a fire requires both fuel and an ignition source, close preflight inspection should be given to the engine compartment and wing leading edge and lower surfaces. Leaks in the fuel system, oil system, or exhaust system can lead to a ground or inflight fire.

**NOTE**

Flight should not be attempted with known fuel, oil or exhaust leaks. The presence of fuel, unusual oil or exhaust stains may be an indication of system leaks and should be corrected prior to flight.

If an airplane fire is discovered on the ground or during takeoff, but prior to committed flight, the airplane is to be landed and/or stopped and the passengers and crew evacuated as soon as practical.

Fires originating inflight must be controlled as quickly as possible in an attempt to prevent major structural damage. Both auxiliary fuel pumps should be turned off and the emergency crossfeed shutoff pulled up to reduce pressure on the total fuel system (each auxiliary pump pressurizes a crossfeed line to the opposite fuel selector). The engine on the wing in which the fire exists should be shut down and its fuel selector positioned to OFF even though the fire may not have originated in the fuel system. The cabin heater draws fuel from the crossfeed system and should also be turned off. Descent for landing should be initiated immediately.

An open emergency exit or foul weather window produces a low pressure in the cabin. To avoid drawing the fire into the cabin, the emergency exit and foul weather window should be kept closed. This condition is aggravated with the landing gear and flaps extended. Therefore, the pilot should lower the gear as late in the landing approach as possible. A no-flap landing should also be attempted if practical.

A fire or smoke in the cabin should be controlled by identifying and shutting down the faulty system. Smoke may be removed by opening the cabin air controls. If the smoke increases in intensity when the air controls are opened, they should be closed as this indicates a possible fire in the heater or nose compartment. Normally the pressurization air system will remove smoke from the cabin; however, if the smoke is intense, it may be necessary to initiate the pressurization air contamination procedure presented in this section. When the smoke is intense, the pilot may choose to expel the smoke through the foul weather windows. The foul weather windows should be closed immediately if the fire becomes more intense when the windows are opened.

# EMERGENCY DESCENT PROCEDURES

## PREFERRED PROCEDURE

1. Throttles - IDLE.
2. Propellers - FULL FORWARD.
3. Mixtures - ADJUST for smooth engine operation.
4. Wing Flaps - UP.
5. Landing Gear - UP.
6. Moderate Bank - INITIATE until descent attitude has been established.
7. Airspeed - 235 KIAS.

## IN TURBULENT ATMOSPHERIC CONDITIONS

1. Throttles - IDLE.
2. Propellers - FULL FORWARD.
3. Mixtures - ADJUST for smooth engine operation.
4. Wing Flaps - DOWN 45°.
5. Landing Gear - DOWN.
6. Moderate Bank - INITIATE until descent attitude has been established.
7. Airspeed - 146 KIAS.





# EMERGENCY LANDING PROCEDURES

## FORCED LANDING (With Power)

1. Drag over selected field with 15° wing flaps and 105 KIAS noting type of terrain and obstructions.
2. Plan a wheels-down landing if surface is smooth and hard.
   a. Execute a normal landing, keeping nosewheel off ground until speed is decreased.
3. If terrain is rough or soft, plan a wheels-up landing as follows:
   a. Approach at 105 KIAS with 15° wing flaps.
   b. Pressurization Air Controls - PULL.
   c. All Switches Except Magneto Switches - OFF.
   d. Mixtures - IDLE CUT-OFF.
   e. Magneto Switches - OFF.
   f. Fuel Selectors - OFF (Feel For Detent).
   g. Emergency Crossfeed Shutoff - OFF (Pull Up).
   h. Land in a slightly nose-high attitude.

**NOTE**

On smooth sod with landing gear retracted, the airplane will slide straight ahead about 800 feet with very little damage.

## FORCED LANDING (Complete Power Loss)

1. Mixtures - IDLE CUT-OFF.
2. Propellers - FEATHER.
3. Fuel Selectors - OFF (Feel For Detent).
4. Emergency Crossfeed Shutoff - OFF (Pull Up).
5. All Switches Except Battery Switch - OFF.
6. Approach - 120 KIAS.
7. If field is smooth and hard, plan a landing as follows:
   a. Landing Gear - DOWN within gliding distance of field.
      (1) Landing Gear Switch - DOWN.
      (2) GEAR HYD Circuit Breaker - PULL.
      (3) Emergency Gear Extension T-Handle - PULL.
      (4) Gear Down Lights - ON; Unlocked Light - OFF.
      (5) Gear Warning Horn - CHECK.
   b. Wing Flaps - EXTEND as necessary within gliding distance of field.
   c. Approach - 105 KIAS.
   d. Battery Switch - OFF.
   e. Make a normal landing, keeping nosewheel off the ground as long as practical.
8. If field is rough or soft, plan a wheels-up landing as follows:
   a. Landing Gear - UP.
   b. Approach at 105 KIAS with 15° wing flaps.
   c. Battery Switch - OFF.

d. Land in a slightly nose-high attitude.

NOTE

On smooth sod with landing gear retracted, the airplane will slide straight ahead about 800 feet with very little damage.

## LANDING WITH FLAT MAIN GEAR TIRE

If a blowout occurs during takeoff, proceed as follows:

1. Landing Gear - Leave DOWN.

NOTE

Do not attempt to retract the landing gear if a main gear tire blowout occurs. The main gear tire may be distorted enough to bind the main gear strut within the wheel well and prevent later extension.

2. Fuel Selectors - Turn to main tank on same side as defective tire and feel for detent.

NOTE

Fuel should be used from this tank first, to lighten the load on the wing, prior to attempting a landing if inflight time permits. However, an adequate supply of fuel should be left in this tank so that it may be used during landing.

3. Fuel Selectors - Left Engine - LEFT MAIN (Feel For Detent). Right Engine - RIGHT MAIN (Feel For Detent).
4. Select a runway with a crosswind from the side opposite the defective tire, if a crosswind landing is required.
5. Wing Flaps - DOWN 45°.
6. In approach, align airplane with edge of runway opposite the defective tire, allowing room for a mild turn in the landing roll.
7. Land slightly wing-low on the side of inflated tire and lower nosewheel to ground immediately for positive steering.
8. Use full aileron in landing roll to lighten load on defective tire.
9. Apply brakes only on the inflated tire to minimize landing roll and maintain directional control.
10. Stop airplane to avoid further damage unless active runway must be cleared for other traffic.





## LANDING WITH DEFECTIVE MAIN GEAR

1. Fuel Selectors - Turn to main tank on same side as defective gear and feel for detent. Proceed to destination to reduce fuel load.

NOTE

Fuel should be used from this tank first, to lighten the load on the wing, prior to attempting a landing if in-flight time permits. However, an adequate supply of fuel should be left in this tank so that it may be used during landing.

2. Fuel Selectors - Left Engine - LEFT MAIN (Feel For Detent). Right Engine - RIGHT MAIN (Feel For Detent).
3. Emergency Crossfeed Shutoff - OFF (Pull Up).
4. Select a wide, hard surface runway, or if necessary, a wide sod runway. Select a runway with crosswind from the side opposite the defective landing gear, if a crosswind landing is necessary.
5. Landing Gear - DOWN.
6. Wing Flaps - DOWN 45°.
7. In approach, align airplane with edge of runway opposite the defective landing gear, allowing room for a ground-loop in landing roll.
8. Battery Switch - OFF.
9. Land slightly wing-low toward the operative landing gear and lower the nosewheel immediately for positive steering.
10. Start moderate ground-loop into defective landing gear until airplane stops.
11. Mixtures - IDLE CUT-OFF.
12. Use full aileron in landing roll to lighten the load on the defective landing gear.
13. Apply brakes only on the operative landing gear to maintain desired rate of turn and minimize the landing roll.
14. Fuel Selectors - OFF (Feel For Detent).
15. Evacuate the airplane as soon as it stops.

## LANDING WITH FLAT NOSE GEAR TIRE

If a blowout occurred on the nose gear tire during takeoff, proceed as follows:

1. Landing Gear - Leave DOWN.

NOTE

Do not attempt to retract the landing gear if a nose gear tire blowout occurs. The nose gear tire may be distorted enough to bind the nosewheel strut within the wheel well and prevent later extension.

2. Move disposable load to baggage area and passengers to available rear seat space. Do not exceed aft flight center of gravity limits.
3. Approach at 105 KIAS with 15° wing flaps.
4. Land in a nose-high attitude with or without power.

5. Maintain back pressure on control wheel to hold nosewheel off the ground in landing roll.
6. Use minimum braking in landing roll.
7. Throttles - RETARD in landing roll.
8. As landing roll speed diminishes, hold control wheel fully aft until airplane is stopped.
9. Avoid further damage by holding additional taxi to a minimum.

## LANDING WITH DEFECTIVE NOSE GEAR

1. If Smooth and Hard Surface:
   a. Move disposable load to baggage area and passengers to available rear seat space. Do not exceed aft flight center of gravity limits.
   b. Landing Gear - DOWN.
   c. Approach at 105 KIAS with 15° wing flaps.
   d. All Switches Except Magneto Switches - OFF.
   e. Land in a slightly nose-high attitude.
   f. Mixtures - IDLE CUT-OFF.
   g. Magneto Switches - OFF.
   h. Hold nose off throughout ground roll. Lower gently as speed dissipates.
2. If Rough or Sod Surface:

> NOTE
>
> This procedure will produce a minimum amount of airplane damage on smooth runways. This procedure is also recommended for short, rough or uncertain field conditions where passenger safety, rather than minimum airplane damage is the prime consideration.

   a. Landing Gear - UP.
   b. Approach at 105 KIAS with 15° wing flaps.
   c. All Switches Except Magneto Switches - OFF.
   d. Land in a slightly nose-high attitude.
   e. Mixtures - IDLE CUT-OFF.
   f. Magneto Switches - OFF.
   g. Fuel Selectors - OFF (Feel For Detent).
   h. Emergency Crossfeed Shutoff - OFF (Pull Up).

## LANDING WITHOUT FLAPS (0° Extension)

1. Mixtures - FULL RICH or lean as required for smooth operation.
2. Propellers - FULL FORWARD.
3. Fuel Selectors - MAIN TANKS (Feel For Detent).
4. Minimum Approach Speed - 107 KIAS (See Figure 5-25).
5. Landing Gear - DOWN.





## DITCHING

1. Landing Gear - UP.
2. Plan approach into wind if winds are high and seas are heavy. With heavy swells and light wind, land parallel to swells, being careful not to allow wing tips to hit first.
3. Wing Flaps - DOWN 45°.
4. Carry sufficient power to maintain approximately 300 feet per minute rate-of-descent.
5. Airspeed - 105 KIAS at 5800 pounds weight. Reduce airplane weight by fuel burn-off as much as practical.
6. Maintain a continuous descent until touchdown to avoid flaring and touching down tail-first, pitching forward sharply, and decelerating rapidly. Strive for initial contact at fuselage area below rear cabin section (point of maximum longitudinal curvature of fuselage).

> NOTE
>
> The airplane has not been flight tested in actual ditchings, thus the above recommended procedure is based entirely on the best judgment of Cessna Aircraft Company.

# FUEL SYSTEM EMERGENCY PROCEDURES

## ENGINE-DRIVEN FUEL PUMP FAILURE

1. Fuel Selector - MAIN TANK (Feel For Detent).
2. Auxiliary Fuel Pump - ON.
3. Cowl Flap - AS REQUIRED.
4. Mixture - FULL RICH. Adjust fuel flow to coincide with power setting.
5. As Soon as Practical - LAND.
6. Crossfeed is unusable if other engine is operating.

> NOTE
>
> If both an engine-driven fuel pump and an auxiliary fuel pump fail on the same side of the airplane, the failing engine cannot be supplied with fuel from the opposite main tank since that auxiliary fuel pump will operate on the low pressure setting as long as the corresponding engine-driven fuel pump is operative.

# ELECTRICAL SYSTEM EMERGENCY PROCEDURES

## ALTERNATOR FAILURE (Single)

### Indicated By Illumination Of Failure Light

1. Electrical Load - REDUCE.
2. If Circuit Breaker is tripped:
   a. Turn off affected alternator.
   b. Reset affected alternator circuit breaker.
   c. Turn on affected alternator switch.
   d. If circuit breaker reopens, turn off alternator.
3. If Circuit Breaker does not trip:
   a. Select affected alternator on voltammeter and monitor output.
   b. If output is normal and failure light remains on, disregard fail indication and have indicator checked after landing.
   c. If output is insufficient, turn off alternator and reduce electrical load to one alternator capacity.
   d. If complete loss of alternator output occurs, check field fuse and replace if necessary. Spare fuses are located on the left side of the console forward of the field fuses.
   e. If an intermittent light indication accompanied by voltammeter fluctuation is observed, turn off affected alternator and reduce load to one alternator capacity.
   f. Restrict load on remaining alternator to 80% of the rated load.

## ALTERNATOR FAILURE (Dual)

### Indicated By Illumination Of Failure Lights

1. Electrical Load - REDUCE.
2. If Circuit Breakers are tripped:
   a. Turn off alternators.
   b. Reset circuit breakers.
   c. Turn on left alternator and monitor output on voltammeter.
   d. If alternator is charging, leave it on. Disregard failure light if still illuminated.
   e. If still inoperative, turn off left alternator.
   f. Repeat steps c through e for right alternator.
   g. If circuit breakers reopen, prepare to terminate flight.
3. If Circuit Breakers have not tripped:
   a. Turn off alternators.
   b. Check field fuses and replace if necessary. Spare fuses are located on the left side of the console forward of the field fuses.
   c. Turn on left alternator and monitor output on voltammeter.
   d. If alternator is charging, leave it on. Disregard failure light if still illuminated.
   e. If still inoperative, turn off left alternator.
   f. Repeat steps c through e for right alternator.
   g. If both alternators are still inoperative, turn off alternators and turn on emergency power alternator field switch.
   h. Repeat steps c through e for each alternator.
   i. If still inoperative, turn off alternator, nonessential electrical items and prepare to terminate flight.

# AVIONICS BUS FAILURE

1. Avionics Bus Switch - OFF.
2. Emergency Power Avionics Bus Switch - ON.





# LANDING GEAR EMERGENCY PROCEDURES

## HYD PRESS LIGHT ILLUMINATED AFTER GEAR CYCLE

1. Landing Gear Switch - RAPIDLY RECYCLE.
2. If HYD PRESS light still illuminated:
   a. Landing Gear - DOWN.
   b. GEAR HYD Circuit Breaker - PULL.
   c. If HYD PRESS light remains illuminated - LAND as soon as practical.

> NOTE
>
> Insure the GEAR HYD circuit breaker is reset before further extension or retraction of the landing gear is attempted.

## LANDING GEAR DOWN AND LOCKED LIGHT ILLUMINATED WITH GEAR HANDLE UP AND HYD PRESS LIGHT OUT

1. Perform "LANDING GEAR WILL NOT EXTEND HYDRAULICALLY" Checklist.

> NOTE
>
> Failure of any one of the three down lock switches in the down position may result in that gear not locking down during a gear down cycle if the other two gears lock down first. The down and locked light for the affected gear may remain on continually regardless of actual gear position.

## LANDING GEAR WILL NOT EXTEND HYDRAULICALLY

1. Airspeed - 130 KIAS or less.

> NOTE
>
> As low an airspeed as practical is recommended as a lower airspeed will decrease the airloads on the nose gear during extension, thereby insuring the greatest probability of gear extension.

2. Landing Gear Switch - DOWN.
3. GEAR HYD Circuit Breaker - PULL.
4. Emergency Gear Extension T-Handle - PULL.
5. Gear Down Lights - ON; Unlocked Light - OFF.
6. If Main Gear Does Not Lock Down - YAW AIRPLANE. Airloads will lock main gear down if up locks have released.

7. Gear Warning Horn - CHECK.
8. As Soon As Practical - LAND.

**CAUTION**

The landing gear cannot be retracted inflight, once the emergency gear extension T-handle has been pulled. Ground servicing is required.

### LANDING GEAR WILL NOT RETRACT HYDRAULICALLY

1. Landing Gear Switch - DOWN.
2. Gear Down Lights - ON; Unlocked Light - OFF.
3. Gear Warning Horn - CHECK.
4. As Soon as Practical - LAND.

## FLIGHT INSTRUMENTS EMERGENCY PROCEDURES

### VACUUM PUMP FAILURE (Attitude And Directional Gyros)

1. Failure indicated by left or right red failure button exposed on vacuum gage.
2. Automatic valve will select operative source.
3. Vacuum Pressure - CHECK proper vacuum from operative source.

### OBSTRUCTION OR ICING OF STATIC SOURCE

1. Static Source - ALTERNATE. Alternate static source is for pilot's instruments only when dual static system is installed.
2. Excess Altitude and Airspeed - MAINTAIN to compensate for change in calibration.

NOTE

See Figures 5-2 and 5-4 for airspeed and altimeter corrections with static source to ALTERNATE.

## ENGINE INLET AIR SYSTEM ICING EMERGENCY PROCEDURES

### AIR INLET OR FILTER ICING

1. Alternate Air Control(s) - PULL OUT.
2. Propeller(s) - INCREASE (2550 RPM For Normal Cruise).
3. Mixture(s) - LEAN as required.
4. Pressurization Air Control(s) - PULL LH and/or RH as necessary.
   a. With Both Pressurization Air Sources Dumped:
      (1) Cabin Vent Control - PULL.
      (2) Cabin Pressurization Switch - DEPRESSURIZE.





   b. Above 10,000 Ft. with both pressurization air sources dumped:
      (1) If Supplementary Oxygen is Not Available - EMERGENCY DESCENT TO 10,000 FEET.
      (2) If Supplementary Oxygen is Available:
         (a) Oxygen Knob - PULL ON.
         (b) Assure each occupant is using oxygen.
         (c) Descend as soon as practical to 10,000 Feet.

## PRESSURIZATION SYSTEM EMERGENCY PROCEDURES

### IMPENDING SKIN PANEL OR WINDOW FAILURE

1. Cabin Pressurization Switch - DEPRESSURIZE.
2. Cabin Vent Control - PULL.
3. Pressurization Air Controls - PULL.
4. If Above 10,000 Feet and Supplementary Oxygen is Not Available - EMERGENCY DESCENT TO 10,000 FEET.
5. If Above 10,000 Feet and Supplementary Oxygen is Available:
   a. Oxygen Knob - PULL ON.
   b. Assure each occupant is using oxygen.
   c. Descend as soon as practical to 10,000 Feet.

### CABIN OVERPRESSURE (Over 5.3 PSI)

1. Pressurization Air Controls - PULL.
2. If Above 10,000 Feet and Supplementary Oxygen is Not Available - EMERGENCY DESCENT TO 10,000 FEET.
3. If Above 10,000 Feet and Supplementary Oxygen is Available:
   a. Oxygen Knob - PULL ON.
   b. Assure each occupant is using oxygen.
   c. Descend as soon as practical to 10,000 Feet.

### LOSS OF PRESSURIZATION ABOVE 10,000 FEET

1. Without Supplementary Oxygen - EMERGENCY DESCENT TO 10,000 FEET.
2. With Supplementary Oxygen:
   a. Oxygen Knob - PULL ON.
   b. Assure each occupant is using oxygen.
   c. Descend as soon as practical to 10,000 Feet.

### PRESSURIZATION AIR CONTAMINATION

1. Pressurization Air Control(s) - PULL LH and/or RH as necessary.
   a. With Both Air Sources Dumped:
      (1) Cabin Vent Control - PULL.
      (2) Cabin Pressurization Switch - DEPRESSURIZE.
2. Above 10,000 Feet with Both Air Sources Dumped:
   a. If Supplementary Oxygen is Not Available - EMERGENCY DESCENT TO 10,000 FEET.
   b. If Supplementary Oxygen is Available:
      (1) Oxygen Knob - PULL ON.
      (2) Assure each occupant is using oxygen.
      (3) Descend as soon as practical to 10,000 Feet.

## PROPELLER SYNCHROPHASER

### ENGINE INOPERATIVE PROCEDURES

1. Propeller Synchrophaser (if installed) - OFF.

### SYNCHROPHASER FAILURE

1. Propeller Synchrophaser (if installed) - OFF.
2. Propeller Synchrophaser Circuit Breaker (if installed) - PULL.

## EMERGENCY EXIT WINDOW REMOVAL

The forward oval cabin window on the right side of the passenger compartment should be removed as follows:

1. Emergency Release Handle Plastic Cover - PULL OFF.
2. Side Table (If Installed) - PULL UP and INBOARD.
3. Release Handle - TURN COUNTERCLOCKWISE.
4. Emergency Exit Window - PULL IN and DOWN.

## SPINS

Intentional spins are not permitted in this airplane. Should a spin occur, however, the following recovery procedures should be employed:

1. Throttles - CLOSE IMMEDIATELY.
2. Ailerons - NEUTRALIZE.
2. Rudder - HOLD FULL RUDDER opposite the direction of rotation.
4. Control Wheel - FORWARD BRISKLY, 1/2 turn after applying full rudder.
5. Inboard Engine - INCREASE POWER to slow rotation. (If Necessary).

After Rotation has stopped:

6. Rudder - NEUTRALIZE.
7. Inboard Engine (If used) - DECREASE POWER to equalize engines.
8. Control Wheel - PULL to recover from resultant dive. Apply smooth steady control pressure.

NOTE

The airplane has not been flight tested in spins, thus the above recommended procedure is based entirely on the best judgment of Cessna Aircraft Company.





# SECTION 4
# NORMAL PROCEDURES
## TABLE OF CONTENTS



## INTRODUCTION

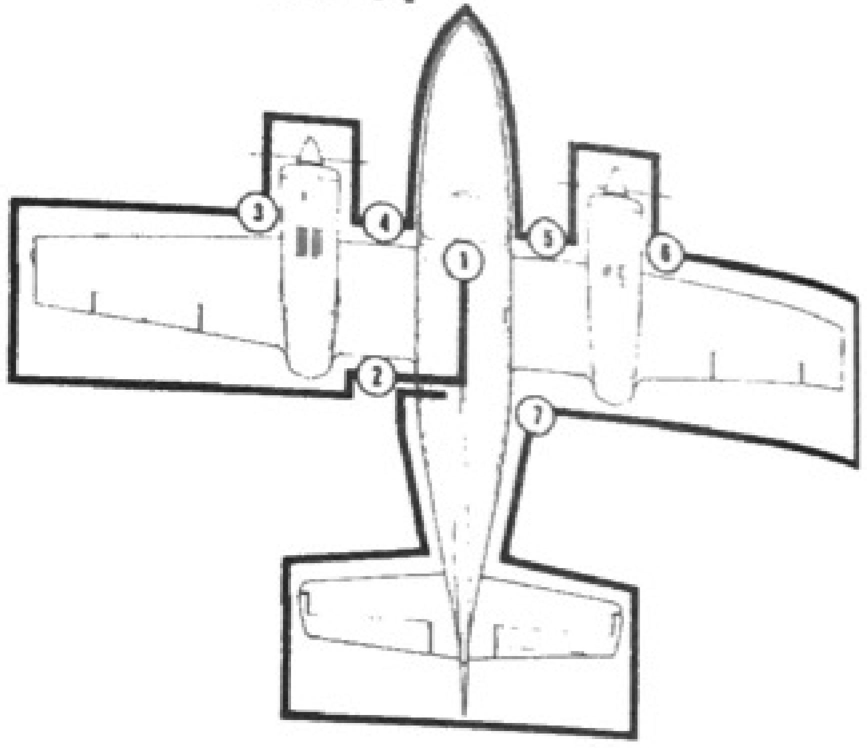
Section 4 of this handbook describes the recommended procedures for normal operations. The first part of this section provides normal procedural action required in an abbreviated checklist form. Amplification of the abbreviated checklist is presented in the second part of this section.

NOTE

Refer to Section 9 of this handbook for amended operating limitations, operating procedures, performance data and other necessary information for airplanes equipped with specific options.

MODEL 414A

# PREFLIGHT INSPECTION




NOTE

- Visually check inspection plates and general airplane condition during walk-around inspection. If night flight is planned, check operation of all lights and make sure a flashlight is available.
- Refer to Section 8 for quantities, materials and specifications of frequently used service items.

(1) a. Control Lock(s) - REMOVE and stow.
b. Parking Brake - SET.
c. Static Source Selector - NORMAL.
d. All Switches - OFF.
e. All Circuit Breakers - IN.
f. Voltammeter Selector - BATT.
g. Oxygen - ON; Quantity, Masks and Hoses - CHECK; Oxygen - OFF.
h. Landing Gear Switch - DOWN.
i. Trim Tab Controls (3) - SET for takeoff.
j. Left Fuel Selector - LEFT MAIN (Feel For Detent).
k. Right Fuel Selector - RIGHT MAIN (Feel For Detent).
l. Emergency Crossfeed Shutoff - OPEN (Push Down).
m. Battery Switch - ON.
n. Fuel Gages - CHECK quantity and operation.
o.*Fuel Totalizer - SET.
p. Wing Flaps - DOWN 45o.
q. Anti-Collision Lights - CHECK operation.
r.*Electric Windshield - CHECK operation by observing discharge on voltammeter if inflight use is anticipated. Insure system is turned off after operational check.
s. Cabin Fire Extinguisher - CHECK SECURE.
t. Pitot, Stall and Vent Heat Switch(es) - ON 20 seconds then OFF. Insure pitot tube cover(s) are removed before actuating pitot heat switch(es).
u. Navigation Lights - ON.
v. Windshields and Windows - CHECK for cracks and general condition.

(2) a. Battery Compartment Cover - SECURE.
b. Wing Locker Baggage Door - SECURE.
c. Wing Flap - CHECK security and attachment.
d. Control Surface Lock - REMOVE, if installed.
e. Aileron and Tab - CHECK condition, freedom of movement and tab position.
f. Navigation Light - CHECK operation.
g. Landing Light Filament - CHECK condition.
h. Stall Warning Vane - CHECK freedom of movement, audible warning and warm.
i. Main Tank Fuel Vent - CLEAR.
j. Bottom Outboard Wing - CHECK for fuel leaks or stains.
k. Main Tank Fuel Quantity - CHECK; Cap - SECURE.
l.*Outboard Deice Boot - CHECK condition and security.
m. Main Tank Fuel Sumps - DRAIN (2 Drains).
n. Fuel Strainer - DRAIN.

(3) a. Engine Compartment General Condition - CHECK for fuel, oil, hydraulic fluid and exhaust leaks or stains.
b. Intake Air and Intercooler Opening - CLEAR.
c. Oil Level - CHECK minimum 9 quarts.
d. Propeller and Spinner - EXAMINE for nicks, security and oil leaks.
e. Engine Openings - CLEAR.
f.*Inboard Deice Boot - CHECK condition and security.
g. Main Gear, Strut, Door, Tire and Wheel Well - CHECK.
h. Wing Tie Down - REMOVE.
i. Crossfeed Line - DRAIN.
j. Lower Fuselage, Nose and Center Section - CHECK for fuel and oil leaks or stains and antenna security.
k. Heat Exchanger Opening - CLEAR.
l.*Engine Fire Extinguisher Bottle Pressure - CHECK temp/charge pressure schedule.

Figure 4-1 (Sheet 1 of 2)





MODEL 414A

# PREFLIGHT INSPECTION

(4) a. Hydraulic Fluid Reservoir Level - CHECK.
b. Emergency Landing Gear Blow Down Bottle Pressure - CHECK in the green arc. Check that red ring is not showing on the control rod. If red ring is visible, refer to the Airplane Service Manual before flight.
c. Nose Baggage Door - SECURE.
d. Avionics Bay Door - SECURE.
e. Nose Gear, Strut, Stop Block, Door, Tire and Wheel Well - CHECK.
f. Tie Down - REMOVE.
g. Pitot Cover - REMOVE; Pitot Tube - CLEAR and WARM.
h. Ram Air Inlet - CLEAR.
i.*Pitot Cover - REMOVE; Pitot Tube - CLEAR and WARM.
j.*Oxygen Overboard Discharge Indicator - CHECK green disc installed.
k. Heater Inlet and Outlet - CLEAR.
l. Baggage Door - SECURE.

(5) a. Heat Exchanger Opening - CLEAR.
b.*Inboard Deice Boot - CHECK condition and security.
c. Lower Fuselage, Nose and Center Section - CHECK for fuel and oil leaks or stains and antenna security.
d. Main Gear, Strut, Door, Tire and Wheel Well - CHECK.
e. Wing Tie Down - REMOVE.
f. Crossfeed Line - DRAIN.
g.*Engine Fire Extinguisher Bottle Pressure - CHECK temp/charge pressure schedule.
h.*Air Conditioning Outlet Air Opening - CLEAR.
i. Intake Air and Intercooler Opening - CLEAR.
j. Oil Level - CHECK minimum 9 quarts.
k. Propeller and Spinner - EXAMINE for nicks, security and oil leaks.
l. Engine Openings - CLEAR.

(6) a.*Air Conditioning Fluid Level - CHECK.
b.*Air Conditioning Inlet Air Opening - CHECK DOOR CLOSED.
c. Engine Compartment General Condition - CHECK for fuel, oil, hydraulic fluid and exhaust leaks or stains.
d. Fuel Strainer - DRAIN.
e. Main Tank Fuel Sumps - DRAIN (2 Drains).
f.*Outboard Deice Boot - CHECK condition and security.
g. Main Tank Fuel Quantity - CHECK; Cap - SECURE.
h. Fuel Vent - CLEAR.
i. Bottom Outboard Wing - CHECK for fuel leaks or stains.
j.*Landing Light Filament - CHECK condition.
k. Navigation Light - CHECK operation.
l. Control Surface Lock - REMOVE, if installed.
m. Aileron and Servo Tab - CHECK condition, freedom of movement and tab position. Move aileron up; tab should move down.
n. Wing Flap - CHECK security and attachment.
o. Wing Locker Baggage Door - SECURE.
p.*Alcohol Deice Tank - CHECK quantity.

(7) a. Static Port(s) - CLEAR. Do not blow into static ports.
b. Tailcone Drain Holes - CHECK clear of obstructions.
c.*Deice Boots - CHECK condition and security.
d. Control Surface Lock(s) - REMOVE, if installed.
e. Elevator and Tab - CHECK condition, freedom of movement and tab position.
f. Rudder and Tab - CHECK condition, freedom of movement and tab position. Move rudder right; tab should move left.
g. Tie Down - REMOVE.
h.*Deice Boots - CHECK condition and security.
i.*Rudder Lock - RELEASED.
j. Static Port(s) - CLEAR. Do not blow into static ports.
k. Cabin Door and Seal - CHECK security and condition.
l. Wing Flaps - UP. Visually check retraction.
m. Battery Switch - OFF.
n. Navigation Lights - OFF.

*Denotes items to be checked if the applicable optional equipment is installed on your airplane.

Figure 4-1 (Sheet 2 of 2)

# NORMAL PROCEDURES ABBREVIATED CHECKLIST

NOTE

This Abbreviated Normal Procedures Checklist is included as a supplement to the Amplified Normal Procedures Checklist. The Abbreviated Normal Procedures Checklist should not be used until the flight crew has become familiar with the airplane and systems. All amplified normal procedure items must be accomplished regardless of which checklist is used.

## AIRSPEEDS FOR SAFE OPERATION

Conditions:
1. Takeoff Weight 6750 Pounds
2. Landing Weight 6750 Pounds
3. Sea Level, Standard Day

| | |
|---|---|
| (1) Air Minimum Control Speed | 79 KIAS |
| (2) Takeoff and Climb to 50 Feet (0° Wing Flaps) | 98 KIAS |
| (3) All Engines Best Angle-of-Climb Speed (0° Wing Flaps) | 88 KIAS |
| (4) All Engines Best Rate-of-Climb Speed (0° Wing Flaps) | 108 KIAS |
| (5) All Engines Landing Approach Speed (45° Wing Flaps) | 94 KIAS |
| (6) Maneuvering Speed | 145 KIAS |
| (7) Structural Cruise Speed | 203 KIAS |
| (8) Never Exceed Speed | 237 KIAS |
| (9) Speed for Transition to Balked Landing Conditions | 82 KIAS |
| (10) Maximum Demonstrated Crosswind Velocity | 19 KNOTS |

Figure 4-2

## BEFORE STARTING ENGINES

1. Preflight - COMPLETE.
2. Cabin Door - LATCHED and SECURE.
3. Control Locks - REMOVE.
4. Seat, Seat Belts and Shoulder Harness - ADJUST and SECURE.
5. Fuel Selectors - MAIN TANKS.
6. Landing Gear Switch - DOWN.
7. Mixtures, Propellers and Throttles - SET.
8. All Switches and Circuit Breakers - SET.
9. Battery and Alternators - ON.
10. Landing Gear Position Indicator Lights - Check green lights ON.
11. Annunciator Panel - PRESS-TO-TEST.
12. Lights - AS REQUIRED.

## STARTING ENGINES

1. Propellers - CLEAR.
2. Magneto Switches - ON.
3. Engines - START.
4. Auxiliary Fuel Pumps - LOW.
5. Engine Instruments - CHECK.

## BEFORE TAXIING

1. Passenger Briefing - COMPLETE.
2. Avionics - ON and SET.

## TAXIING

1. Brakes - CHECK.
2. Flight Instruments - CHECK.

## BEFORE TAKEOFF

1. Fuel Quantity - CHECK.
2. Fuel Selectors - RECHECK - MAIN TANKS.
3. Emergency Crossfeed Shutoff - CHECK OPEN (Push Down).
4. Cowl Flaps - OPEN.
5. Trim Tabs - SET.
6. Wing Flaps - UP.
7. Propeller Synchrophaser (if installed) - AS DESIRED.
8. Avionics and Radios - SET.
9. Flight Instruments and Avionics - SET.
10. Alternate Air Controls - IN.
11. Pressurization - SET.
12. Auxiliary Fuel Pumps - ON.
13. Flight Controls - CHECK.
14. Engine Run Up:
    a. Throttles - 1700 RPM.
    b. L and R HYD FLOW Lights - OFF.
    c. Alternators - CHECK.
    d. Vacuum System - CHECK.
    e. Magnetos - CHECK.
    f. Propellers - CHECK.
    g. Mixtures - CHECK.
    h. Engine Instruments - CHECK.
    i. Throttles - 1000 RPM.
    j. Quadrant Friction Lock - ADJUST.
15. Exterior Lights - AS REQUIRED.
16. Ice Protection Equipment - AS REQUIRED.
17. Air Conditioning (if installed) - SET.
18. All Cabin Doors and Windows - CLOSED.
19. Annunciator Panel - CLEAR.
20. Seat Belts and Shoulder Harness - SECURE.





## TAKEOFF

1. Power - SET FOR TAKEOFF.
2. Mixtures - CHECK fuel flows in the white arc.
3. Engine Instruments - CHECK.
4. Air Minimum Control Speed - 79 KIAS.
5. Takeoff and Climb to 50 Feet - 98 KIAS at 6750 pounds. Refer to Section 5 for speeds at reduced weights.

## AFTER TAKEOFF

1. Landing Gear - RETRACT.
2. Best Angle-of-Climb Speed - 88 KIAS at sea level to 92 KIAS at 20,000 feet with obstacle.
3. Best Rate-of-Climb Speed - 108 KIAS at sea level and 6750 pounds. Refer to Section 5 for speed at reduced weight.

## CLIMB

1. Power - SET.
2. Mixtures - ADJUST.
3. Cowl Flaps - AS REQUIRED.
4. Pressurization - SET.

## CRUISE

1. Cruise Power - SET.
2. Auxiliary Fuel Pumps - OFF (LOW, if fuel flow fluctuates).
3. Mixtures - LEAN.
4. Cowl Flaps - AS REQUIRED.
5. Propellers - SYNCHRONIZE manually.
6. Propeller Synchrophaser (if installed) - PHASE.
7. Fuel Selectors - MAIN TANKS.
8. Cabin Altitude and Delta Pressure - CHECK.

## DESCENT

1. Fuel Selectors - MAIN TANKS.
2. Auxiliary Fuel Pumps - ON.
3. Pressurization - SET.
4. Power - AS REQUIRED.
5. Cowl Flaps - CLOSE.
6. Mixtures - ADJUST.
7. Altimeter - SET.

# BEFORE LANDING

1. Seat Belts and Shoulder Harness - SECURE.
2. Propeller Synchrophaser (if installed) - AS DESIRED.
3. Wing Flaps - AS REQUIRED.
4. Landing Gear - DOWN.
5. Mixtures - ADJUST.
6. Propellers - FULL FORWARD.
7. Approach Speed - 94 KIAS at 6750 pounds. Refer to Section 5 for speeds at reduced weights.

# AFTER LANDING

1. Auxiliary Fuel Pumps - LOW.
2. Cowl Flaps - OPEN.
3. Wing Flaps - UP.

# SHUTDOWN

1. Parking Brake - SET if brakes are cool.
2. Accessory Switches - OFF.
3. Auxiliary Fuel Pumps - OFF.
4. Engines - SHUT DOWN.
5. Battery, Alternator And Magneto Switches - OFF.

# SECTION 7
# AIRPLANE & SYSTEMS DESCRIPTIONS

## TABLE OF CONTENTS

Page

# TABLE OF CONTENTS (CONTINUED)

Page

# INTRODUCTION

Section 7 of this handbook provides a description and operation of the airplane and its systems.

> NOTE
>
> Operational procedures for optional systems and equipment are presented in Section 9.

# AIRFRAME

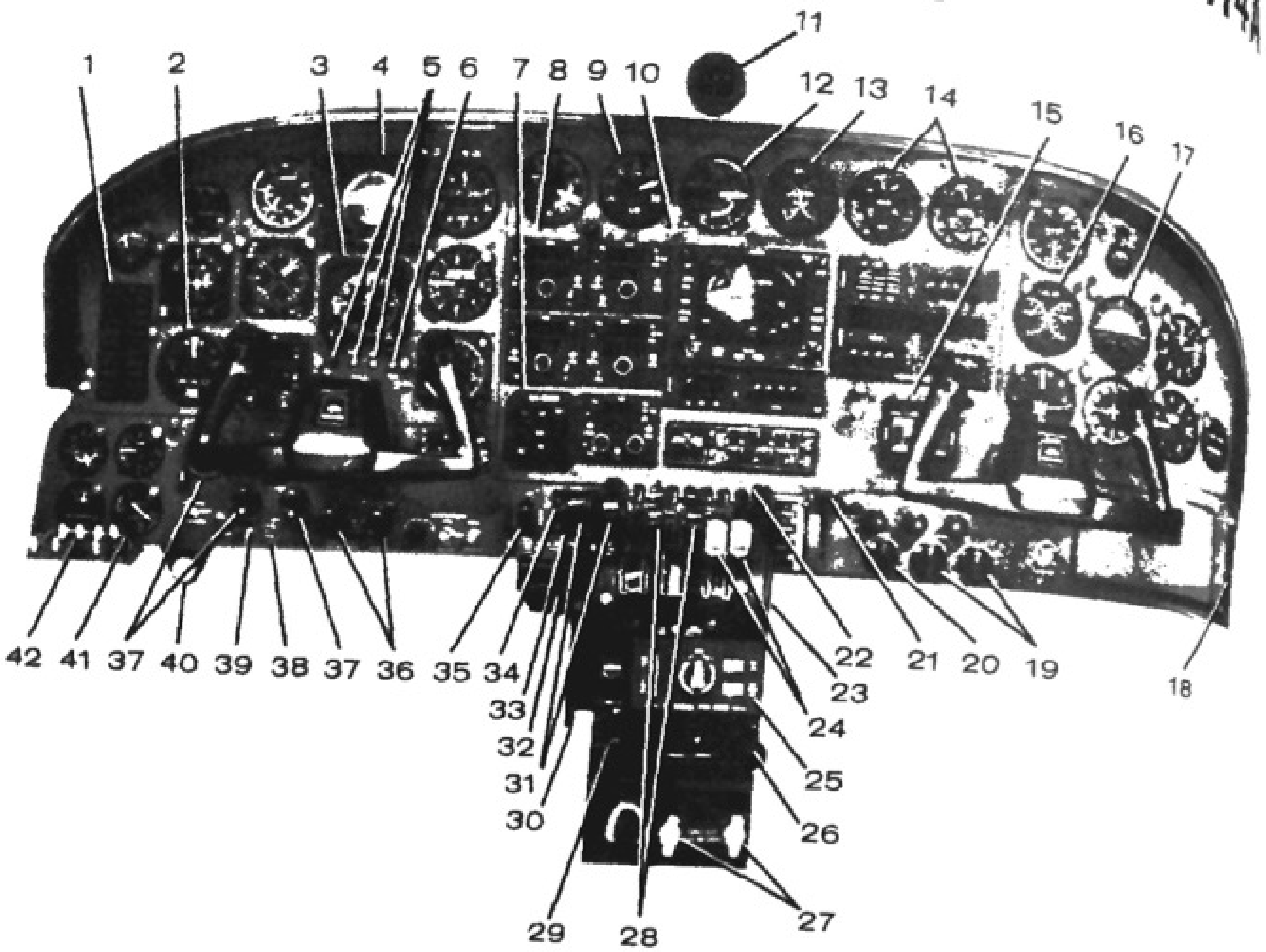
The Model 414 Chancellor is a 6-to 8-place, all-metal, low-wing, pressurized airplane. The fuselage and empennage are of semimonocoque construction. The cabin area is sealed and structurally reinforced for pressurization. The wing and horizontal and vertical tail surfaces are of conventional aluminum construction. The wing uses 2 main spars which attach to the carry-thru spars. The retractable landing gear is a tricycle design using air-over-oil shock struts.

The 414 Chancellor II and 414 Chancellor III are identical to the 414 Chancellor except a selection of popular optional equipment has been included as standard equipment.

# INSTRUMENT PANEL

The instrument panel, see Figure 7-1, contains the instruments and controls necessary for safe flight. The instrument panel presented is typical, as it contains all standard items and a good selection of popular optional equipment. The function and operation of the instrument panel features not described here have been explained in this section or Section 9 under the applicable system.

# INSTRUMENT PANEL



1. ANNUNCIATOR PANEL
2. FLIGHT INSTRUMENT GROUP
3. FLIGHT DIRECTOR HSI (OPTIONAL)
4. FLIGHT DIRECTOR FDI (OPTIONAL)
5. MARKER BEACON LIGHTS (OPTIONAL)
6. MARKER BEACON TEST SWITCH (OPTIONAL)
7. FLIGHT DIRECTOR MODE SELECTOR (OPTIONAL)
8. AVIONICS CONTROL PANEL
9. ENGINE INSTRUMENT GROUP
10. PROPELLER SYNCHROPHASER SWITCH (OPTIONAL)
11. COMPASS
12. FUEL FLOW GAGE
13. ECONOMY MIXTURE INDICATOR (OPTIONAL)
14. COMBINATION ENGINE GAGES
15. FIRE DETECTION PANEL (OPTIONAL)
16. FUEL QUANTITY GAGE
17. RIGHT FLIGHT INSTRUMENT GROUP (OPTIONAL)
18. RIGHT SIDE CONSOLE
19. PRESSURIZATION AIR TEMPERATURE CONTROLS
20. HEATER AND CABIN AIR CONTROL PANEL
21. FLAP POSITION SWITCH
22. LIGHT DIMMING CONTROLS
23. QUADRANT FRICTION LOCK
24. MIXTURE CONTROLS
25. AUTOPILOT CONTROL HEAD (OPTIONAL)
26. RUDDER TRIM CONTROL
27. COWL FLAP CONTROLS
28. PROPELLER CONTROLS
29. AILERON TRIM CONTROL
30. ELEVATOR TRIM CONTROL
31. THROTTLE CONTROLS
32. EMERGENCY LANDING GEAR EXTENSION T-HANDLE
33. LANDING GEAR POSITION INDICATOR LIGHTS
34. GEAR UNLOCKED LIGHT
35. LANDING GEAR SWITCH
36. ALTERNATE AIR CONTROLS
37. CABIN PRESSURIZATION CONTROLS AND INDICATORS
38. OXYGEN CONTROL
39. CABIN DOOR LIGHT SWITCH
40. PARKING BRAKE CONTROL
41. OXYGEN CYLINDER PRESSURE GAGE (OPTIONAL)
42. LEFT SIDE CONSOLE

Figure 7-1





## OVERHEAD CONSOLE

The overhead console, see Figure 7-2, includes the avionics speaker and instrument panel floodlight and aisle courtesy lights with dimming control and pilot and copilot overhead directional air vents.

### OVERHEAD CONSOLE

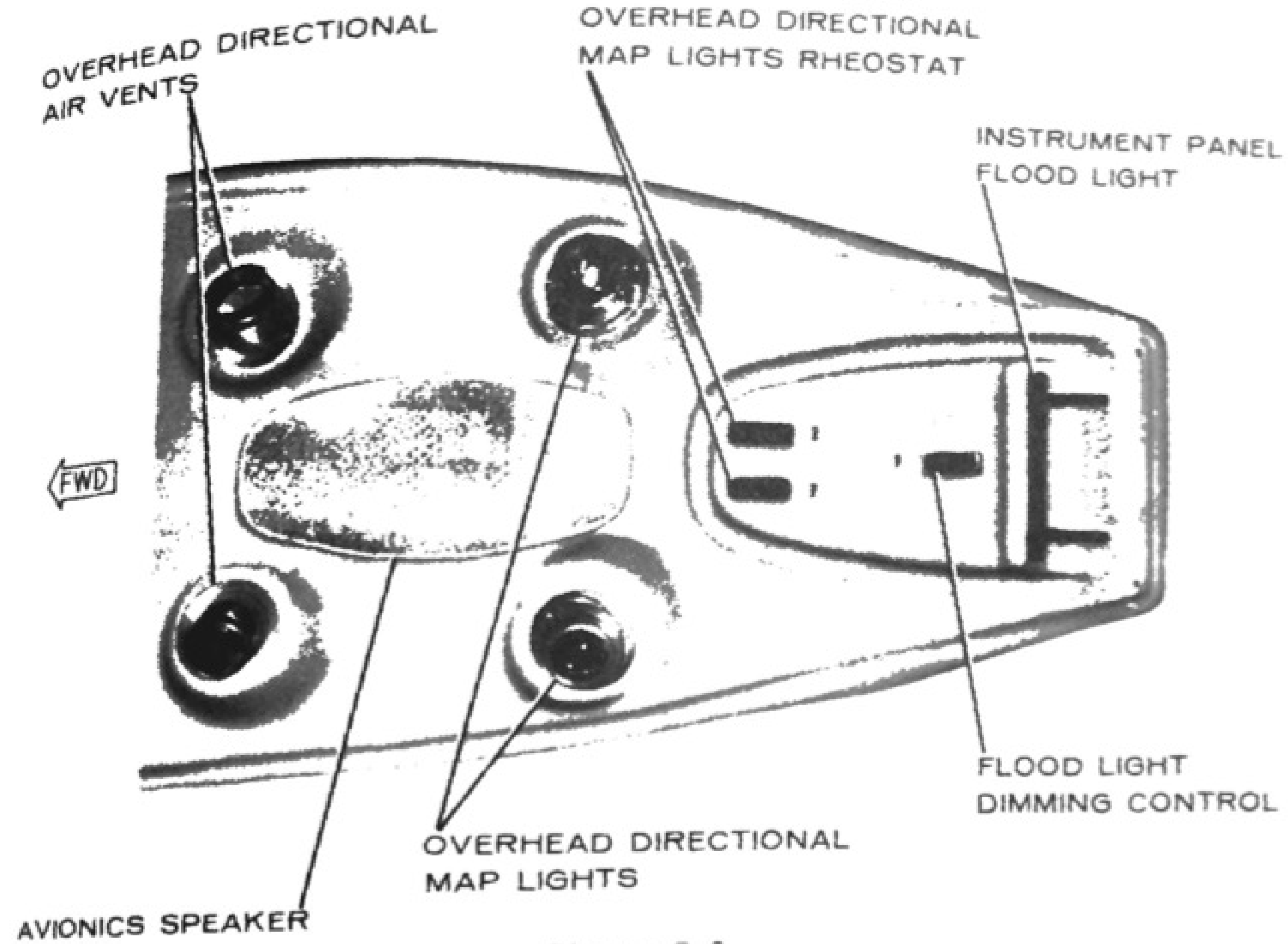



Figure 7-2

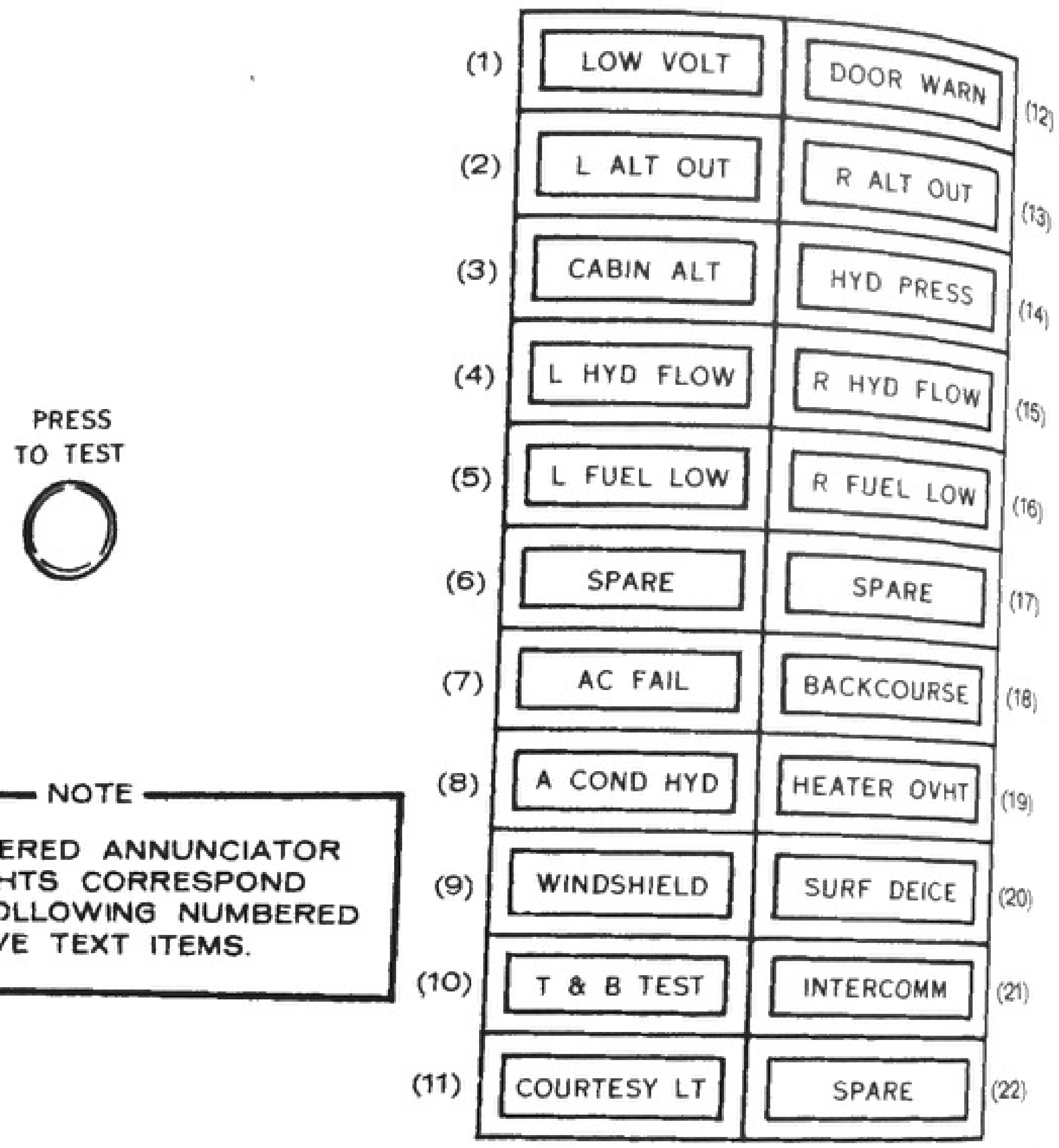
## ANNUNCIATOR PANEL

The annunciator panel, see Figure 7-3, is located on the left side of the pilot's instrument panel. The panel annunciates items of interest to the pilot in the applicable color of red, amber, green or white. No dimming capability of the annunciator lights is provided.

When a hazardous condition exists, requiring immediate corrective action, a red warning light will illuminate. When an impending possibly dangerous condition exists, requiring attention but not necessarily immediate action, an amber light will illuminate. A green or white light will illuminate to indicate a safe or normal configuration, condition of performance, operation of essential equipment or to attract attention and impart information for routine action purposes.

A press-to-test button is provided to the left of the annunciator panel. When the button is pressed, all annunciator panel lights, landing gear position and unlocked lights, propeller synchrophaser light and marker beacon lights will be tested and should illuminate. If the throttles are retarded or flaps are extended more than 15 degrees, the gear warning horn will sound when the button is pressed. Refer to Section 8 for bulb replacement.

# ANNUNCIATOR PANEL




**NOTE**

THE NUMBERED ANNUNCIATOR PANEL LIGHTS CORRESPOND TO THE FOLLOWING NUMBERED DESCRIPTIVE TEXT ITEMS.

Figure 7-3

**NOTE**

A spare light lens is installed in each blank location of the annunciator panel when the optional system is not installed. These lenses can be replaced with the appropriate lens when additional optional equipment is installed.

The following numbered items, see Figure 7-3, describe the applicable system condition when the annunciator light is illuminated.

1. The red low voltage light advises that the airplane bus voltage is less than 25 volts.
2. The amber left alternator out light advises that the left alternator is not generating.





3. The amber cabin altitude light advises that cabin altitude is above 10,000 feet.
4. The amber left hydraulic flow light advises that insufficient flow exists at 1000 propeller RPM or above and that the cause may be a result of pump, lines, filter or bypass valve failure.
5. The amber left main tank fuel low light advises that approximately 60 pounds of fuel remains in the left main tank.
6. The white spare light is reserved for optional equipment.
7. The amber alternating current failure light advises that a loss of AC power has occurred.
8. The green air conditioning hydraulic pressure light advises that the optional air conditioning compressor is in operation.
9. The green electric windshield heater light advises that the heating elements in the optional electric windshield are operating.
10. The green turn-and-bank test light will only illuminate when the press-to-test button is pushed and power is being provided to the turn-and-bank electrical circuit.
11. The white courtesy light advises that the overhead flight deck flood light and main cabin door entry lights are illuminated.
12. The red door warning light advises that the main cabin door is not secured for flight.
13. The amber right alternator out light advises that the right alternator is not generating.
14. The amber hydraulic pressure light advises that hydraulic pressure is being applied to the landing gear retraction and extension system.
15. The amber right hydraulic flow light advises that insufficient flow exists at 1000 propeller RPM or above and that the cause may be a result of pump, lines, filter or bypass valve failure.
16. The amber right main tank fuel low light advises that approximately 60 pounds of fuel remains in the right main tank.
17. The white spare light is reserved for optional equipment.
18. The amber back course light advises that the optional navigation equipment is programmed for a back course approach.
19. The amber heater overheat light advises that the heater has reached an abnormal temperature and has been automatically deenergized. Once this light illuminates, the heater cannot be operated until resetting of the safety device has been completed.
20. The green surface deice light advises that the optional tail deice boots have reached full inflation pressure.
21. The white intercom light advises that the optional flight deck or passenger compartment microphone switch is pressed and communication is possible.
22. The white spare light is reserved for optional equipment.

## FLIGHT CONTROLS SYSTEM

The flight controls consist of the ailerons, elevators and rudder and their respective trim systems. All of these surfaces are constructed of aluminum and are statically mass balanced.

## AILERON SYSTEM

Each aileron, see Figure 7-4, is attached to the rear main wing spar at two points. The aileron is actuated by a bell crank which is attached to a wheel in the wing. The wheel is actuated by cables attached to the pilot's control wheel. When the rudder is actuated, a spring assembly, intercon-nected to the aileron system, causes the ailerons to automatically assist the turn.

### AILERON SYSTEM

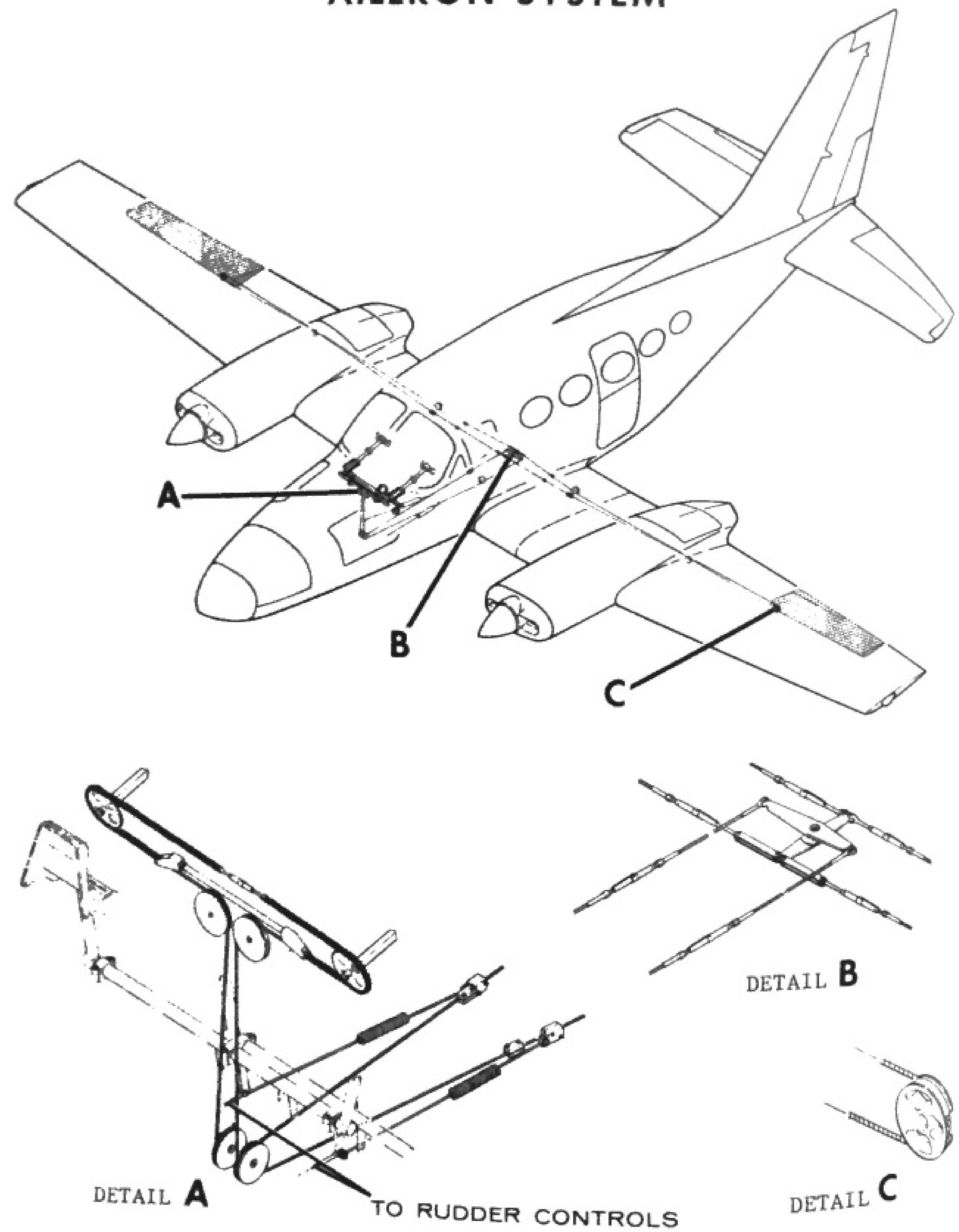



Figure 7-4





## AILERON TRIM SYSTEM

Aileron trim, see Figure 7-5, is achieved by a trim tab attached to the left aileron with a full length piano-type hinge. The trim tab is actuated by a push-pull rod which is attached to a jack screw type actuator in the wing. The actuator is driven by cables attached to the trim control knob on the cockpit control pedestal. The aileron trim tab also acts as a servo tab so that aerodynamic forces on the tab will move the ailerons to the selected position, which reduces the forces required to activate the ailerons in flight.

### AILERON TRIM SYSTEM

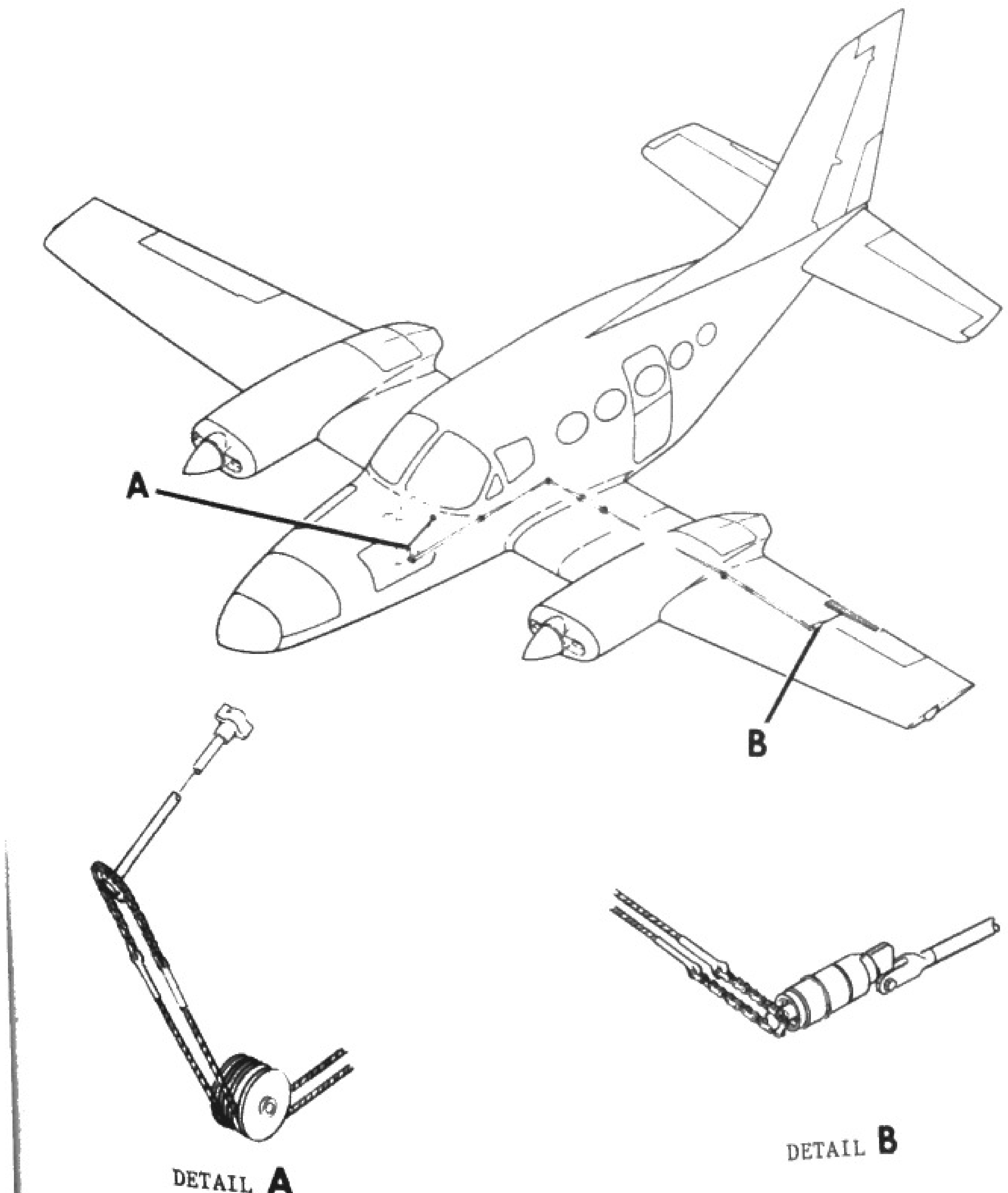



Figure 7-5

## ELEVATOR SYSTEM

The two elevator control surfaces, see Figure 7-6, are connected by a torque tube. The resulting elevator assembly is attached to the rear spar of the horizontal stabilizer at six points. The elevator assembly is actuated by a push-pull rod which is attached to a bell crank in the empennage. The bell crank is actuated by cables attached to the pilot's control wheel.

ELEVATOR SYSTEM

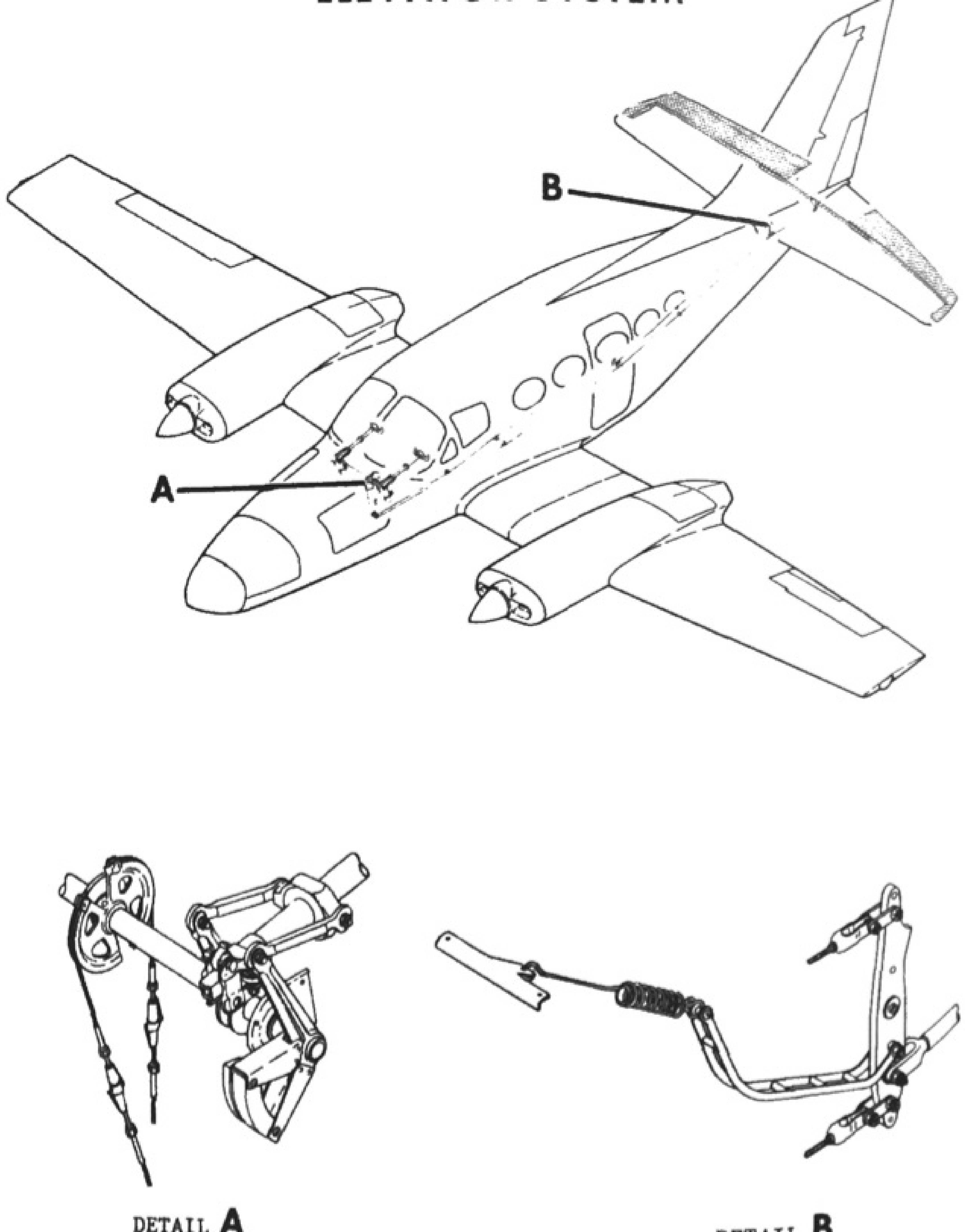



Figure 7-6





## ELEVATOR TRIM SYSTEM

Elevator trim, see Figure 7-7, is achieved by an elevator trim tab attached to the right elevator with a full length, piano-type hinge. The trim tab is actuated by a push-pull rod which is attached to a jack screw type actuator in the horizontal stabilizer. The actuator is driven by cables attached to the trim control wheel on the cockpit control pedestal.

ELEVATOR TRIM SYSTEM

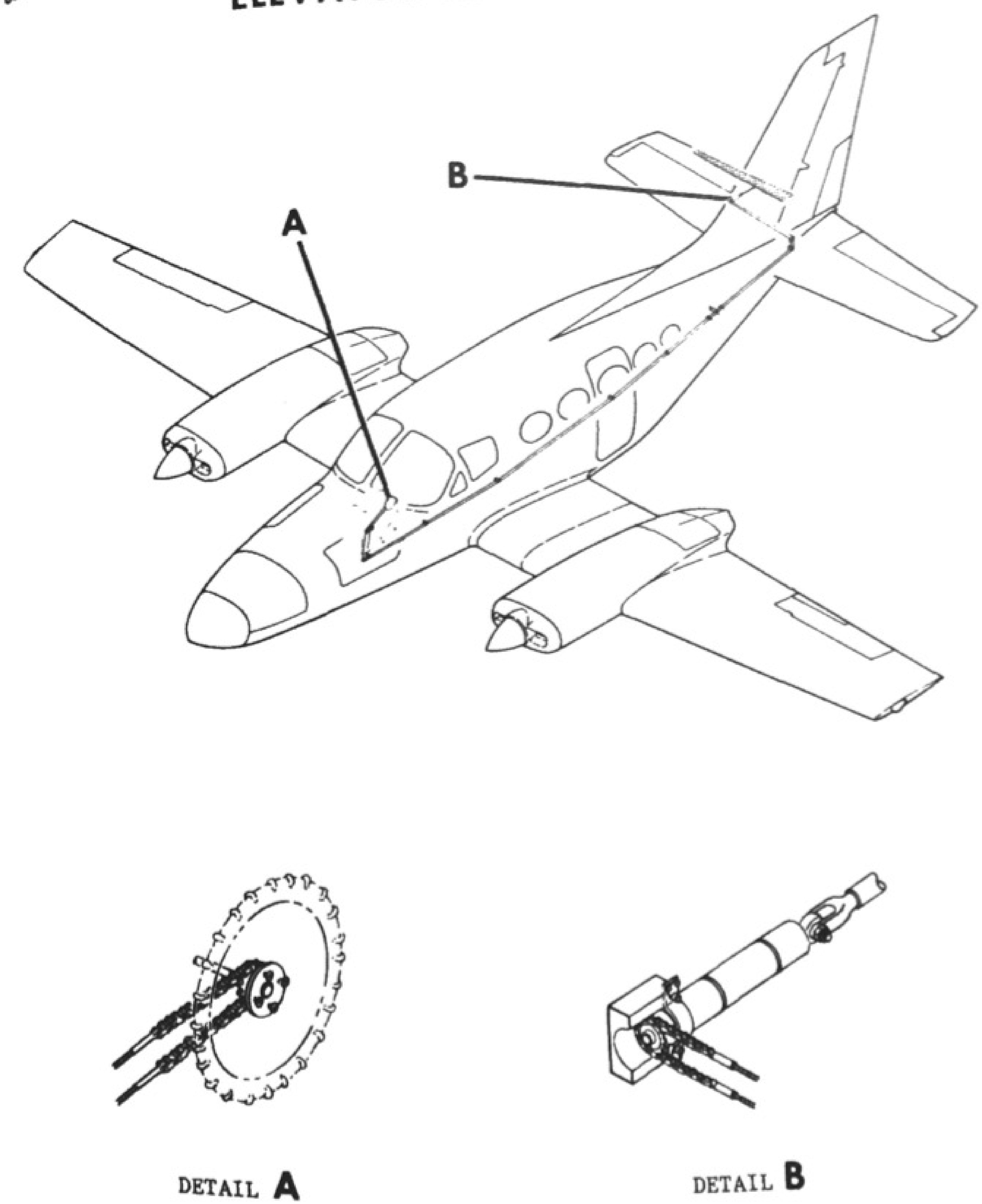



Figure 7-7

## RUDDER SYSTEM

The rudder, see Figure 7-8, is attached to the vertical stabilizer rear main spar at three points. The rudder is actuated by a bell crank attached to the bottom of the rudder. The bell crank is actuated by cables attached to the cockpit rudder pedals. When the rudder is actuated, a cable and spring assembly that is connected to the aileron system causes the ailerons to automatically assist the turn.

### RUDDER SYSTEM

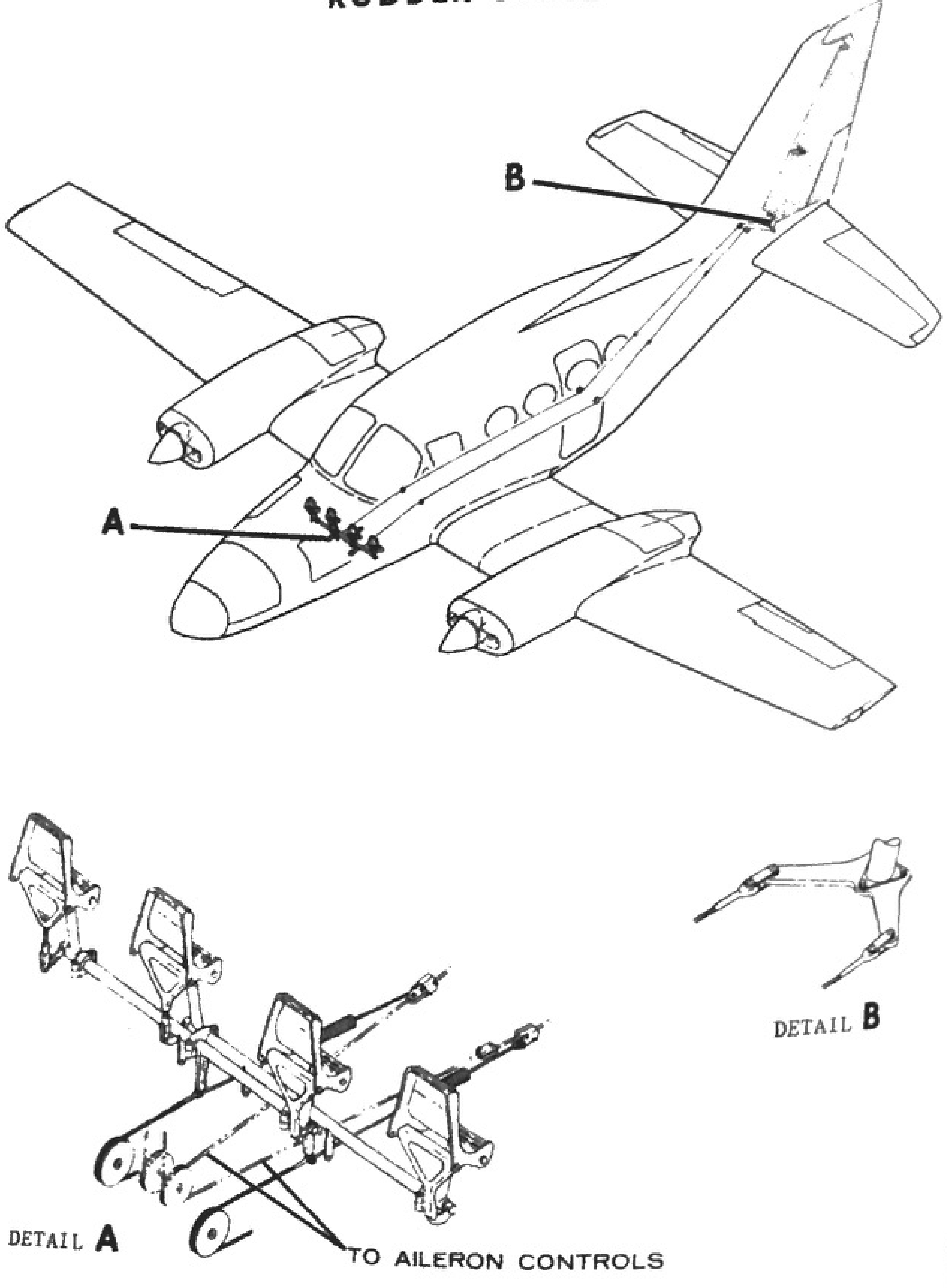



Figure 7-8





## RUDDER TRIM SYSTEM

Rudder trim, see Figure 7-9, is achieved by a trim tab attached to the lower half of the rudder with a full length piano-type hinge. The trim tab is actuated by a push-pull rod which is attached to a jack screw type actuator in the vertical stabilizer. The actuator is driven by cables attached to the rudder trim wheel on the cockpit control pedestal. The rudder trim tab also acts as a servo tab so that aerodynamic forces on the tab will move the rudder to the selected position, which reduces the forces required to activate the rudder in flight.

### RUDDER TRIM SYSTEM

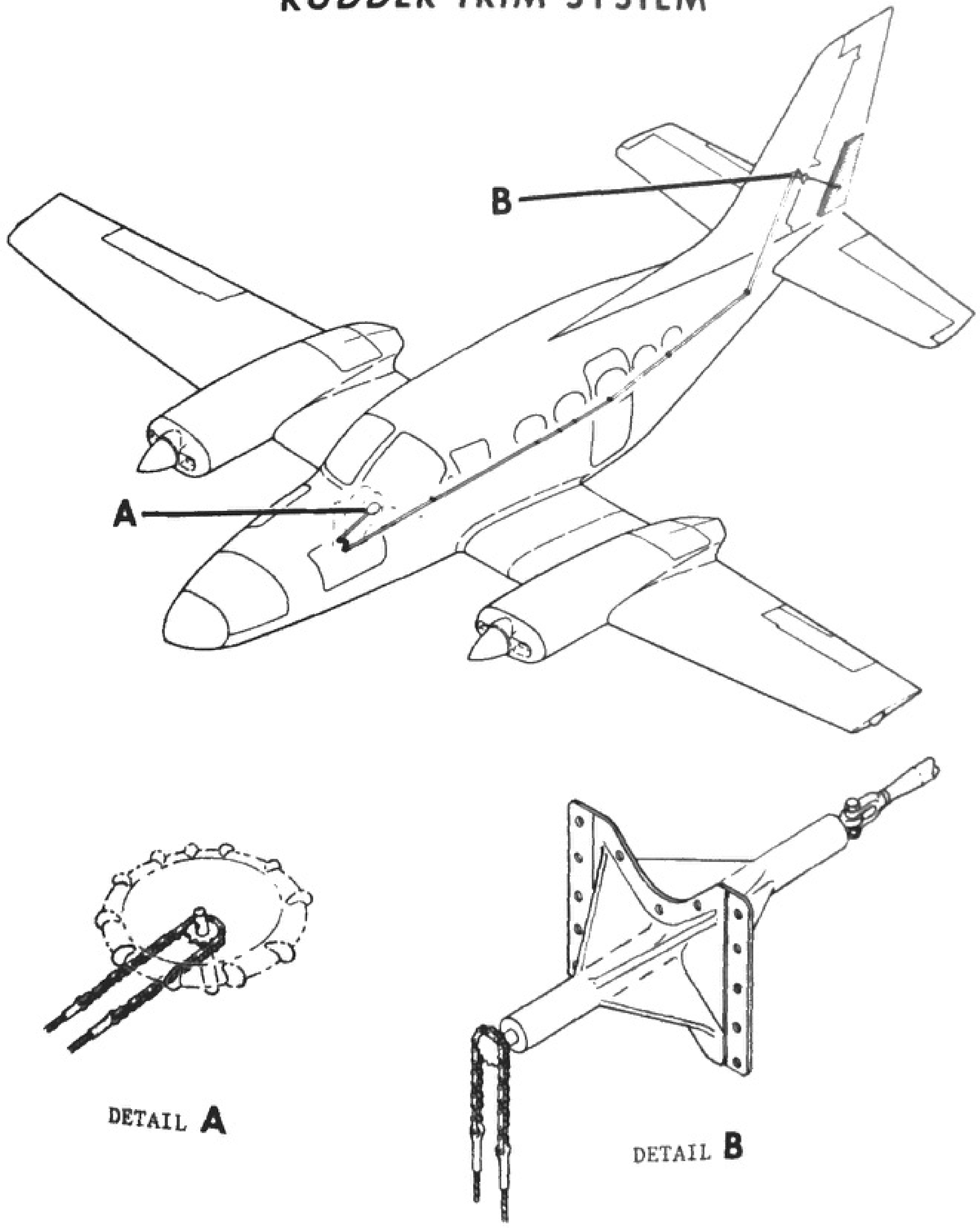



Figure 7-9

## NOSEWHEEL STEERING SYSTEM

The nosewheel steering system, see Figure 7-10, consists of the rudder pedals, nose gear, bungee spring assembly and cables. During ground operation, the nose gear automatically engages the nosewheel steering system, allowing normal directional control.

### NOSEWHEEL STEERING SYSTEM

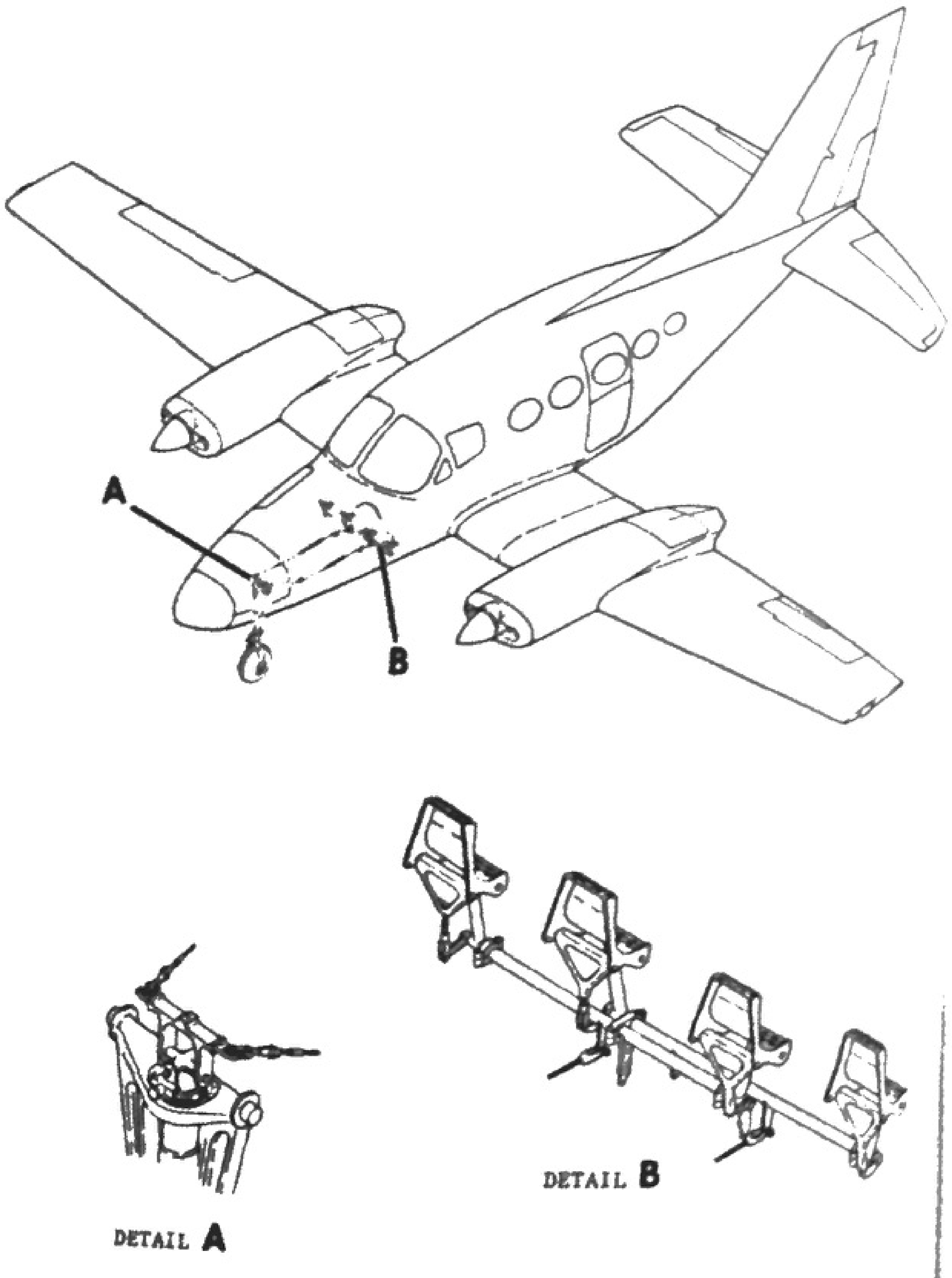



Figure 7-10





The minimum turning distance is presented in Figure 7-11. Always use as large a radius of turn as is practical. Turning tighter than necessary requires excessive braking on the inboard wheel which decreases the tire life.

---NOTE---

Minimum turning distance is effected with inboard wheel brake locked, full rudder and differential power.

### MINIMUM TURNING DISTANCE

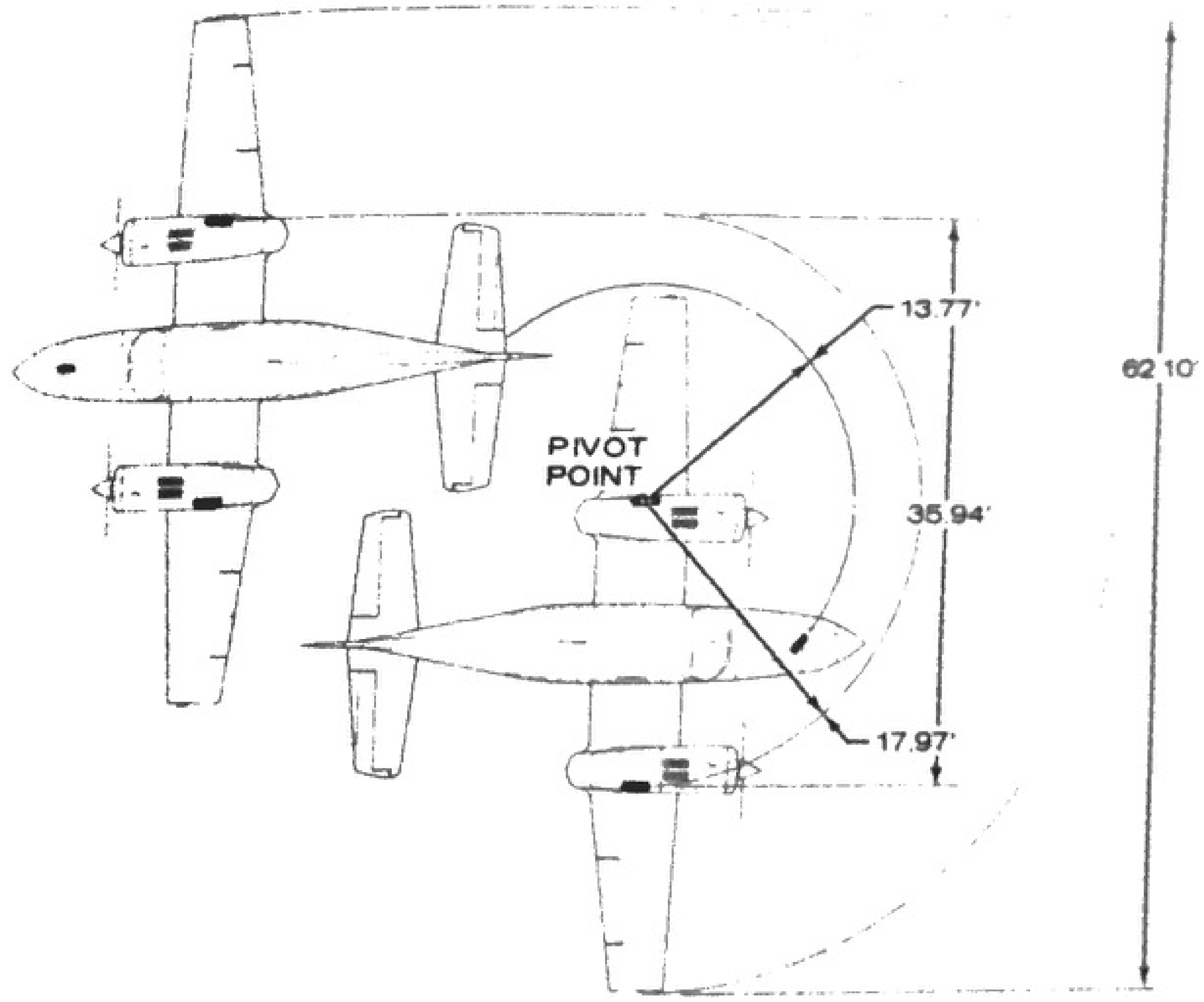



Figure 7-11

## WING FLAPS SYSTEM

The wing flaps, see Figure 7-12, are of the split flap design. Each wing flap (two per side) is attached to the rear wing main spar lower surface and is actuated by two push-pull rods attached to bell cranks in the wing. The bell cranks in each wing are ganged together with push-pull rods. Each inboard push-pull rod is attached to a cable which is actuated by an electric motor with reduction gear in the fuselage center section.

The electric flap motor is controlled by the wing flap position switch, see Figure 7-1, in the cockpit. This switch incorporates a preselect feature which allows the pilot to select the amount of flap extension desired. When the 0°, 15°, 30° or 45° position is selected, the flap motor is electrically actuated and drives the flaps toward the selected position. As the flaps move, an intermediate cable feeds position information back to the preselect assembly. When the actual flap position equals the selected position, a microswitch deenergizes the flap motor.

## WING FLAPS SYSTEM

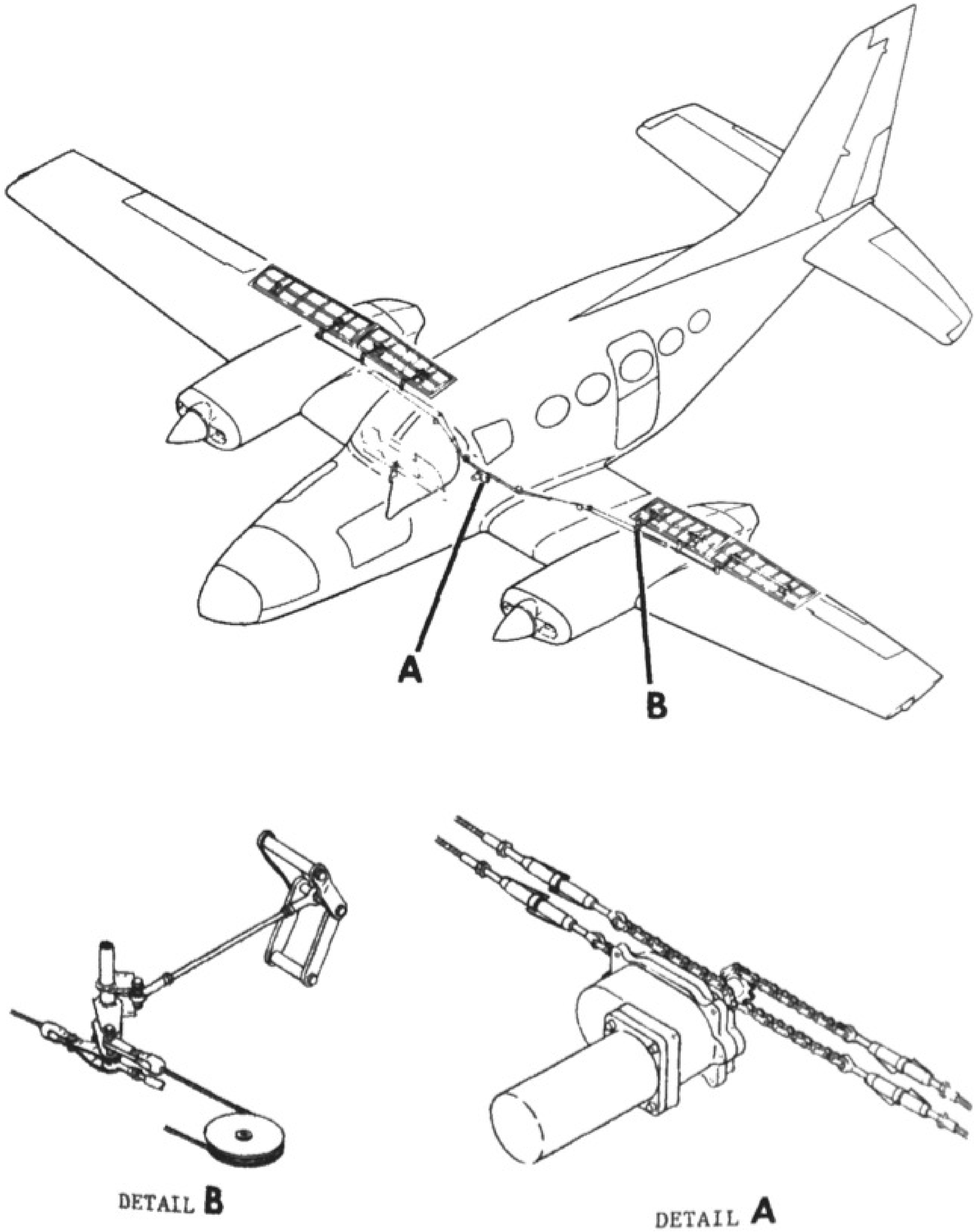



Figure 7-12





## LANDING GEAR SYSTEM

The retractable tricycle landing gear, see Figure 7-13, is electrically controlled and hydraulically actuated. The individual landing gear actuators incorporate an internal lock to hold the landing gear in the extended position. The landing gear is held in the retracted position by mechanical uplocks that are released hydraulically during gear extension. During ground operation, accidental gear retraction, regardless of gear switch position, is prevented by a safety switch located on the left landing gear shock strut. The weight of the airplane compresses the shock strut, causing the safety switch to open, thus preventing electrical power from reaching the landing gear control valve.

The landing gear doors are mechanically linked to their respective landing gear, retracting and extending with each landing gear. The landing gear is operated by a switch, see Figure 7-16, which is identified by a wheel-shaped knob. The switch positions are UP and DOWN. To operate the gear, pull out the landing gear switch and move it to the desired position. This allows electrical power to energize the gear control valve and the hydraulic pressure to drive the landing gear towards the selected position. The hydraulic pressure light, located on the annunciator panel, see Figure 7-3, will remain on until the landing gear is locked into position. The system also incorporates a left and right hydraulic flow light which illuminates at low engine RPM or in the event of a hydraulic pump failure.

## LANDING GEAR SYSTEM

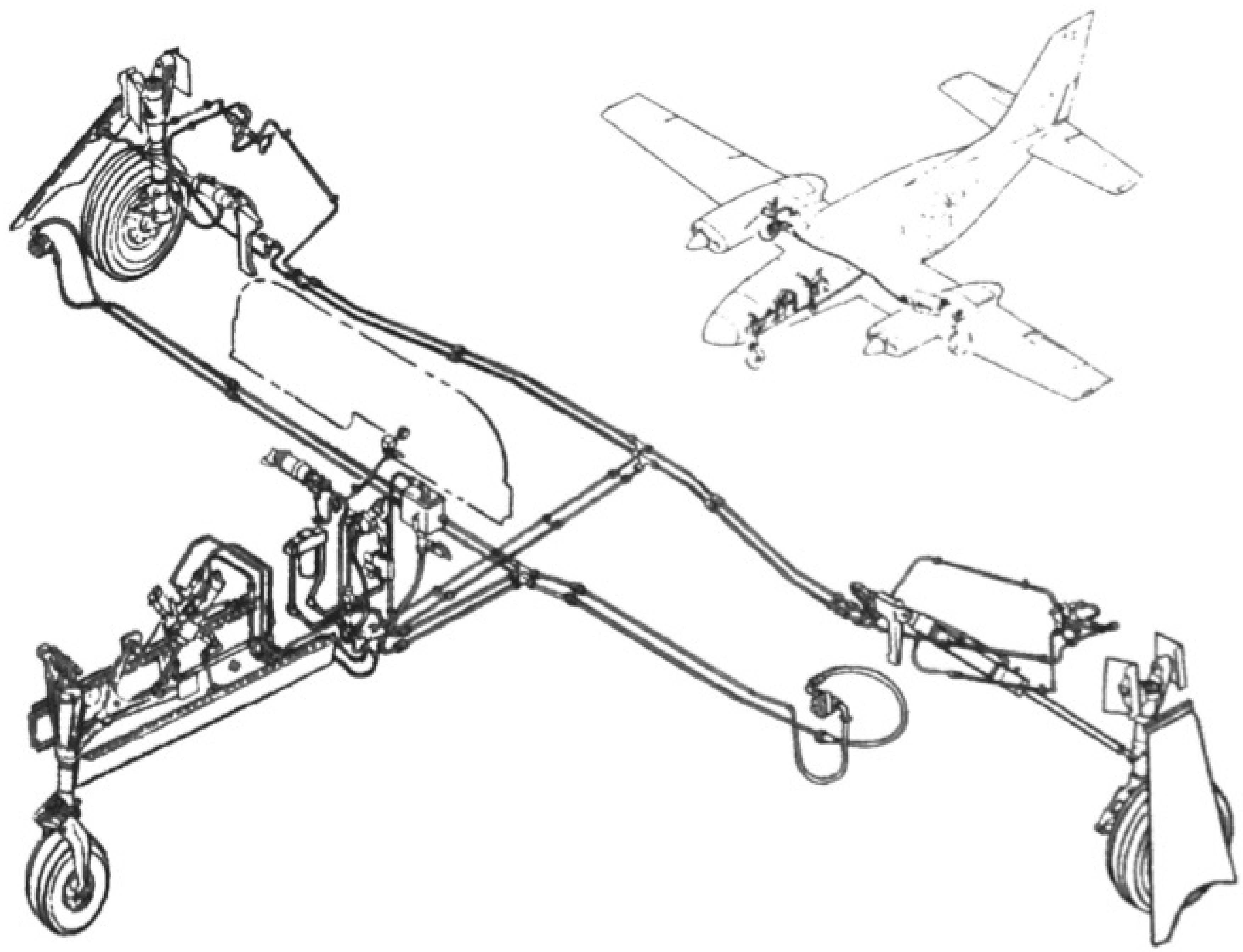


Figure 7-13

# HYDRAULIC SYSTEM SCHEMATIC

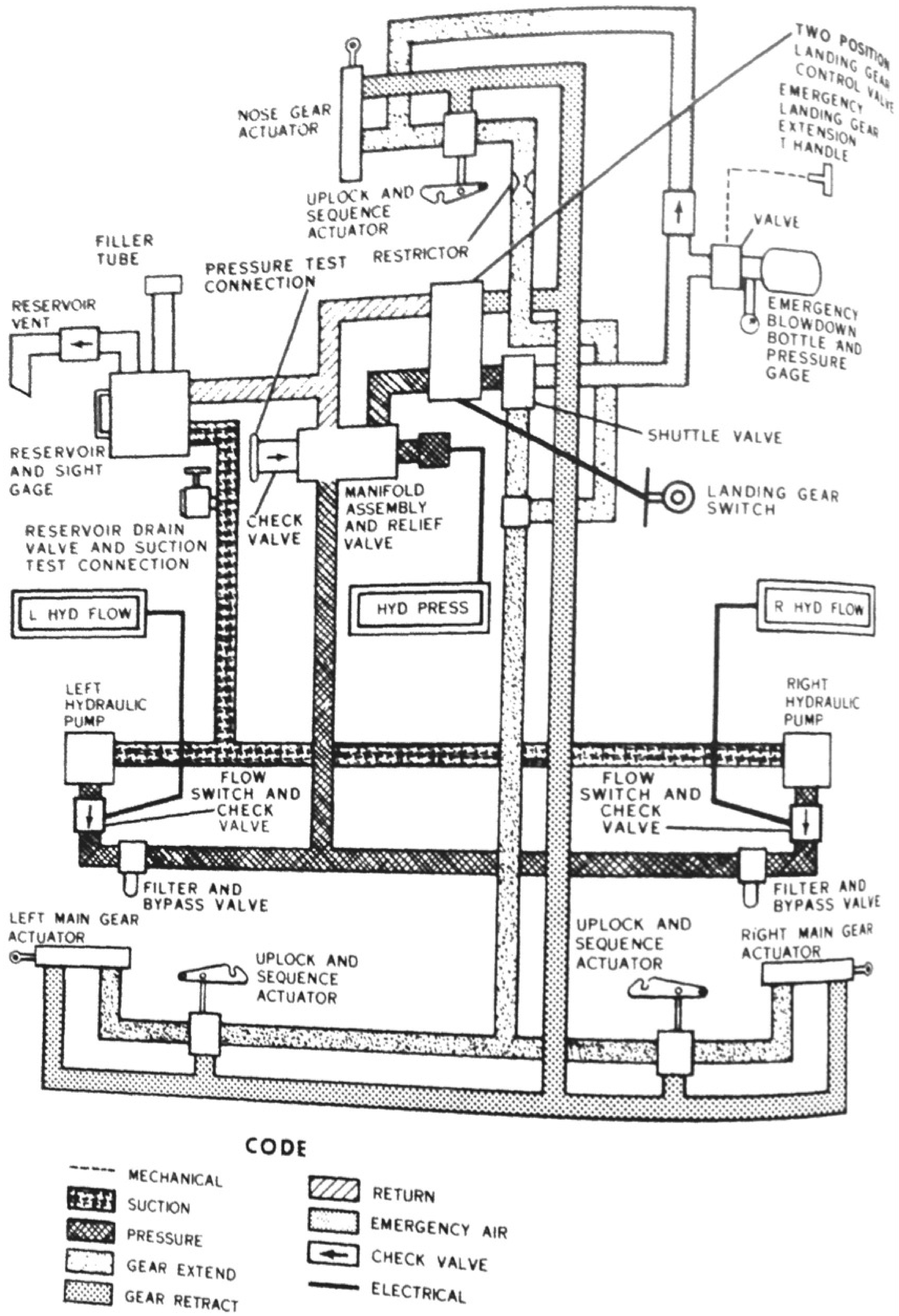



Figure 7-14

## LANDING GEAR HYDRAULIC SYSTEM

Hydraulic pressure at 1750 psi is supplied on demand by the hydraulic pump which is mounted on each engine, see Figure 7-14. The hydraulic reservoir, located in the nose baggage compartment, see Figure 7-15, incorporates a sight gage for checking the fluid level while the gear is extended. An electrically actuated gear control valve controls the flow of hydraulic fluid to the individual gear cylinders. The gear control valve receives power through the landing gear position switch. The landing gear completes the retraction cycle in approximately 4.5 seconds at maximum engine RPM. The actuation cycle time increases as engine RPM decreases or with the loss of an engine-driven hydraulic pump.

## HYDRAULIC RESERVOIR SIGHT GAGE AND EMERGENCY BLOW DOWN BOTTLE PRESSURE GAGE

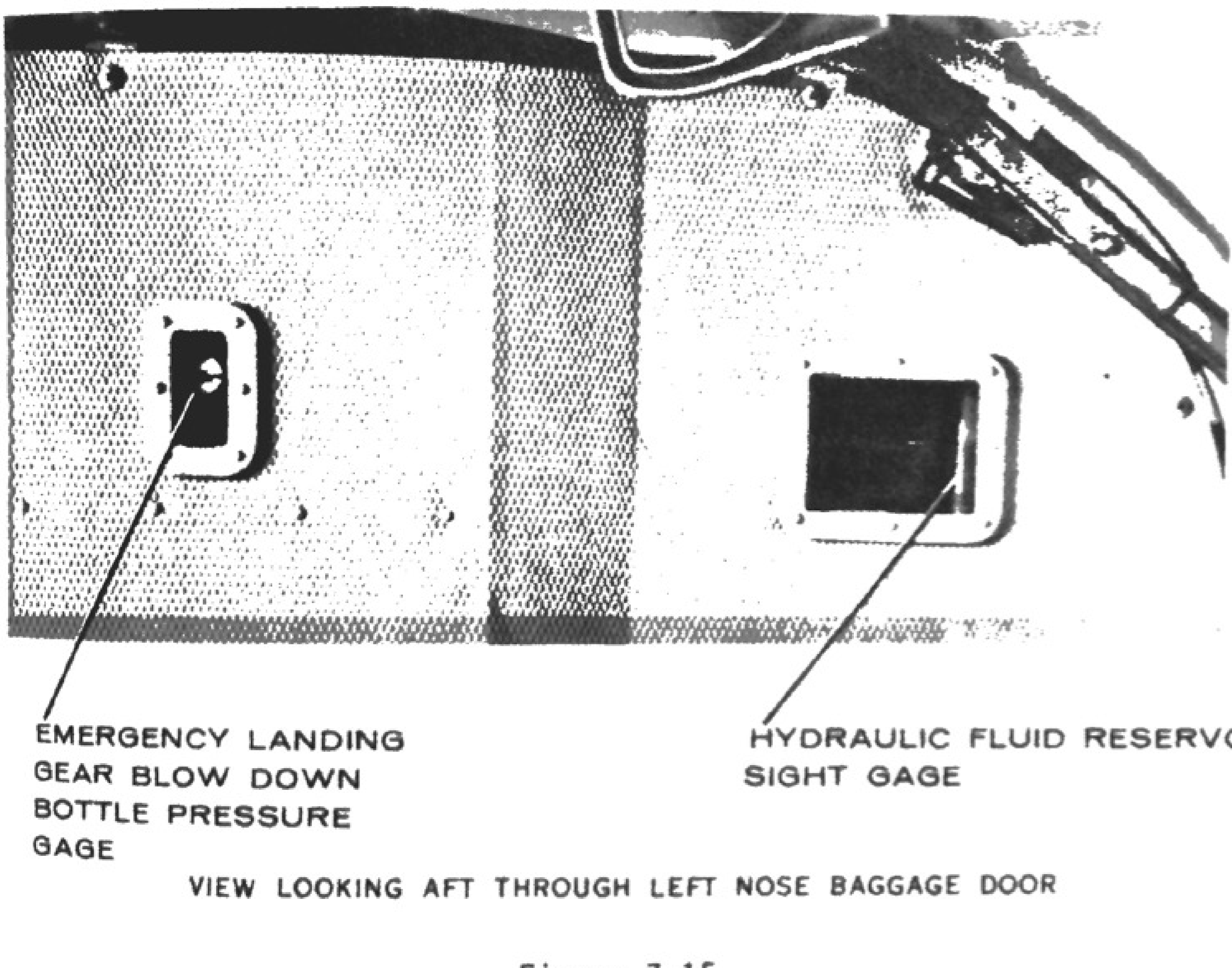



Figure 7-15

## LANDING GEAR POSITION LIGHTS

Four landing gear position indicator lights, see Figure 7-16, are contained in two modules located beneath the avionics control panel just left of the center of the instrument panel. One module contains three of these lights (one for each gear) which are green and will illuminate when each landing gear is fully extended and locked. The other light module is red and will illuminate when any or all the gears are unlocked (intermediate position). When the gear unlocked light and gear down lights are not illuminated, the landing gear is in the UP and locked position. Refer to Section 8 for bulb replacement.

## LANDING GEAR WARNING HORN

The landing gear warning horn is controlled by the throttles and the wing flap position. The warning horn will sound intermittently if either throttle is retarded below approximately 15.0 inches Hg. manifold pressure with the landing gear retracted or if the wing flaps are lowered past the 15° position with the landing gear in any position except extended and locked. The warning horn can be activated by either the wing flap position switch or by throttle position as each functions independently of the other. The warning horn is also connected to the UP position of the landing gear position switch and will sound if the switch is placed in the UP position while the airplane is on the ground. The system can be checked by activating the PRESS-TO-TEST button, see Figure 7-3, located near the annunciator panel while retarding one throttle at a time. Also, lowering the wing flaps past the 15° position with the PRESS-TO-TEST button activated will cause the landing gear warning horn to sound.

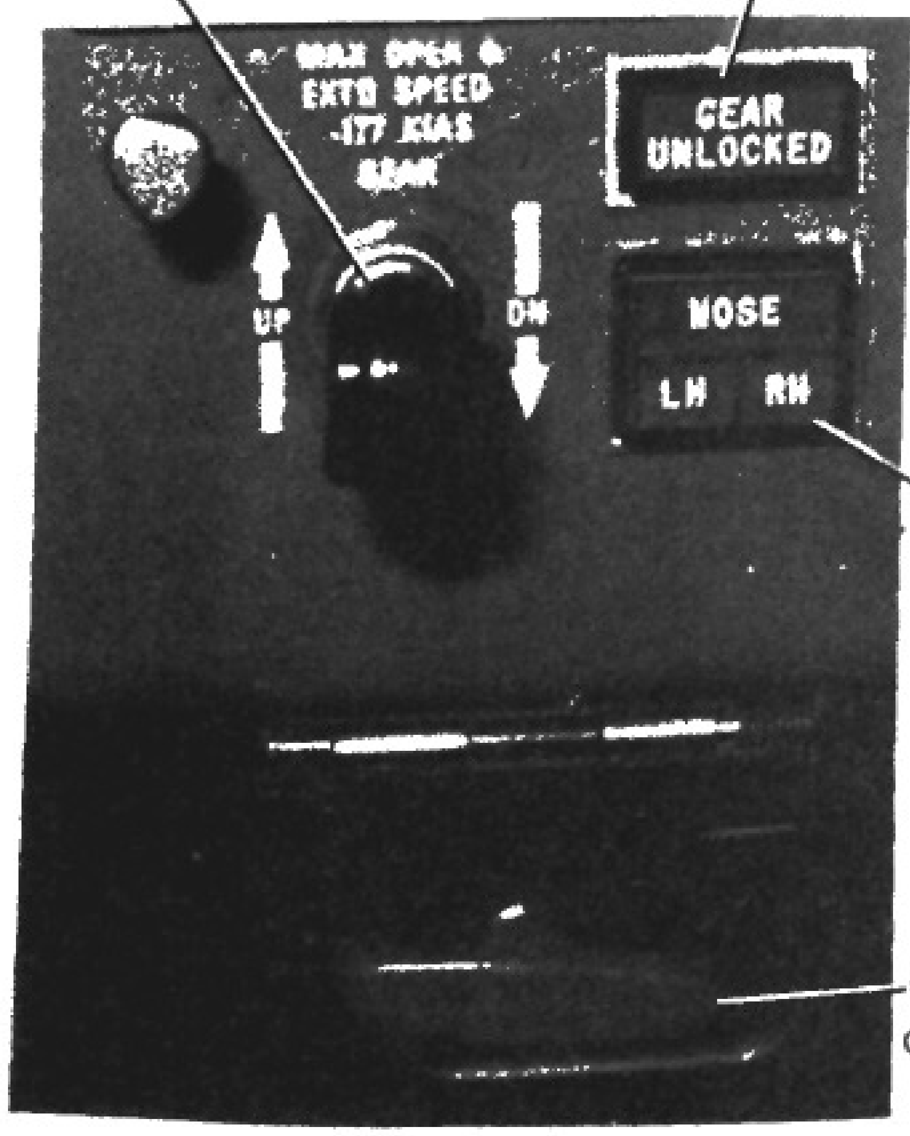
## LANDING GEAR EMERGENCY EXTENSION SYSTEM

The landing gear emergency extension system, see Figure 7-16, consists of a red emergency gear extension T-handle, a blowdown bottle, located in the nose baggage compartment, and associated plumbing. The procedure for emergency gear extension is given in Section 3. Pulling the emergency control releases dry nitrogen under pressure into the shuttle valve, causing the shuttle valve to move from the hydraulic to the air position. The nitrogen then flows into the uplocks which releases the gear to the free-fall position, and then into the landing gear cylinders, which drives the landing gear into the down and locked position.

## EMERGENCY LANDING GEAR EXTENSION SYSTEM

LANDING GEAR SWITCH

LANDING GEAR UNLOCKED INDICATOR LIGHT (RED)




LANDING GEAR DOWN POSITION LIGHTS (GREEN)

EMERGENCY GEAR CONTROL T-HANDLE

Figure 7-16





---NOTE---

The landing gear cannot be retracted after emergency gear extension until the system has been ground serviced.

## LANDING GEAR SHOCK STRUTS

Shock absorption is provided on each gear by an air-over-oil shock strut. This strut is composed of two basic parts: an upper barrel assembly and an inner tube assembly which fits inside the upper barrel assembly. The inner barrel assembly contains an orifice and tapered metering pin which vary the resistance to shock according to severity transmitted to the upper barrel assembly.

## FUEL SYSTEM

The fuel system, see Figure 7-17, consists of two main tanks, two fuel selectors, emergency crossfeed shutoff valves and necessary components to complete the system.

### MAIN TANKS

The main fuel tanks are an integral portion of the sealed wet wing. These tanks supply their respective engine with fuel for normal operations, including takeoffs and landings. An auxiliary fuel pump, located outside the tank, provides fuel pressure for priming during engine start. In the event of an engine fuel pump failure, the auxiliary fuel pump will supply fuel to the engine if the auxiliary fuel pump switches are on. The main tank is vented to the atmosphere by a combination flush vent and a .50-inch diameter drain located on the lower surface of the wing. The flush mounted vent eliminates the need for heated vents. The fuel tanks are serviced through a flush filler located in the top surface of each wing.

### FUEL SELECTORS

Two fuel selectors, one for each engine, are provided on the floor between the pilot and copilot seats. The selectors allow selection of main fuel, crossfeed and off.

During normal flight operations, position the left fuel selector to LEFT MAIN and the right fuel selector to RIGHT MAIN. This allows fuel to flow from each main tank, through the fuel selector, to the respective engine-driven fuel pump. Fuel may be crossfed from the left main tank to the right engine or from the right main tank to the left engine. Both engines will be supplied with fuel from the right main tank when both fuel selectors are positioned to RIGHT MAIN. Conversely, both engines will be supplied with fuel from the left main tank when both fuel selectors are positioned to LEFT MAIN. The crossfeed function is used for balancing asymmetric fuel loads and supplying the engine-driven fuel pump from the

# FUEL SYSTEM SCHEMATIC

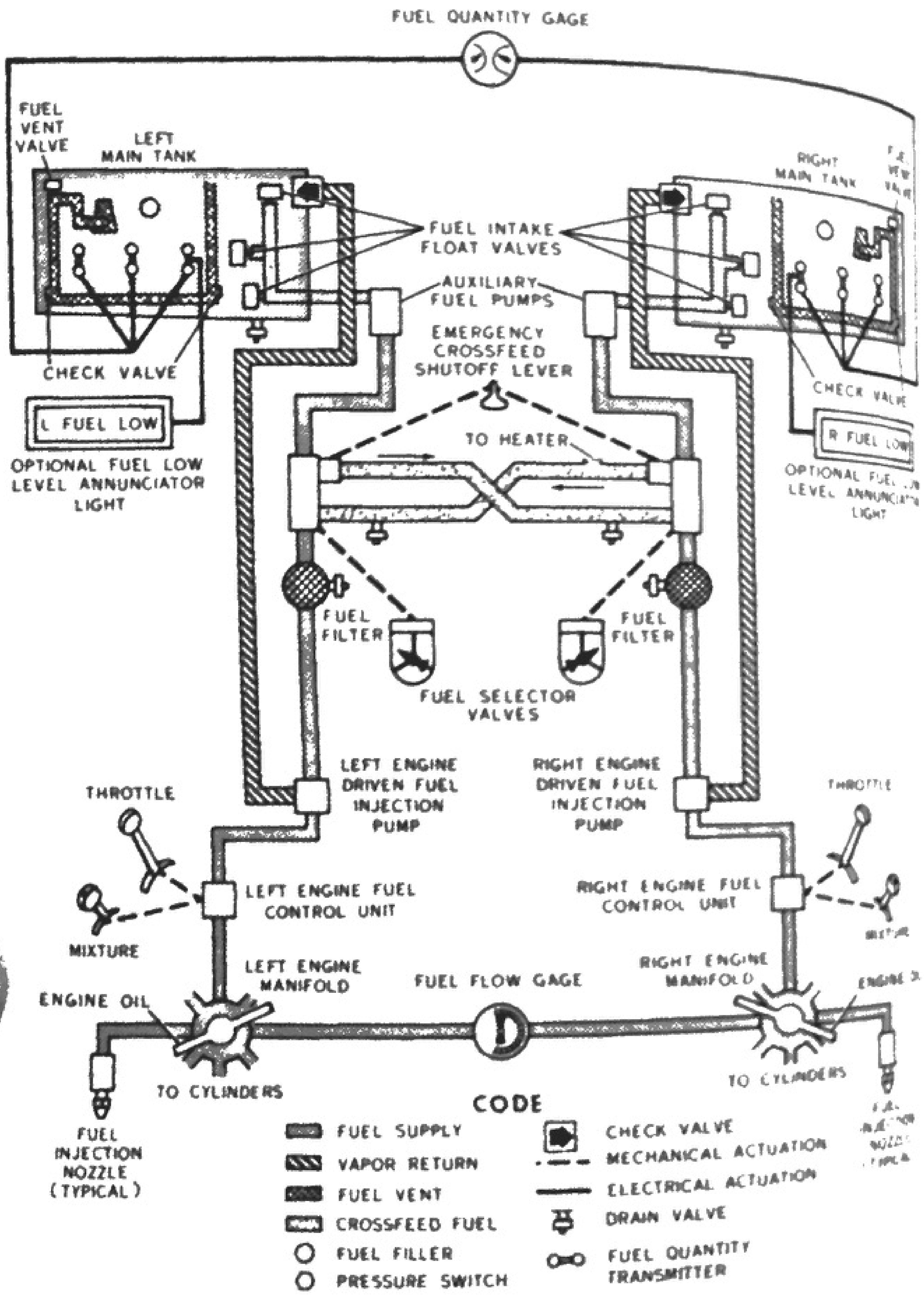



Figure 7-17





opposite main tank. The LEFT ENG OFF position or RIGHT ENG OFF position (the center button must be depressed as the selector valve is rotated to the off position) on the fuel selectors allows no fuel to flow to the engine-driven fuel pump.

The fuel selector handles form the pointers for the selectors. The ends of the handles are arrow-shaped and point to the position on the selector placard which corresponds to the position of the control valves.

## EMERGENCY CROSSFEED SHUTOFF LEVER

A two-position emergency crossfeed shutoff lever is located between the fuel selector handles. When the shutoff lever is pulled up, crossfeeding of main tank fuel and heater operation is stopped. This lever is for emergency crossfeed control only, since its function is to isolate the fuel crossfeed lines from the fuel tanks in the event of a nacelle, wing or center section fire or a wheels up landing.

## AUXILIARY FUEL PUMP SWITCHES

A 3-position auxiliary fuel pump switch, see Figure 7-19, is provided for each main fuel tank pump providing 5.5 PSI pressure for vapor clearing and purging. In the LOW position, the auxiliary fuel pumps operate at low speed. The ON position runs the auxiliary fuel pumps at low speed, as long as the engine-driven pumps are functioning. With an engine-driven pump failure and the switch in the ON position, the auxiliary pump on that side will switch to high speed automatically, providing sufficient fuel for all partial-power engine operations.

## FUEL DRAIN VALVES

Fuel quick-drain valves are provided for each fuel tank, fuel filter and crossfeed line. The drains provide a location for removing moisture and sediment from the fuel system. The drains, located on the lower surface of the main tanks, are actuated by depressing the lower portion of the valve. A special screwdriver is provided with the airplane which allows a 2-ounce sample to be drained and inspected without fuel spillage.

## FUEL FLOW GAGE

The fuel flow gage, see Figure 7-1, is a dual instrument which indicates the approximate fuel consumption of each engine in pounds per hour. The fuel flow gage used with the injection system senses the pressure at which fuel is delivered to the engine spray nozzles. Since fuel pressure at this point is approximately proportional to the fuel consumption of the engine, the gage is marked as a flowmeter.

The gage dial is marked with arc segments corresponding to proper fuel flow for various power settings and maximum power altitudes and is used as a guide to quickly set the mixtures. These gage markings are predicated on the use of 100 grade aviation fuel. Increase fuel flow 2% above markings when 100LL grade aviation fuel is used.

The gage has takeoff, climb and cruise markings for various percentages of power. The takeoff range (white arc) presents the desired fuel flow (full rich schedule for proper engine cooling) for full power (2700 RPM and 38.0 inches Hg. manifold pressure) operation under all conditions up to

20,000 feet altitude. A white triangle represents the desired fuel flow for maximum normal operating power (38.0 inches Hg. at 2600 RPM) for operation at all conditions up to 20,000 feet altitude. The climb range (blue segments) presents the desired fuel flow for best power mixture at 75% power with an enriched mixture for higher power settings to allow proper engine cooling during climb conditions. The cruise range presents the desired fuel flow for recommended lean mixture at the specified percent power.

## FUEL QUANTITY GAGE

The dual indicating fuel quantity gage, see Figure 7-1, is calibrated in pounds and will accurately indicate the weight of fuel contained in the tanks regardless of whether 100 grade aviation or 100LL grade aviation fuel is used; however, fuel density varies with temperature, therefore a full tank will weigh more on a cold day than on a warm day. This will be reflected by the weight shown on the gage. A gallons scale is provided in blue on the indicator for convenience in allowing the pilot to determine the approximate volume of fuel on board. The volume markings are predicated on the use of 100 grade aviation fuel. Reduce the indicated gallonage reading by 4% when 100LL grade aviation fuel is used.

## FUEL LOW LEVEL WARNING LIGHTS

The optional fuel low level warning lights, see Figure 7-3, provide a warning when the left and/or right main tanks contain approximately 60 pounds of fuel. The warning is provided by the L FUEL LOW and R FUEL LOW lights located on the annunciator panel. These lights are actuated by a float switch located in each main fuel tank. Each light operates independently from the fuel quantity indicating system.

## ENGINE-DRIVEN FUEL PUMPS

Each engine is equipped with a mechanically driven fuel pump which provides fuel to the metering unit. Each pump also contains a bypass which returns excess fuel and vapor to the main tanks at all times. Should these pumps fail, the main tank auxiliary pumps can provide sufficient fuel flow for all partial-power engine operations. These auxiliary pumps, however, operate at a fixed pressure, consequently the mixture must be leaned when operating at a low power setting to prevent flooding in the engines. Conversely, if an engine-driven pump failure should occur during high power operation, adequate fuel flow may not be available to insure rated power and adequate engine cooling.

# BRAKE SYSTEM

The airplane is provided with an independent hydraulically actuated brake system for each main wheel. A hydraulic master cylinder is attached to each pilot's rudder pedal. Hydraulic lines and hoses are routed from each master cylinder to the wheel cylinder on each brake assembly. No manual adjustment is necessary on these brakes. The brakes can be operated from either pilot's or copilot's pedals. The parking brake system consists of a manually operated handle assembly, see Figure 7-1, connected to the parking brake valves located in each main brake line. When pressure is applied to the brake system and the parking brake handle is pulled, the valve holds pressure on the brake assemblies until released. To release the parking brakes, push the parking brake handle in. It is not necessary to depress the rudder pedals when releasing the parking brake.





# ELECTRICAL SYSTEM

Electrical energy, see Figure 7-18, is supplied by a 28-volt, negative-ground, direct current system powered by an alternator on each engine. The electrical system has independent circuits for each side with each alternator having its own regulator and overvoltage protection relay. The voltage regulators are connected to provide proper load sharing. A 24-volt battery is located in the left stub wing. Immediate detection of low system voltage is provided by a LOW VOLT light on the annunciator panel, see Figure 7-3. The light will illuminate when the airplane bus voltage decreases below approximately 25 volts.

NOTE

> Insure all circuit breakers are engaged and serviceable fuses are installed before all flights. Never operate with any blown fuses or disengaged circuit breakers without a thorough knowledge of the consequences.

## BATTERY AND ALTERNATOR SWITCHES

Separate battery and alternator switches, see Figure 7-19, are provided as a means of checking for a malfunctioning alternator circuit and to permit such a circuit to be turned off. If an alternator circuit fails or malfunctions, or when one engine is not running, the switch for that alternator should be turned off. Operation should be continued on the functioning alternator, using only necessary electrical equipment. If both alternator circuits should malfunction, equipment can be operated at short intervals on the battery alone. In either case, a landing should be made as soon as practical to check and repair the circuits.

## EMERGENCY POWER ALTERNATOR FIELD SWITCH

An emergency power alternator field switch, see Figure 7-19, is located on the aft top side of the side console. The switch is used when the alternators will not self-excite. Placing the switch in the ON position provides excitation from the battery even through the battery is considered to have failed.

## OVERVOLTAGE RELAYS

Two overvoltage relays in the electrical system constantly monitor their respective alternator output. Should an alternator exceed the normal operating voltage, the overvoltage relay will trip, taking the affected alternator off the line. The overvoltage relay can be reset by cycling the applicable alternator switch.

## VOLTAMMETER

A voltammeter, see Figure 7-19, located on the left side console, is provided to monitor alternator current output, battery charge or discharge rate and bus voltage. A selector switch, see Figure 7-19, labeled L ALT, R ALT, BATT, and VOLTS is located to the left of the voltammeter. By positioning the switch to L ALT, R ALT, or BATT position, the respective alternator or battery amperage can be monitored. By positioning the switch to the VOLTS position, the electrical system bus voltage can be monitored.

# ELECTRICAL SYSTEM SCHEMATIC



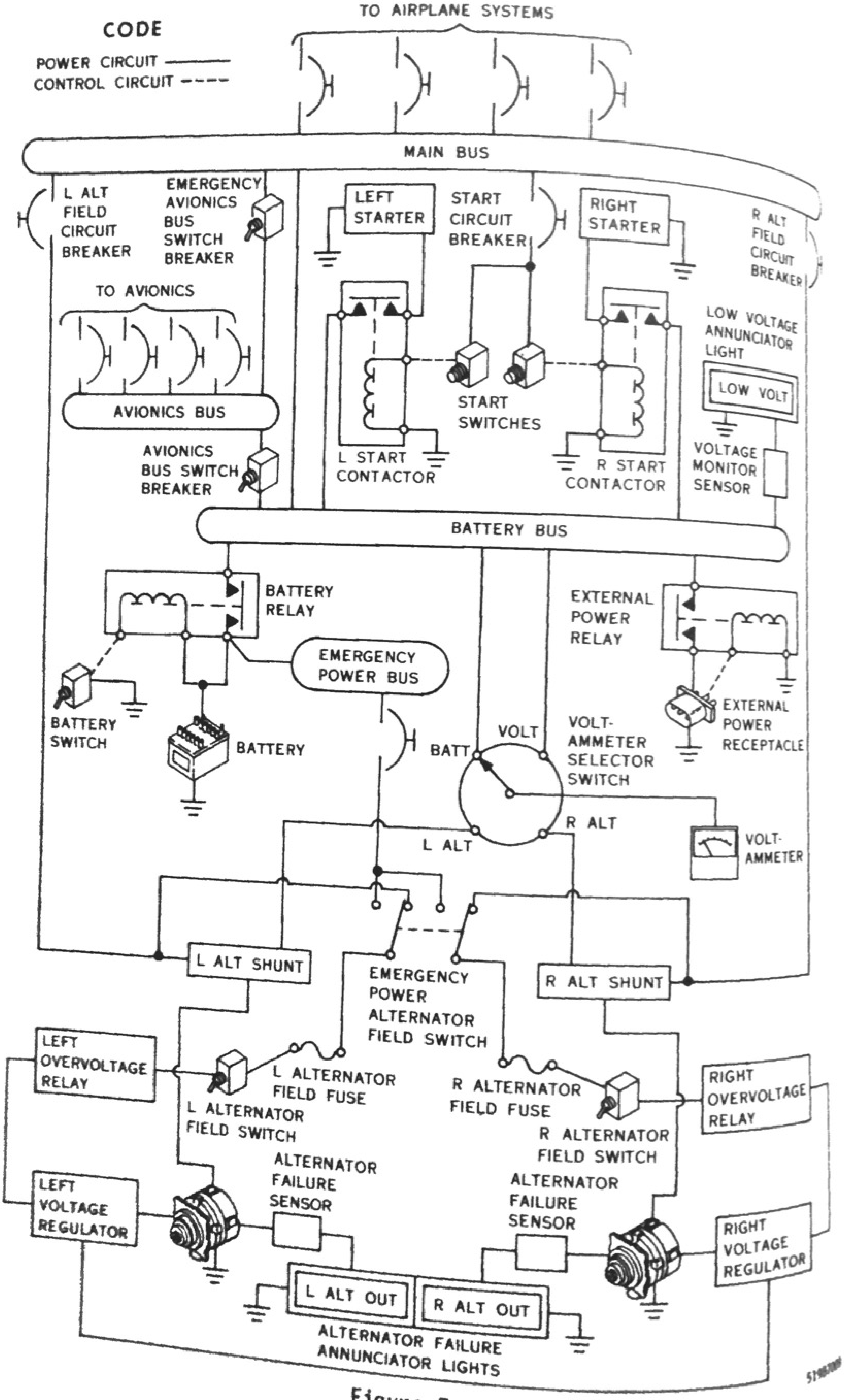
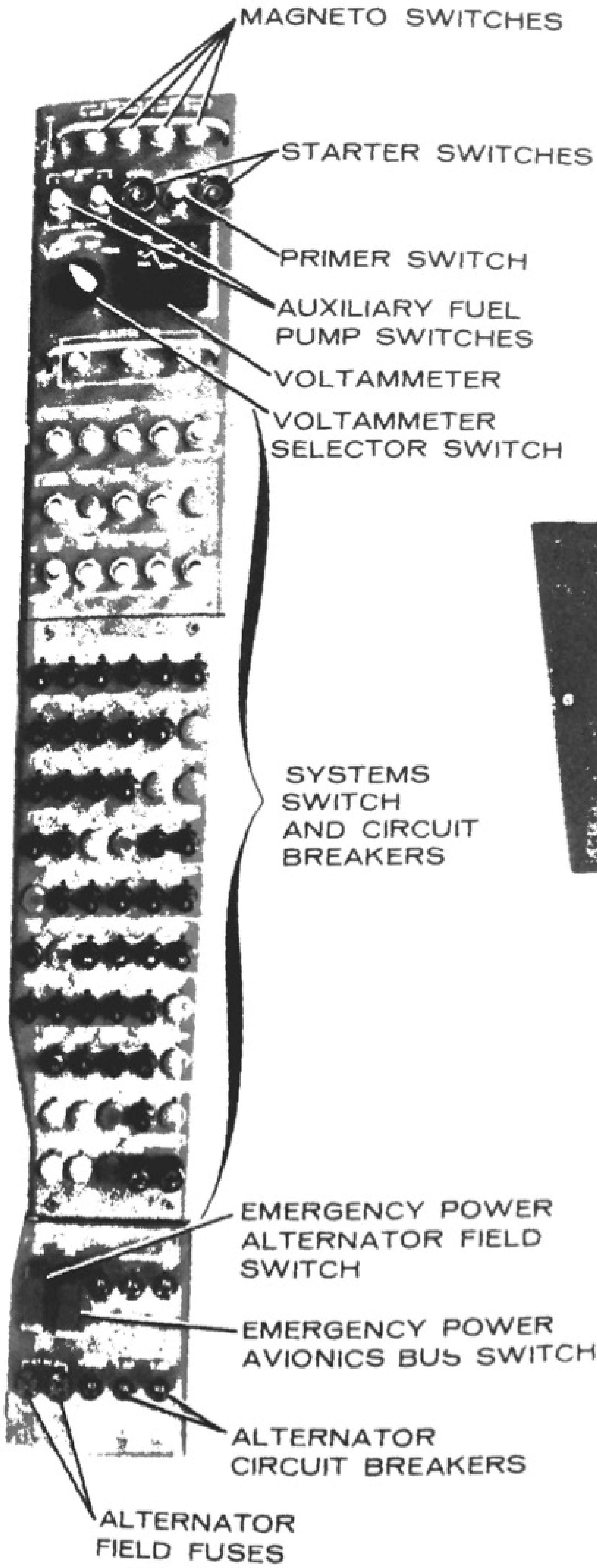
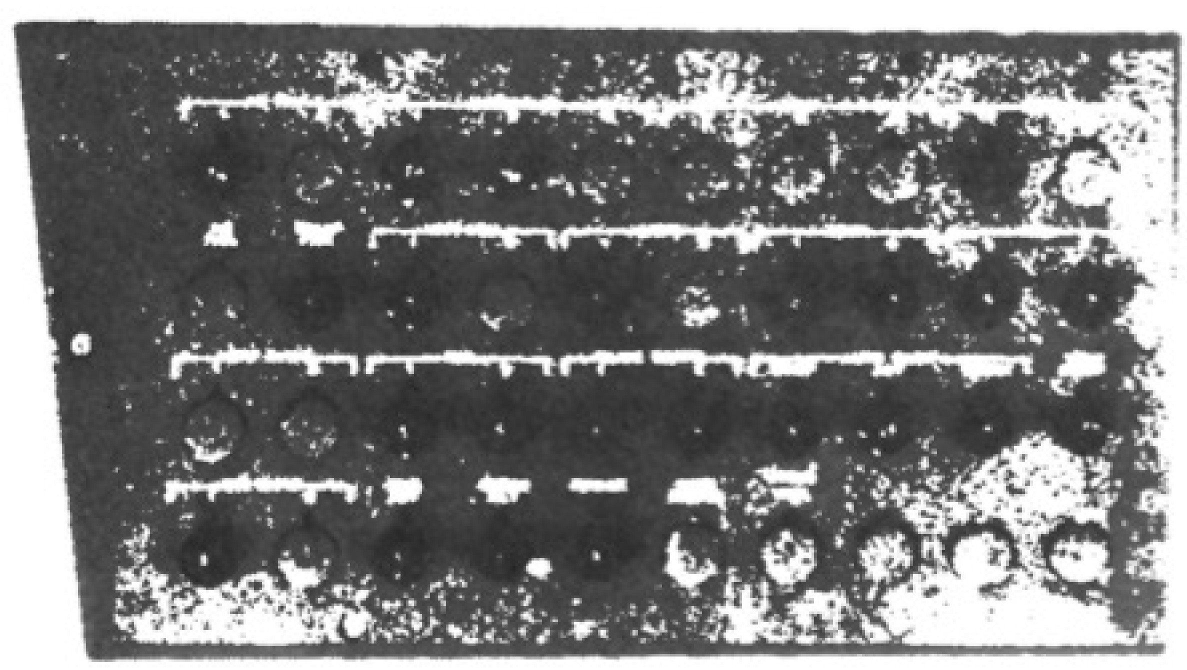



Figure 7-18

# LEFT AND RIGHT SIDE CONSOLES




LEFT SIDE



RIGHT SIDE

Figure 7-19

## CIRCUIT BREAKERS AND SWITCH BREAKERS

All electrical systems in the airplane are protected by push-to-reset type circuit breakers or switch breakers, see Figure 7-17. Should an overload occur in any circuit, the resulting heat rise will cause the controlling circuit breaker to "pop" out, opening the circuit or allowing the switch breaker to return to the OFF position. After allowing to cool for approximately three minutes, the circuit breaker may be pushed in (until a click is heard or felt) or the switch breaker may be returned to the ON position to reenergize the circuit. However, the circuit breaker should not be held in nor the switch breaker forced to remain in the ON position if it opens the circuit a second time as this indicates a short circuit.

## EXTERNAL POWER RECEPTACLE

An optional external power receptacle may be installed in the left wing aft nacelle fairing. The receptacle accepts a standard external power source plug.

# LIGHTING SYSTEM

## EXTERNAL LIGHTING

The airplane is equipped with four navigation lights, two retractable landing lights (right light is optional), an optional taxi light, two anti-collision lights and two optional wing deice lights. Refer to Section 8 for bulb replacement.

### Navigation Lights

The navigation lights are located in the tailcone stinger and in each wing tip assembly. These lights are energized with the navigation lights switch breaker on the side console, see Figure 7-19. Proper operation can be checked by observing reflections on the ground below the tail light and from objects surrounding the airplane.

### Landing Lights

The retractable landing lights (right light is optional) are located in the lower surface of the wing tips. These lights are extended, retracted and illuminated by the landing light switch breaker on the side console, see Figure 7-19. With the switch positioned to LDG, the landing lights will extend and illuminate. In the off (center) position, the lights will remain extended but will not illuminate. In the RETRACT position, the lights will retract flush with the respective wing tip.

### Taxi Lights

The optional taxi light, attached to the nose gear, provides adequate illumination for night taxiing. The taxi light is controlled by the taxi light switch breaker on the side console, see Figure 7-19.





### Anti-Collision Lights

The anti-collision lights, with individual power supplies, are located in the wing tips. These lights are actuated by the anti-collision light switch breaker on the side console, see Figure 7-19.

**NOTE**

Do not operate the anti-collision lights in conditions of fog, clouds or haze as the reflection of the light beam can cause disorientation or vertigo.

### Wing Deice Lights

The optional wing deice lights are installed in the outboard side of each engine nacelle and illuminate the outboard wing leading edge deice boots. The lights allow the pilot to check for ice accumulation on the wing leading edges. The lights are actuated by the deice light switch breaker on the side console, see Figure 7-19.

All exterior lighting should be checked for proper operation before night flying. Cockpit recognition of operational exterior lighting can be determined by looking for ground illumination by the various lights.

## INTERNAL LIGHTING

The airplane is equipped with lighting for baggage areas, cabin doorway, cockpit controls and indicators, cockpit illumination and cabin illumination.

## COCKPIT LIGHTING CONTROLS

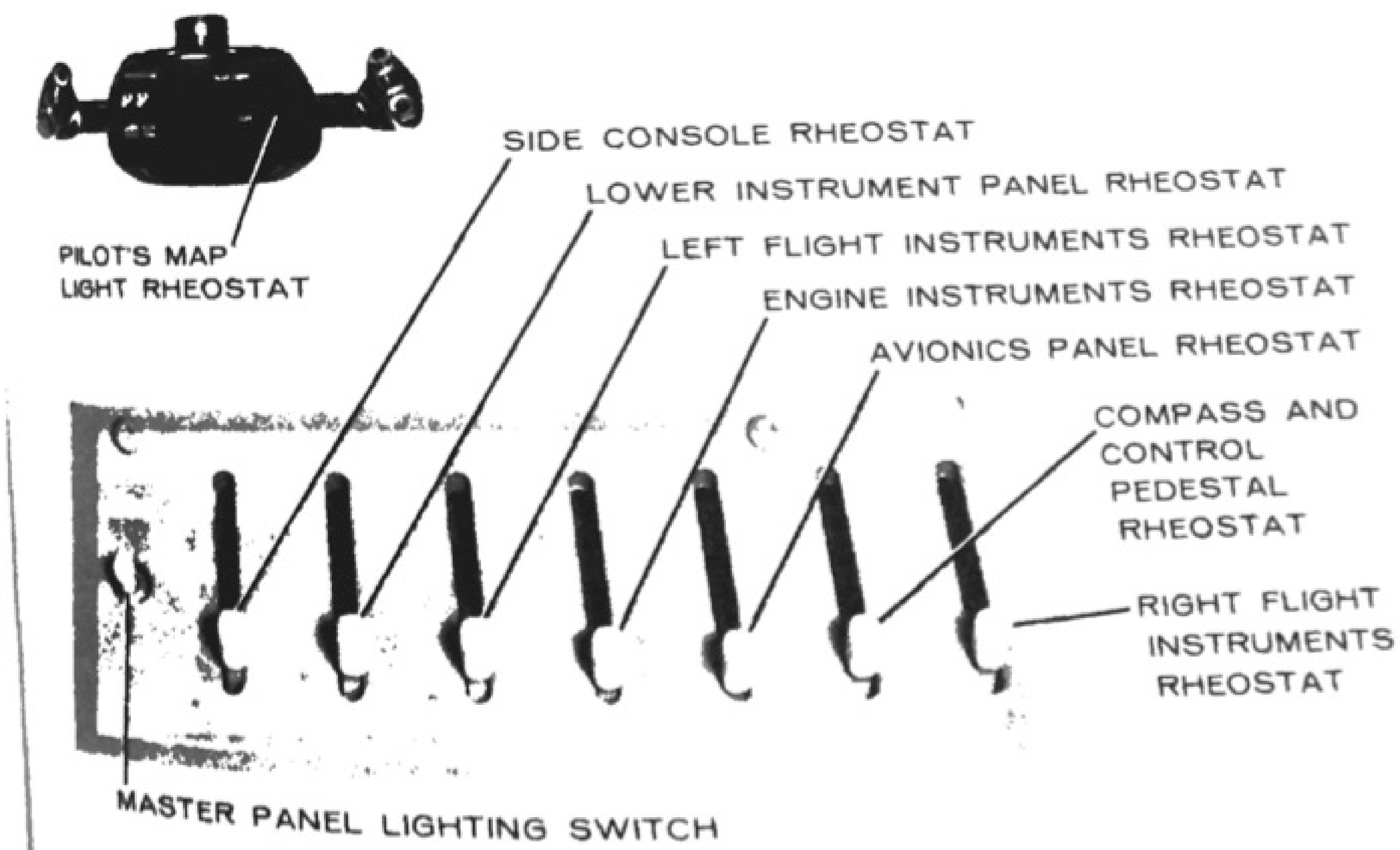



Figure 7-20

Optional baggage area lights are provided for both wing lockers and the nose baggage areas. The lights are actuated when the applicable baggage door is opened and extinguish when the door is closed.

The cabin doorway and instrument panel floodlight provides adequate illumination for night boarding. These lights are controlled by a switch immediately inside the cabin doorway, see Figure 7-21, or by a switch on the instrument panel, see Figure 7-1. An optional timer is available which will automatically extinguish the cabin doorway and instrument panel floodlights 15 minutes after leaving the airplane if the lights were not switched off. The system operation is as follows:

1. The cabin doorway and instrument panel floodlights can be actuated by either of the two switches described above. Any time the lights come on, the timer begins to count down for 15 minutes.
2. With the cabin door closed, the lights will operate in a normal fashion (i.e., lights out, movement of either switch turns lights on; lights on, movement of either switch turns lights off), unless the timer has extinguished the lights, thus requiring cycling of either switch to turn the lights on again.
3. Opening the door will turn the lights on unless the timer extinguished the lights, in which case, one movement of the door switch is also required in order to turn the lights on.
4. With the cabin door open, the lights will always be on unless the timer has turned them off. Movement of the door switch is required to reset the lights to on for an additional 15 minutes.
5. Closing the door will extinguish the lights only if the system is switched off. If the system is on, the timer must continue to run down to extinguish the lights.

## CABIN LIGHTING AND CONTROLS

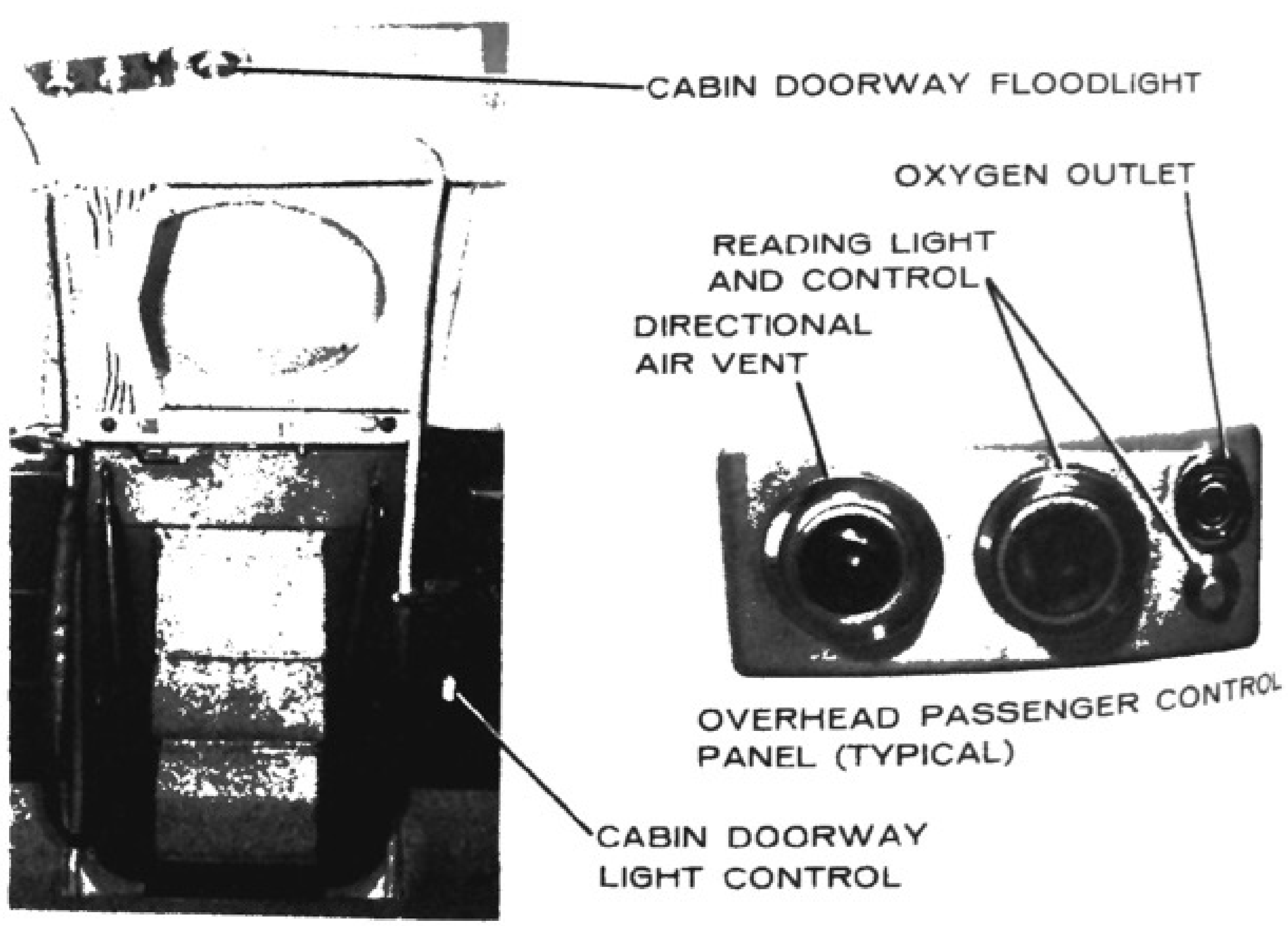



Figure 7-21





Cockpit lighting is provided by the instrument panel floodlight, instrument postlights and overhead map lights. All cockpit lights are variable intensity and are controlled by rheostats on the top of the control pedestal and pilot's control wheel, see Figure 7-20.

NOTE

> The master lighting switch must be positioned to DAY during daylight operations to insure maximum illumination of the annunciator panel lights.

Individual reading lights and controls, see Figure 7-21, are provided in the cabin for each passenger seat. Refer to Section 8 for bulb replacement.

## PITOT PRESSURE SYSTEM

The standard pitot pressure system, see Figure 7-22, consists of an electrically heated pitot tube mounted on the left side at the bottom of the fuselage nose, suitable plumbing and an airspeed indicator.

When the pitot heat switch is placed in the ON position, the heating elements in the pitot tube are electrically heated to maintain proper operation of the system during icing conditions. Do not operate for prolonged periods while on the ground to prevent overheating of the heating elements.

When the optional copilot's instruments are installed, a second pitot system is used. This second pitot head is located on the right side at the bottom of the fuselage nose and is connected to the copilot's airspeed indicator. This dual system allows a completely independent second presentation of airspeed pitot pressure. Pitot heat for the additional head is controlled by an additional pitot heat switch located adjacent to the standard pitot heat switch.

## STATIC PRESSURE SYSTEM

Static pressure for the pilot's airspeed, altimeter and rate-of-climb indicators, see Figure 7-22, is obtained by a normal external static source or an alternate internal static source should the external source fail.

A static source selector, installed in the static system directly below the parking brake handle, allows selection of the normal or alternate static source. When the selector is positioned to NORMAL, the pilot's instruments reference the static source located aft of the main cabin door. When the selector is positioned to ALTERNATE, the pilot's instruments reference the alternate static source in the nose compartment. Refer to Section 5 for airspeed and altimeter corrections when the static source is positioned to ALTERNATE. A drain valve is located behind the map pocket on the copilot's side.

CAUTION

> Do not open the drain valve while the cabin is pressurized as flight instrument damage will result.

When the optional copilot's instruments are installed, a second set of static ports are installed aft of the main cabin door below the standard static ports. The added static ports are manifolded together and are used as a reference for the copilot's instruments only. This dual system allows a completely independent second static pressure source. No alternate static source is provided for the copilot's instruments. Optional static port heaters are controlled by the stall and vent heat switch.

## PITOT STATIC SYSTEM SCHEMATIC

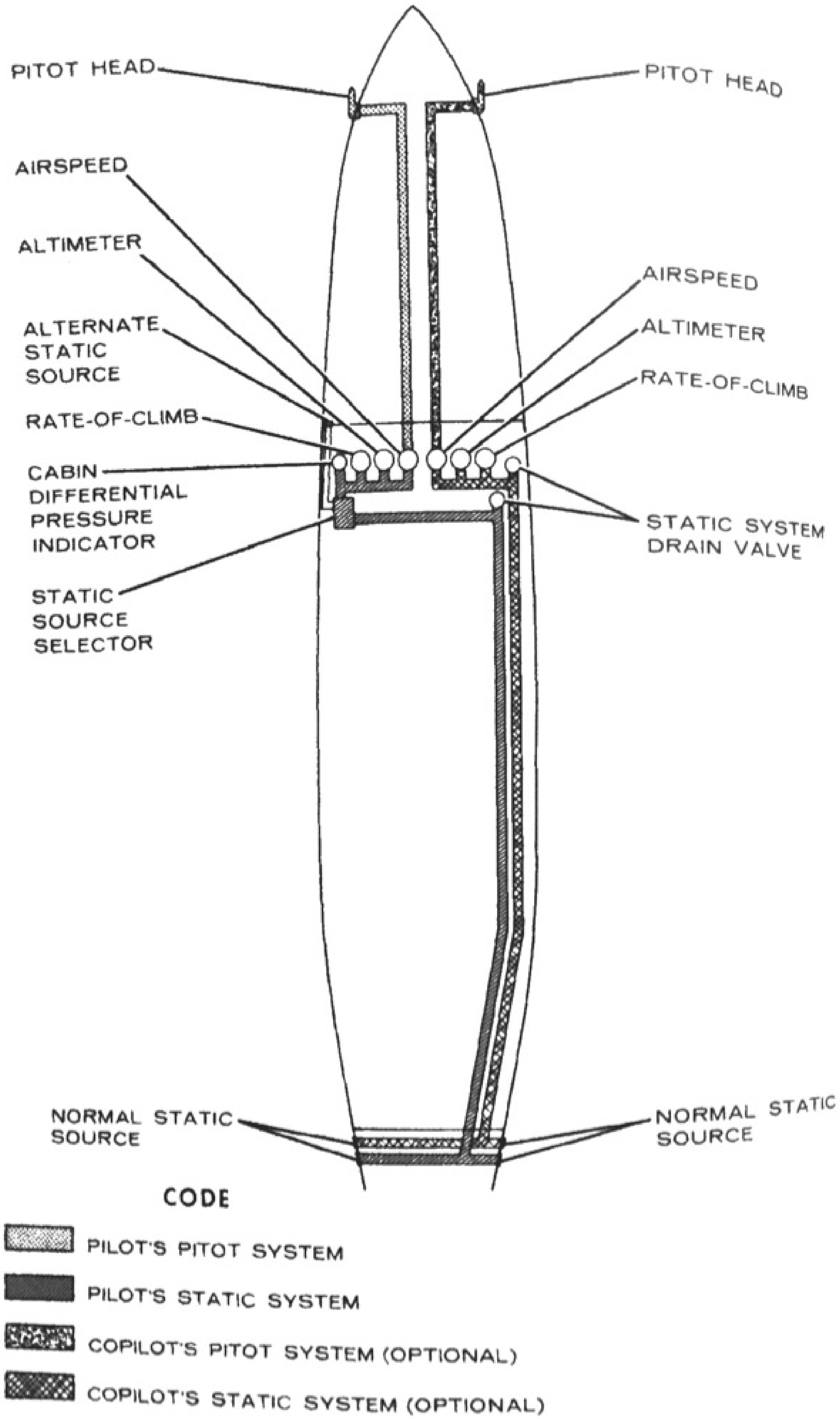



Figure 7-22





## VACUUM SYSTEM

A vacuum system, see Figure 7-23, is installed to provide a source of vacuum for the vacuum instruments. The system consists of an engine-driven vacuum pump on each engine, a pressure relief valve for each pump, a common vacuum manifold, a vacuum air filter, a suction gage and gyro instruments.

Each vacuum pump pulls a vacuum on the common manifold, exhausting the air overboard. The maximum amount of vacuum pulled on the manifold by each vacuum pump is controlled to a preset level by each pressure relief valve. Should either of the pumps fail, a check valve is provided in each end of the manifold to isolate the inoperative vacuum pump from the system.

The exhaust air side of each attitude gyro is connected to the vacuum manifold thus providing a smooth steady vacuum for the gyros. The vacuum pressure being applied to the gyros is constantly presented on the suction gage. This gage also provides failure indicators for the left and right vacuum pumps. These indicators are small red buttons located in the lower portion of the suction gage which are spring-loaded to the extended (failed) position. When normal vacuum is applied in the manifold, the failure buttons are pulled flush with the gage face. Should insufficient vacuum occur on either side, the respective red button will extend. No corrective action is required by the pilot, as the system will automatically isolate the failed vacuum source, allowing normal operation on the remaining operative vacuum pump.

The inlet air side of the attitude gyros are connected to a common vacuum air filter which cleans the ambient nose compartment air before allowing it to enter the gyros.

## FLIGHT INSTRUMENTS

The basic flight instruments, see Figure 7-1, consist of airspeed, altimeter and rate-of-climb indicators, electric turn-and-bank and vacuum horizon and directional gyros.

Operation of the airspeed, altimeter and rate-of-climb indicators can be determined by cross-checking the copilot's instruments, if installed. Also, when a climb or descent is initiated, these instruments should indicate the appropriate change. If no change is indicated, it is reasonable to assume static source blockage has occurred and the alternate static source should be selected. If the possibility of static source icing is present, actuation of the stall and vent heat switch might deice the static sources, allowing a return to the normal static source, if the optional heated static sources are installed. If only the airspeed indicator appears to be affected when the climb or descent is initiated, it is reasonable to assume a pitot system blockage has occurred. If the possibility of pitot source icing is present, actuation of the pitot heat switch will clear the ice blockage. Reference the optional copilot's instruments and optional angle-of-attack indicator for airspeed information until a reliable airspeed indication can be obtained. If neither optional system is installed, fly attitude and power references.

Operation of the turn-and-bank needle can be checked by initiating a standard rate turn and cross-checking the turn rate with the directional gyro. An indicated standard rate turn should show a turning rate of 3 degrees per second on the directional gyro. Pushing the PRESS-TO-TEST

# VACUUM SYSTEM SCHEMATIC

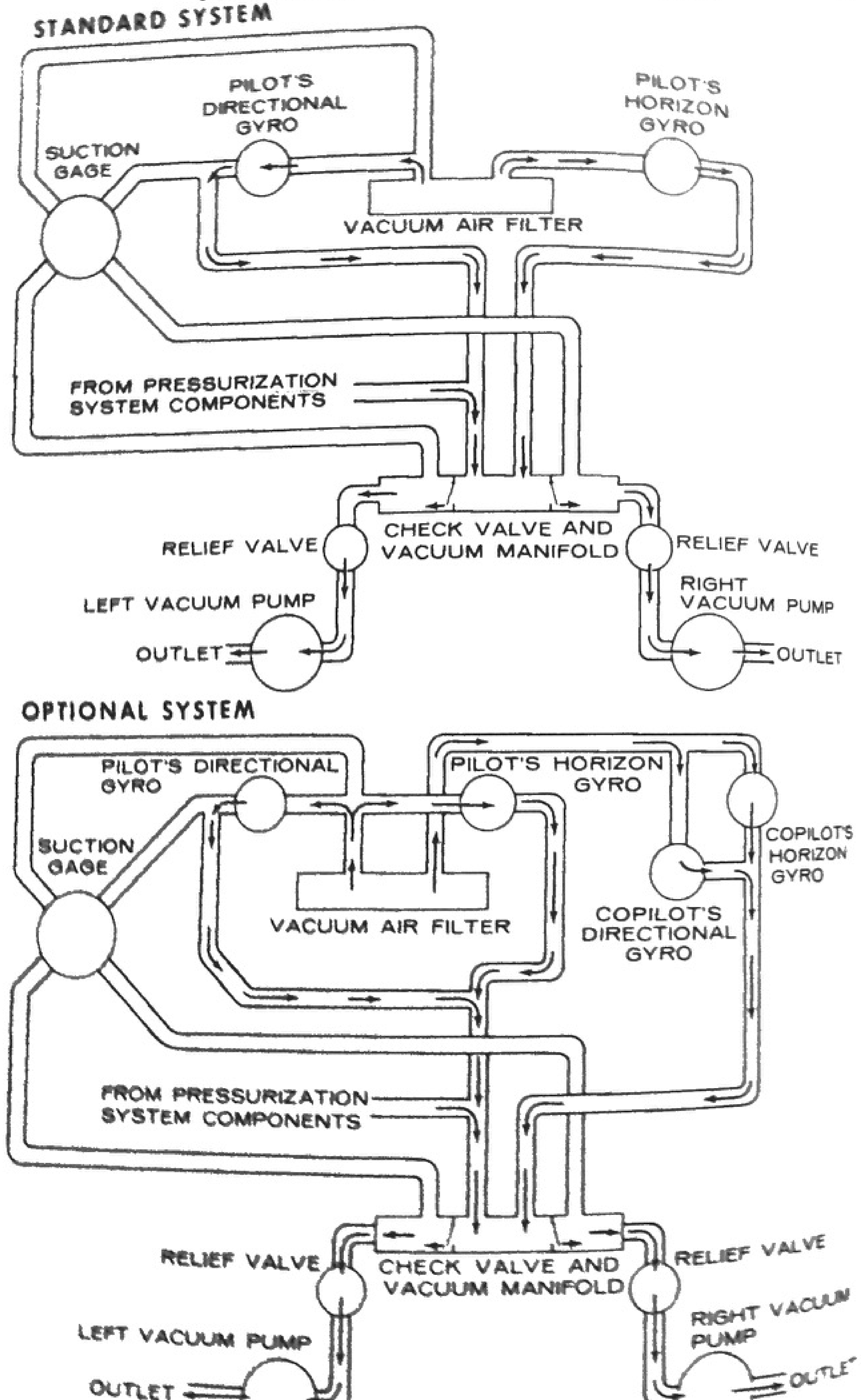



Figure 7-23





button adjacent to the annunciator panel will illuminate the T & B fail annunciator light if power is being applied to the turn and bank indicator. After shutdown of the airplane on the ground, abnormal noise coming from the turn-and-bank can indicate a near failure condition. The ball part of the turn-and-bank is virtually failure proof. Inaccuracy can result only if the indicator is not level in the instrument panel. With the airplane on level ground, the ball should be centered in the race.

Operation of the directional and horizon gyros can be checked during taxiing by watching for an abnormally slow erection rate and erratic operation. After shutdown of the airplane on the ground, abnormal noise coming from either gyro can indicate a near failure condition. Checking the suction gage for proper vacuum and no failure buttons exposed will assure proper gyro vacuum is available.

In flight, the directional gyro can be checked by flying a standard rate turn and observing the directional gyro for a turning rate of 3 degrees per second. Also, the precession rate in straight and level flight should not exceed 5 degrees in 10 minutes. The horizon gyro operation can be checked by establishing a level flight attitude; the gyro should indicate wings level within 1 degree. Initiate a 20-degree bank for a 180-degree turn, then smoothly return to level flight; gyro should indicate wings level within 3 degrees. Establish level flight at 150 KIAS; gyro should indicate level airplane within 1 degree. Smoothly pitch airplane nose down 15 degrees, then return to level flight; gyro should indicate level flight within 1 degree.

## STALL WARNING SYSTEM

A stall warning system is required equipment which consists of a stall warning transmitter vane located in the left outboard wing leading edge, a flight deck warning horn and the necessary wiring to complete the system.

The stall warning horn will sound 5 to 10 KIAS above the stall in all flight configurations. Proper operation of the warning system can be checked during preflight inspection by moving the stall warning vane, the horn should sound. Condition of the stall warning vane heater should also be checked during preflight by actuating the stall and vent heat switch and feeling the vane for heat.

## AVIONICS

### AVIONICS INTERFERENCE

NOTE

When tuned to a weak NAV signal, keying the COM transmitter may cause momentary interference within the NAV receiver causing a NAV flag to appear. Should circumstances warrant, ATC should be requested to assign another COM frequency.

### AVIONICS MASTER SWITCHES

Two optional avionics master switches are provided with factory installed avionics. The master switch breaker, labeled [illegible], is located on the top forward section of the side console, see Figure 7-19. This switch supplies power from the battery bus through a circuit breaker located forward of the battery box to the individual avionics circuit breakers and is used for all normal operations. An emergency power avionics bus switch breaker labeled EMER POWER AVIONICS BUS is located in the lower section of the outside console and is protected by a red switch guard cover, see Figure 7-19. This switch supplies power from the alternator bus to the individual avionics circuit breakers. The emergency power avionics bus switch is recommended for use only when the avionics bus switch associated wiring or battery circuits become inoperative.

# CABIN FEATURES

## CABIN FIRE EXTINGUISHER (If Installed)

A portable 2-1/2 pound Halon 1211 fire extinguisher is provided in case of an inadvertent cabin fire. The fire extinguisher, located beneath the copilot's chair, should be checked prior to each flight to ensure that bottle pressure, as indicated by the gage on the bottle, is within the green arc (approximately 125 PSI). To operate the bottle:

1. Loosen the retaining clamp and remove extinguisher from bracket.
2. Hold bottle upright, pull retaining pin, and press lever to discharge.

NOTE

- Begin discharge 5 feet from fire, at base of the flame, and sweep as required across the flame.
- Extinguisher should be recharged after each use.

# ENGINES

The airplane is equipped with two, 6-cylinder, turbocharged fuel-injected engines with provisions for cabin pressurization. Each engine is rated at 310 horsepower at 2700 RPM and 38.0 inches Hg. manifold pressure. Each engine is provided with an oil pump, fuel pump, vacuum pump, propeller governor, tachometer generator, starter and alternator.

## ENGINE CONTROLS

The control pedestal contains all engine controls except the alternate air controls. The three primary engine controls are in groups of two at the top of the pedestal; starting from left to right they are: (1) throttle, (2) propeller and (3) mixture.

### Throttle Control

The throttle control lever, see Figure 7-1, is used to increase or decrease the engine power by moving the butterfly valve in the fuel-air control unit.

### Propeller Control

The propeller control lever, see Figure 7-1, is used to change the propeller pitch to maintain or set a desired engine RPM.

### Mixture Control

The mixture control lever, see Figure 7-1, is used to control the amount of fuel to be metered by the fuel-air control unit.

### Quadrant Friction Lock

A quadrant friction lock, see Figure 7-1, is provided to prevent the three primary engine controls (six total levers) from creeping once they have been set. The locking knob (approximately one and one-half inches in diameter) is located on the right side of the pedestal.





### Cowl Flap Control

Two cowl flap controls, see Figure 7-1, are located just below the rudder trim tab wheel; one control for each engine. These controls are used to set the cowl flaps in any position from full open to full closed. A locking feature is provided for each control to prevent inadvertent cowl flap position change. Rotating the control clockwise engages the locking mechanism.

### Alternate Air Controls

An alternate air control is provided for each engine, see Figure 7-1. These mechanically actuated, two-position controls are located on the instrument panel below the pilot's control wheel. Normally, the controls are pushed in, providing cold filtered ram air to the engines. When the controls are pulled fully out, warm unfiltered air from inside the cowling is provided to the engines. A locking feature is provided for each control to prevent inadvertent alternate air control position change. Rotating the control clockwise engages the locking mechanism.

### Oil Heated Manifold Valve

The fuel manifold valves are heated with engine oil to reduce the possibility of engine power loss induced by ice formation in the valve cavity. The manifold valve, located on the top of the engine case, regulates metered fuel distribution to the injector nozzles.

## ENGINE OIL SYSTEM

The engines installed in the airplane have a wet sump type, pressure lubricating system. Oil temperature is controlled by a thermally operated valve which either routes oil through the externally mounted cooler or bypasses the oil around the cooler. Oil is routed through internal passages to all moving parts of the engine which require lubrication.

In addition to providing lubrication and cooling for the engine, the oil is used for control of the propeller, actuating the turbocharger waste gate and for lubricating the turbocharger.

Oil pressures from both engines are routed into the fuselage, to the left and right engine gages, see Figure 7-1, where direct oil pressure readings are mechanically displayed. The oil temperatures of both engines are measured on the output side of the oil coolers. The measurements are electrically transmitted to the left and right engine gages where the oil temperatures are displayed.

## IGNITION SYSTEM

Each engine is equipped with a dual ignition system. The ignition systems are entirely independent from each other such that a failure of any part of one system will have no effect on the other system. Each system consists of a magneto located on the rear engine accessory case, ignition harness to distribute the electrical energy and a spark plug in each engine cylinder. The left magneto fires the lower right and upper left spark plugs while the right magneto fires the upper right and lower left spark plugs. When the primary circuit of each magneto is electrically grounded by placing the magneto switch in the OFF position, the magneto will not produce a spark. With the magneto switch positioned to ON, the primary magneto circuit is ungrounded, allowing a high voltage spark to be produced to fire the spark plugs. During engine starting, a high voltage vibrator supplements the magneto spark to assure a fast start.

## FUEL INJECTION SYSTEM

Fuel is supplied to the engine using a low-pressure injection system. The fuel is injected into the cylinder head adjacent to the intake valve on all cylinders. This continuous flow type injection system controls fuel flow to match engine airflow. A manual mixture control and a flow gage, see Figure 7-1, indicating fuel flow are provided for precise leaning at any combination of altitude and power setting. There are no moving parts in this system except for the engine-driven fuel injection pump.

## COWL FLAP SYSTEM

A cowl flap system, consisting of a cowl flap located on the bottom of the nacelle, is provided for each engine to allow manual control of the engine cooling airflow. Cowl flap actuation is achieved by use of a push-pull cable assembly. The cowl flap controls, located on the lower control pedestal, allow any intermediate position to be selected. A locking feature is provided for each control to prevent inadvertent cowl flap control position change. Rotating the control fully clockwise engages the locking mechanism.

## STARTING SYSTEM

The starting system consists of a 24-volt lead acid battery, a direct-drive starter mounted on each engine, a starter button for each engine and necessary wiring and components to complete the system.

The starter is engaged when the starter button, located on the side console, is pushed, see Figure 7-19. Pushing the button closes the starting contactor, allowing the starter to be energized. While the starter is energized, a starting vibrator provides a high-voltage current through the left magneto at a retarded position to assist the normal magneto ignition during the start.

## ENGINE INSTRUMENTS

Engine instrumentation for each engine, see Figure 7-1, consists of mechanical oil pressure, electrical oil temperature and electrical cylinder head temperature presented on the combination engine gage, a mechanical manifold pressure gage, electric tachometer and mechanical fuel flow gage. The gages are placarded as to their operational parameters.

## ENGINE MOUNTS

The engine is mounted to the nacelle structure by four engine mounts. Each mount incorporates two rubber pads capable of sustaining operational loads and providing absorption for engine vibrations.

## ENGINE BREAK-IN PROCEDURE

The engine underwent a run-in at the factory and is ready for the full range of use. It is, however, recommended that cruising be accomplished at 65% to 77.5% power until a total of 50 hours has accumulated or oil consumption has stabilized.

**CAUTION**

The purpose of operating at 65% to 77.5% power with Best Power or Recommended Lean mixture is to insure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.





The airplane is delivered from the factory with corrosion preventative oil in the engine. This oil allows fast ring seating and should not be used any longer than 25 hours. If, during the first 25 hours, oil must be added, use only aviation grade straight mineral oil conforming to Specification MIL-L-6082. Refer to Section 8 for additional oil servicing information.

## TURBO-SYSTEM

Each engine is equipped with a turbocharger and related components to allow rated power to 20,000 feet.

The engines work and act just like any normally aspirated engines; however, because the engines are turbocharged, some of the engine characteristics are different. The intent of this section is to point out some of the items that are affected by turbocharging, and outline the correct procedures to be followed.

For a better understanding of the Turbo-System, let us follow the induction air through the engine until it is expelled as exhaust gases. Reference should be made to the Turbo-System Schematic shown in Figure 7-24 when reading through the following steps.

1. Engine induction air is taken in through the ram air inlet (1), located in the bottom of the engine nacelle, at which point it passes through a filter and then into the compressor (2).

**TURBO-SYSTEM SCHEMATIC**

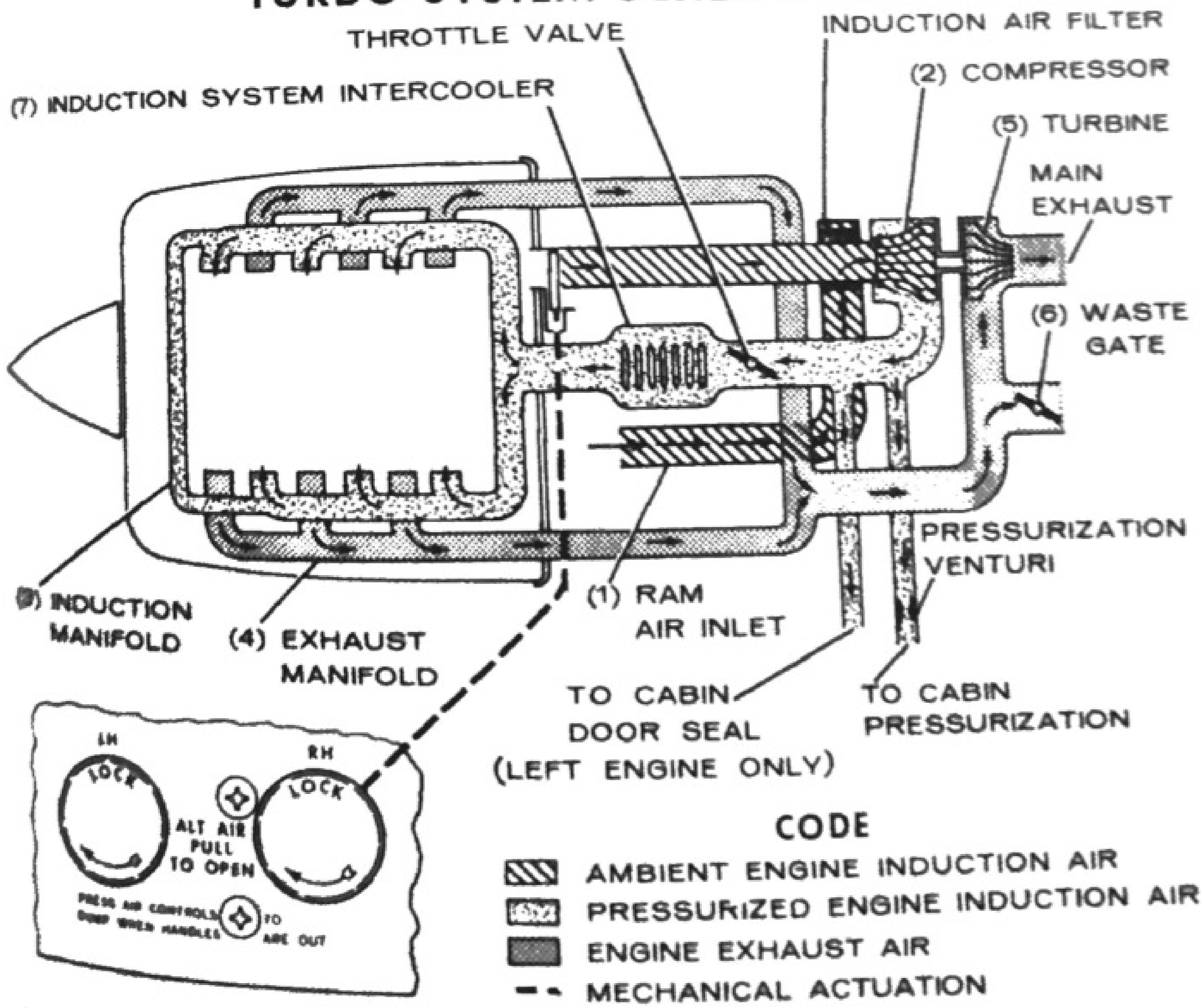



Figure 7-24

2. The compressor compresses the induction air.
3. Most of the pressurized induction air from the compressor then passes through an intercooler (7), then into the cylinders through the induction manifold (3). A small portion of this pressurized air is routed to the cabin for pressurization.
4. The air and fuel are burned and the exhaust gases are then routed to the turbine through the exhaust manifold (4).
5. The exhaust gases drive the turbine (5) which, in turn, drives the compressor.
6. The turbine has enough power to allow the engine to operate in excess of the maximum 38.0 inches Hg. manifold pressure. Therefore, in order not to exceed 38.0 inches Hg. manifold pressure, a bypass or waste gate (6) is used so the excess exhaust gas will be expelled overboard instead of passing through the turbine.

It can be seen from studying steps (1) through (6) that anything that affects the flow of induction air into the compressor, or the flow of exhaust gases into the turbine, will increase or decrease the speed of the turbocharger. This resultant change in flow will have no effect on the engine if the waste gate is still open, because the waste gate position will automatically change to hold compressor discharge pressure constant. The waste gate automatically maintains allowable compressor discharge pressure when below 20,000 feet with full throttle and full RPM. Above 20,000 feet, the throttles must be retarded to maintain the manifold pressure within the allowable limits. When the waste gate is closed, any change in the turbocharger speed will mean a change in engine operation. Anything that causes an increase or decrease in turbine speed will cause an increase or decrease in manifold pressure. If turbine speed increases, the manifold pressure increases; if the turbine speed decreases, the manifold pressure decreases. Any change in exhaust flow to the turbine or ram induction air pressure, whether it is an increase or decrease, will be magnified approximately 8 to 10 times by the compression ratio and the change in flow through the exhaust system.

## Manifold Pressure Variation With Altitude

At full throttle, the turbocharger is capable of maintaining the maximum allowable 38.0 inches Hg. manifold pressure, well above 20,000 feet; however, engine operating limitations establish the maximum manifold pressure that may be used. From 20,000 feet to higher altitudes, the throttles must be retarded to maintain the manifold pressure within the allowable limits.

## Manifold Pressure Variation With Airspeed

When the waste gate is open at low altitude, changes in airspeed have little or no effect on manifold pressure. However, at high altitudes when the waste gate is closed, manifold pressure will vary with variations in airspeed. This is because any change in pressure at the compressor inlet is magnified 8 to 10 times at the compressor outlet due to compression ratio and exhaust flow changes.

## Fuel Flow Variations With Changes In Manifold Pressure

The engine-driven fuel pump output is regulated by engine speed and compressor discharge pressure. Engine fuel flow is regulated by fuel pump output and the metering effects of the throttle and mixture control. When the waste gate is open, fuel flow will vary directly with manifold pressure, engine speed, mixture or throttle position. In this case, manifold pressure is controlled by throttle position and the waste gate controller, while fuel flow varies with throttle movement and manifold pressure.





When the waste gate is closed and manifold pressure changes are due to turbocharger output, as discussed previously, fuel flow will follow manifold pressure even though the throttle position is unchanged. This means that fuel flow adjustments required by the pilot are minimized to the following: (1) small initial adjustments on takeoff or climb-out for the proper rich climb setting, (2) lean-out in cruise to the recommended lean cruise setting, and (3) return to the full rich position for approach and landing.

## Manifold Pressure Variation With Increasing Or Decreasing Fuel Flow

When the waste gate is open, movement of the mixture control has little or no effect on the manifold pressure of the turbocharged engine.

When the waste gate is closed, any change in fuel flow to the engine will have a corresponding change in manifold pressure. That is, increasing the fuel flow will increase the manifold pressure and decreasing the fuel flow will decrease the manifold pressure. This is because an increased fuel flow to the engine increases the mass flow of the exhaust. This turns the turbocharger faster, increasing the induction airflow and raising the manifold pressure.

## Momentary Overboost Of Manifold Pressure

Under some circumstances (such as rapid throttle movement, especially with cold oil) it is possible that the engine can be overboosted above the maximum allowable 38.0 inches Hg. manifold pressure. This would most likely be experienced during the takeoff roll or during a change to full throttle operation in flight. Therefore, it is still necessary that the pilot observe and be prepared to control the manifold pressure.

Slight overboosting is not considered detrimental to the engine so long as it is momentary. Momentary overboost of 2 to 3 inches Hg. manifold pressure can usually be controlled by slower throttle movement and no corrective action is required when momentary overboost corrects itself and is followed by normal engine operation. However, if overboosting of this nature persists, or if the amount of overboost goes as high as 4 inches Hg. manifold pressure or more, the controller system should be checked for necessary replacement or adjustment of components.

## Altitude Operation

Turbocharged airplanes can maintain higher power settings and fuel flows to higher altitudes than are possible with normally aspirated airplanes. As a result, turbocharged airplanes climb faster and higher. Due to the higher fuel flows and the more rapid temperature and barometric pressure changes during these climbs, fuel vaporization in the fuel lines is more probable than with normally aspirated airplanes. Fuel vaporization is usually indicated by fuel flow fluctuations and can be eliminated by pressurizing the fuel system with the auxiliary fuel pumps. Refer to the Normal Procedures Checklist for recommended positioning of the auxiliary fuel pump switches.

## High Altitude Engine Acceleration

The engines will accelerate normally from idle to full throttle with full rich mixture at any altitude below 20,000 feet. At higher altitudes, it is usually necessary to lean the mixture to get smooth engine operation from idle to maximum power. At altitudes above 25,000 feet, and with temperatures above standard, it takes one to two minutes for the turbine to accelerate from idle to maximum RPM, although adequate power is available in 20 to 30 seconds. If fuel flow has been interrupted for any reason, the mixture should be leaned until the engine begins to accelerate as shown by an increase in manifold pressure (with throttle open). Thereafter, adjust the mixture control for smooth engine operation.

### Engine Shutdown

After extended periods of ground engine operation above 1600 RPM or when the cylinder head temperature indicator shows values within the upper half of the green arc, reduce power to between 600 and 800 RPM for a period of not less than 2 to 3 minutes prior to engine shutdown. This procedure is intended to reduce internal turbocharger temperatures and preclude the possibility of premature accumulation of carbon on the turbine shaft seals.

## CABIN AIR SYSTEM

The cabin air system provides for cabin heating, ventilating and defrosting. The system consists of an air inlet in the nose, a cabin fan, a gasoline combustion-type heater, pressurization air temperature controls, and controllable heat outlets in the cabin. Two heat outlets are located at the base of the windshield for defrosting purposes. One outlet duct is located on each side of the aft cabin and two are located on the forward pressure bulkhead, see Figure 7-25 or 7-26.

Cabin heating and ventilating is accomplished by the cabin air DEFROST, AFT and FWD controls, see Figure 7-25 or 7-26. The overhead directional vents also supply unheated ventilating air in the pressurized mode. Forced ventilation is obtained with the two-speed cabin fan which may be operated independently of the heater. When the heater is actuated, the fan automatically operates in low speed; if additional airflow is desired, the HIGH position may be selected.

### HEATING AND DEFROSTING

#### Depressurized

Fresh air is picked up from the air inlet in the nose of the airplane, heated by the heater, and directed to the pilot and passenger compartments. The heating and ventilating air is not recirculated, but exhausts overboard through the cabin pressure regulating valve.

The heating system can be used for ventilation by placing the cabin fan switch, see Figure 7-19, in either the NORMAL or HIGH position. The fan provides unheated fresh air to the cabin through the cabin heat outlets. In flight, ram air pressure can be used for ventilation by placing the cabin heat switch to the OFF position, pulling out the cabin air knobs and opening the heat outlets as desired.

#### Pressurized

Pressurization air is heated by the heater and ducted to the pilot and passenger compartments. To increase passenger comfort and heating system efficiency, the pressurization air temperature controls, see Figure 4-3, may be rotated fully clockwise. This will allow higher pressurization air temperatures, reducing cabin heater requirements. With the left pressurization air temperature control rotated fully clockwise, the overhead vents will supply warm air.





### CABIN HEAT SWITCH BREAKER

The cabin heater is controlled by a two-position cabin heat switch breaker, see Figure 7-19. Switch positions are ON and OFF. Placing the switch breaker in the ON position starts and maintains heater operation and turns the cabin fan on low.

### CABIN FAN SWITCH

The ventilating fan is controlled by a three-position cabin fan switch, see Figure 7-19. Switch positions are NORMAL, OFF and HIGH.

### CABIN AIR TEMPERATURE CONTROL KNOB

The cabin air temperature is controlled by the cabin heat knob, see Figure 7-1. Clockwise rotation of this knob increases the desired temperature.

This knob adjusts a thermostat, which in turn controls heated air temperature in a duct located just aft of the heater. When the temperature of the heated air exceeds the setting of the thermostat, the thermostat automatically opens and shuts off the heater. When the heated air cools to the thermostat setting, the heater starts again. Thus the heater cycles on and off to maintain an even air temperature. Operation is identical for the pressurized and depressurized modes.

### FORWARD CABIN AIR KNOB

The forward cabin air knob directs warm air to two outlets located on the forward pressure bulkhead. These direct outlets allow fast warm-up when the airplane is on the ground. Airflow through the direct outlets is completely shut off by pushing the knob all the way in. The knob may be set at any intermediate position to regulate the quantity of air to the pilot's compartment.

### AFT CABIN AIR KNOB

The aft cabin air knob controls airflow to all passenger compartment heat registers. When the knob is pulled out, the air flows to heat registers in the passengers' compartment. Airflow to the heat registers is completely shutoff by pushing the knob all the way in. The knob may be set in any intermediate position to regulate the quantity of air to the cabin.

### DEFROST KNOB

Windshield defrosting and defogging is controlled by the push-pull defrost knob. When the knob is pulled out, air flows from the defroster outlets at the base of the windshield. When the knob is pushed all the way in, airflow to the defroster outlets is shut off. The knob may be set in any intermediate position to regulate the defroster airflow.

### HEATER OVERHEAT WARNING LIGHT

An amber overheat warning light provided in the annunciator panel is labeled HEATER OVHT, see Figure 7-3. When illuminated, the light indicates that the heater overheat switch has been actuated and that the temperature of the air in the heater has exceeded 163°C (325°F). Once the heater overheat switch has been actuated, the heater turns off and cannot be

## CABIN AIR SYSTEM SCHEMATIC
### DEPRESSURIZED MODE, HEATER ON

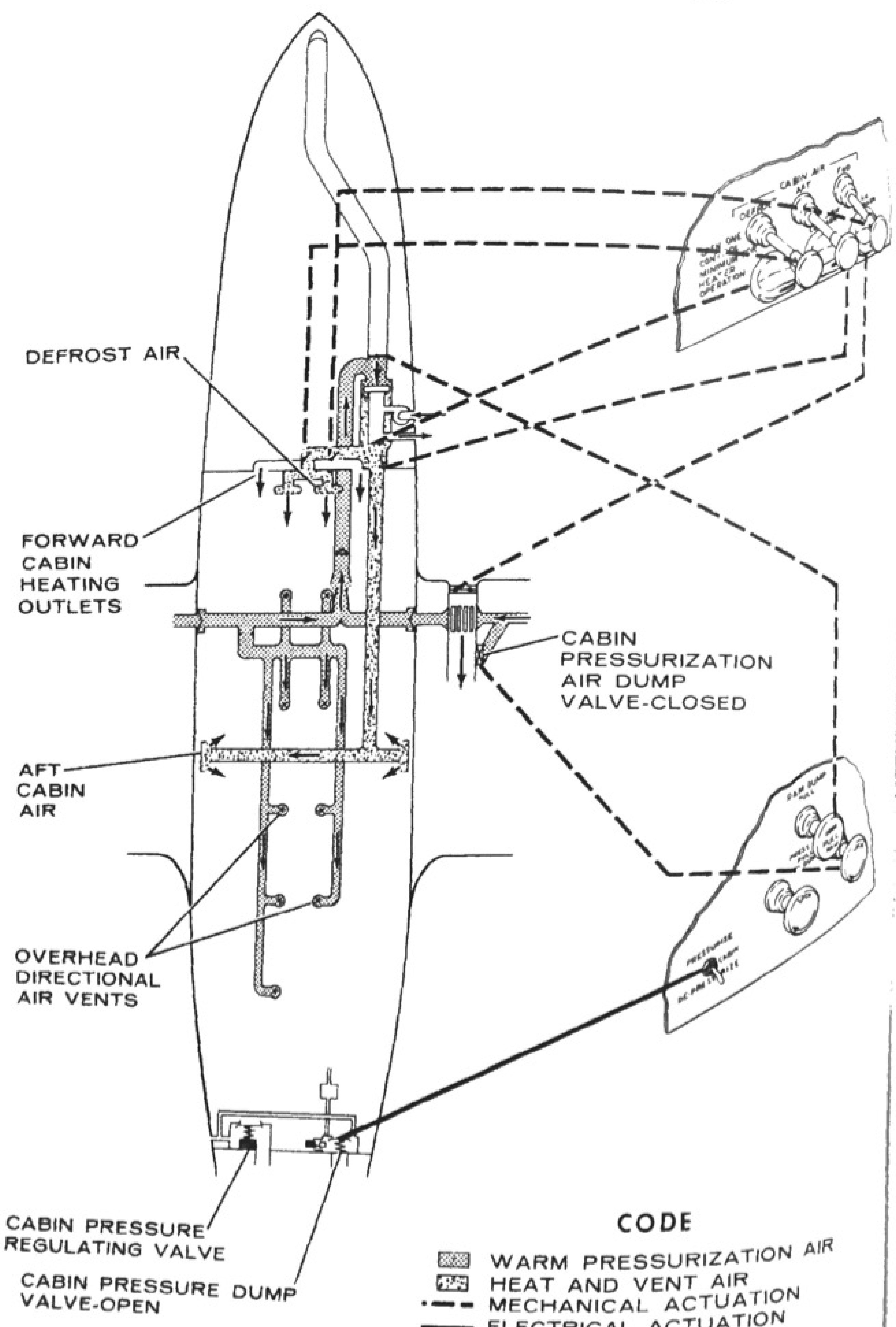



Figure 7-25





restarted until the overheat switch, located in the right forward nose compartment, has been reset. This switch is accessible from inside the nose wheel well. Prior to resetting the overheat switch, the heater should be thoroughly checked to determine the reason for the malfunction.

### HEATER OPERATION FOR HEATING AND DEFROSTING

(1) Battery Switch - ON.
(2) Pressurization Air Controls - PUSH IN.
(3) Cabin Vent Control - PUSH IN.
(4) Cabin Air Knobs - PULL OUT.
(5) Defrost Knob - Adjust as desired (if defrosting is desired).
(6) Cabin Heat Knob - MAX or as desired.
(7) Pressurization Air Temperature Controls - CLOCKWISE.
(8) Cabin Heat Switch - ON.
(9) Heat Registers - As desired.

NOTE

- If warm air is not coming out of the registers within one minute, turn cabin heat switch breaker OFF and try another start. If heater still does not start, no further starting attempt should be made.
- During heater operation, defrost and/or cabin air knobs must be out.

### HEATER USED FOR VENTILATION

(1) Battery Switch - ON.
(2) Cabin Air Knobs - PULL OUT as desired.
(3) Cabin Fan Switch - NORMAL or HIGH as desired.
(4) Heat Registers - As desired.

## CABIN PRESSURIZATION SYSTEM

### OPERATING DETAILS

The airplane may be operated in either the pressurized mode or depressurized mode. The mode selection is made with the cabin pressurization switch and/or the cabin vent control, see Figure 7-27 or 7-29. Mode of operation should be selected prior to takeoff. If a mode selection must be made while airborne, the cabin vent control should be moved very slowly to minimize pressure transients which would cause discomfort to the passengers.

Pressurization air is supplied from each engine turbocharger through the sonic venturi (flow limiter), the heat exchanger and then into the cabin. Adequate flow to maintain pressurization is provided by either engine at normal power settings. Power changes should be made smoothly to prevent sudden changes in pressurization air inflow resulting in cabin pressure transients.

The pressurization controls and indicators of your airplane, see Figure 7-27 (standard system) or 7-29 (optional system), consist of right and left pressurization air controls, a cabin vent control, a cabin pressurization switch, a cabin rate-of-climb indicator and a combination cabin altimeter and differential pressure indicator.

# CABIN AIR SYSTEM SCHEMATIC

MODEL 414A

## PRESSURIZED MODE, HEATER ON

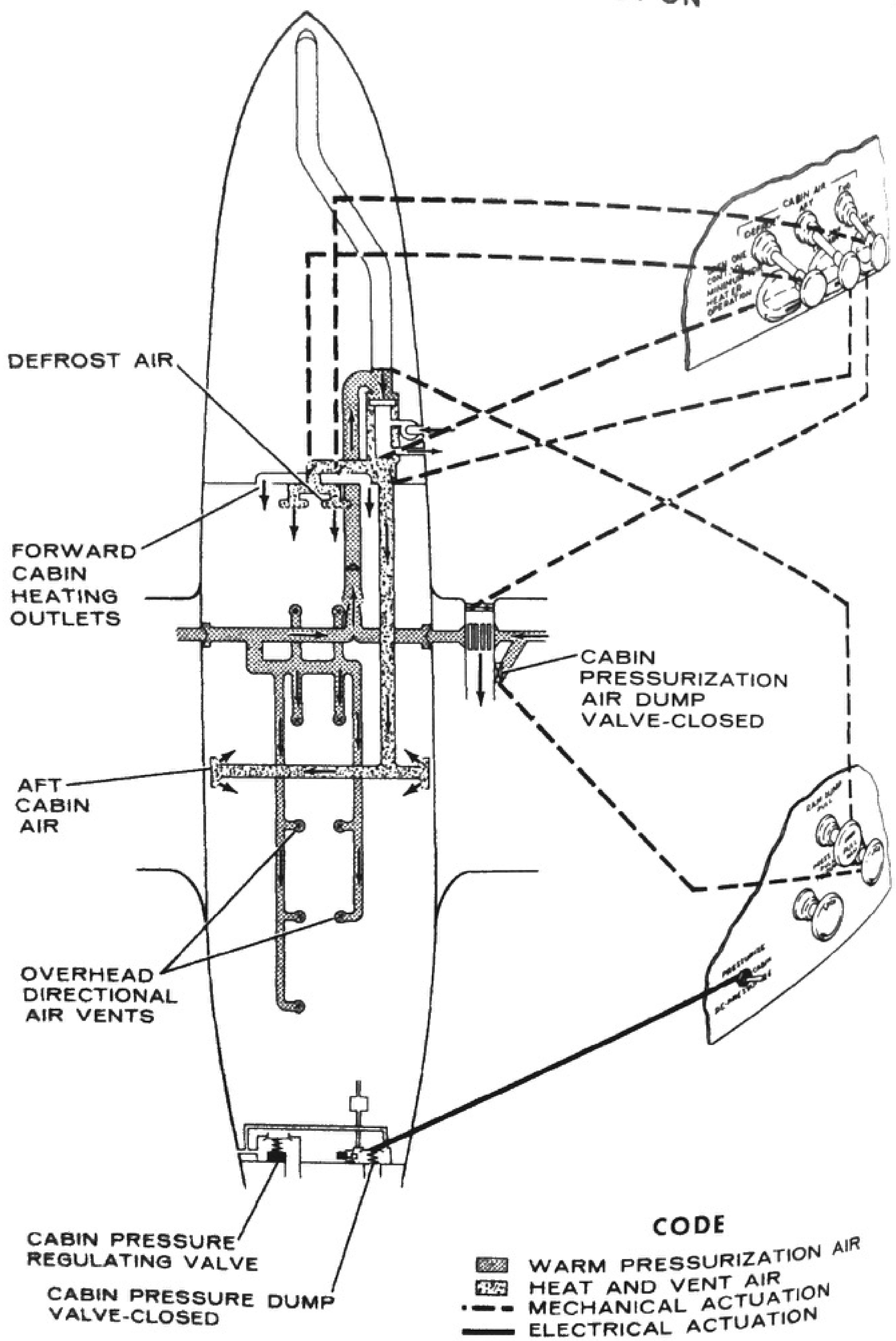



Figure 7-26





MODEL 414A

A warning light, which illuminates at approximately 10,000 feet cabin altitude indicating a need for oxygen, is located in the annunciator panel.

To optimize normal operation in the pressurized mode, position the pressurization controls as follows:

1. Pressurization Air Controls - PUSH IN for all flight operations and ground operation when additional ground ventilation is desired.
2. Cabin Vent Control - PUSH IN for all flight operations and normal ground operation.
   - PULL OUT for additional ground ventilation.
3. Cabin Pressurization Switch - PRESSURIZE.

To optimize normal operation in the depressurized mode, position the pressurization controls as follows:

1. Pressurization Air Controls - PUSH IN if heater operation or additional ground ventilation is desired.
   - PULL OUT if heater operation is not desired.
2. Cabin Vent Control - PUSH IN if in-flight heater operation is desired.
   - PULL OUT if additional ground ventilation is desired.
3. Cabin Pressurization Switch - DEPRESSURIZE.

## STANDARD PRESSURIZATION SYSTEM

The PRESSURIZE position of the cabin pressurization switch, see Figure 7-26, provides for cabin pressurization at altitudes above 8000 feet. The cabin altitude is maintained at 8000 feet at all airplane altitudes between 8000 and 23,120 feet. From 23,120 feet to the operating ceiling of 30,000 feet, 5.0 PSI differential is maintained between cabin and atmosphere.

Until reaching 8000 feet, the cabin rate-of-climb, see Figure 7-27, will be equal to the airplane rate-of-climb. At 8000 feet, the cabin rate-of-climb will drop to zero as pressurization begins. The cabin rate-of-climb will remain approximately at this indication until the airplane has reached an altitude of 23,120 feet. Above this altitude, the cabin altitude will again begin to ascend as the airplane ascends, but at a lesser rate than the airplane rate-of-climb because of the difference in ambient air density and cabin air density. The cabin altitude reaches approximately 10,000 feet at an airplane altitude of 26,500 feet; at this time the altitude warning light on the annunciator panel will illuminate, indicating the need for oxygen.

The cabin differential pressure of 5.0 PSI is limited by the pressure regulator valve, see Figure 7-26, located in the aft portion of the cabin. This valve automatically permits air to leave the cabin to maintain the desired pressure. If the regulating valve should fail in the closed position, a dump valve, see Figure 7-26, also located in the aft portion of the cabin, operates as a safety valve to regulate maximum cabin differential pressure at 5.3 PSI. This is a dual function valve which functions as a cabin dump when the DEPRESSURIZE position is selected with the cabin pressurization switch.

The cabin altitude which is maintained at a given airplane altitude is shown in Figure 7-28.

## STANDARD PRESSURIZATION CONTROLS AND INDICATORS

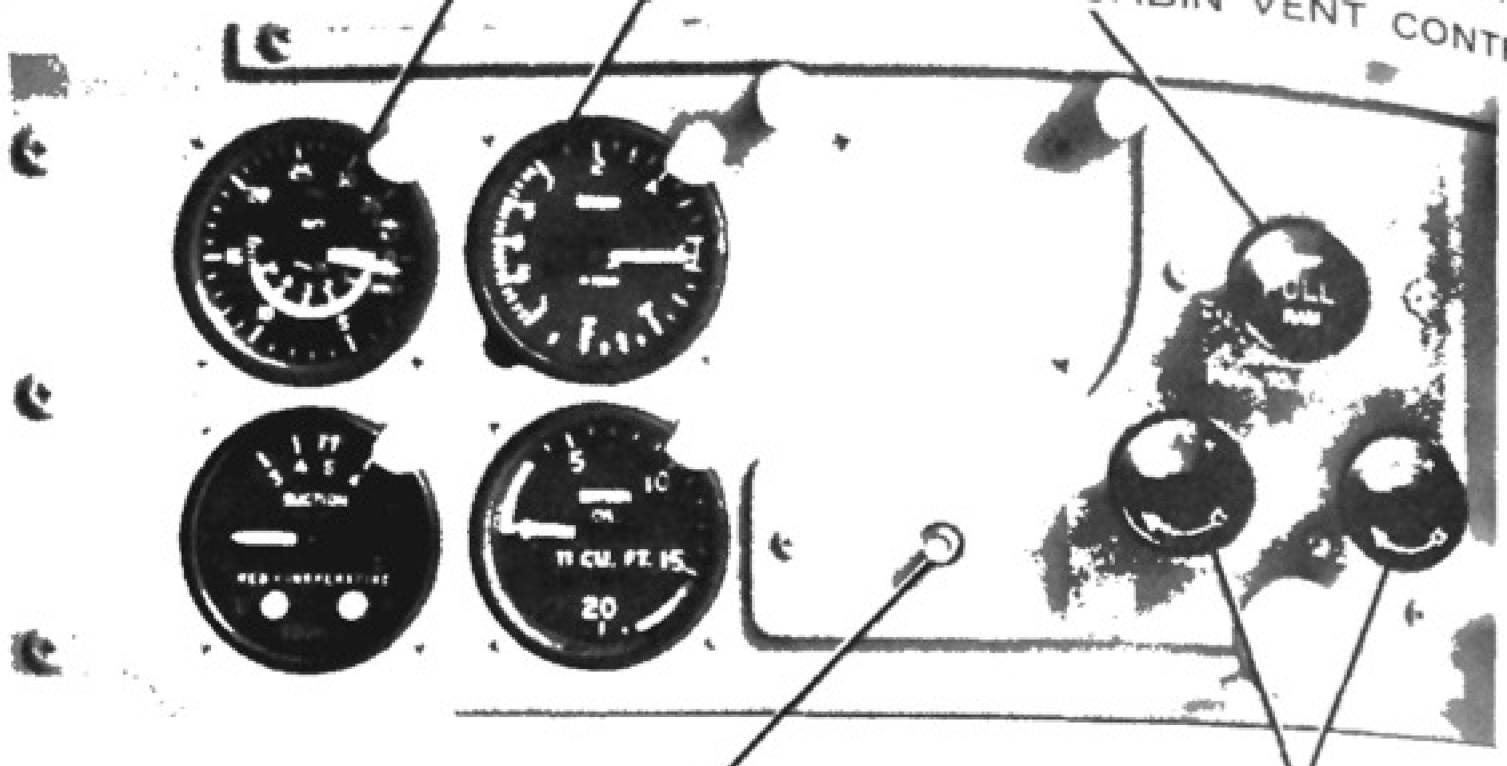



Figure 7-27

The aft cabin dump valve is used during ground operation to assure the cabin pressure differential is zero. The dump valve is opened automatically by the landing gear safety switch when the weight of the airplane is on the landing gear or can be opened manually by selecting the DEPRESSURIZE position of the cabin pressurization switch. Normally, the cabin pressurization switch can be left in the PRESSURIZE position. However, should a malfunction occur or if a landing is attempted above 8000 feet pressure altitude, select the DEPRESSURIZE position. This airplane is not certified for landings with the cabin pressurized.

**NOTE**

The airplane cannot be pressurized on the ground as the landing gear safety switch circuit is interconnected with the aft cabin dump valve circuit.

## STANDARD PRESSURIZATION SCHEDULE

| AIRPLANE ALTITUDE | CABIN ALTITUDE |
|---|---|
| SEA LEVEL TO 8000 FEET | SAME AS AIRPLANE ALTITUDE |
| 8000 to 23,120 FEET | 8000 FEET |
| 24,790 FEET | 9000 FEET |
| 26,500 FEET | 10,000 FEET |
| 28,260 FEET | 11,000 FEET |
| 30,000 FEET | 11,950 FEET |

Figure 7-28





In the event that an emergency should require immediate depressurization, place the cabin pressurization switch in the DEPRESSURIZE position, see Figure 7-25, and pull out the cabin vent control. These actions electrically open the aft cabin dump valve and mechanically open the ram air inlet butterfly valve located in the nose; however, pressurization air will still flow into the cabin.

### OPTIONAL PRESSURIZATION SYSTEM

For the pressurization system to operate, the cabin pressurization switch must be in the PRESSURIZE position and the cabin vent control and pressurization air controls must be pushed in, see Figure 7-29. The desired cabin altitude can then be selected by the cabin altitude control and the desired cabin rate-of-climb can be selected by the cabin rate control, see Figure 7-29. The selected values can be maintained until a cabin altitude is reached which results in a 5.0 PSI differential between the cabin and atmosphere. To obtain the optimum benefit from the cabin altitude control and the cabin rate control, set in the field pressure altitude plus 500 feet on the outer CABIN ALT scale just prior to takeoff with the arrow on the cabin rate control positioned straight up. After takeoff, with the cabin pressure stabilized, slowly reset the cabin altitude control to cruise altitude plus 500 feet on the inner AIRCRAFT ALT scale or destination field pressure altitude plus 500 feet on the outer CABIN ALT scale. Make the selection which will provide the highest cabin altitude. For cruising altitudes below the inner scale values, always select the destination field pressure altitude plus 500 feet on the outer scale. The selection should be made slowly to provide maximum comfort. Adjust the cabin rate control as the climb progresses such that the selected cabin altitude is reached at approximately the same time that the airplane reaches cruising altitude.

## OPTIONAL PRESSURIZATION CONTROLS AND INDICATORS

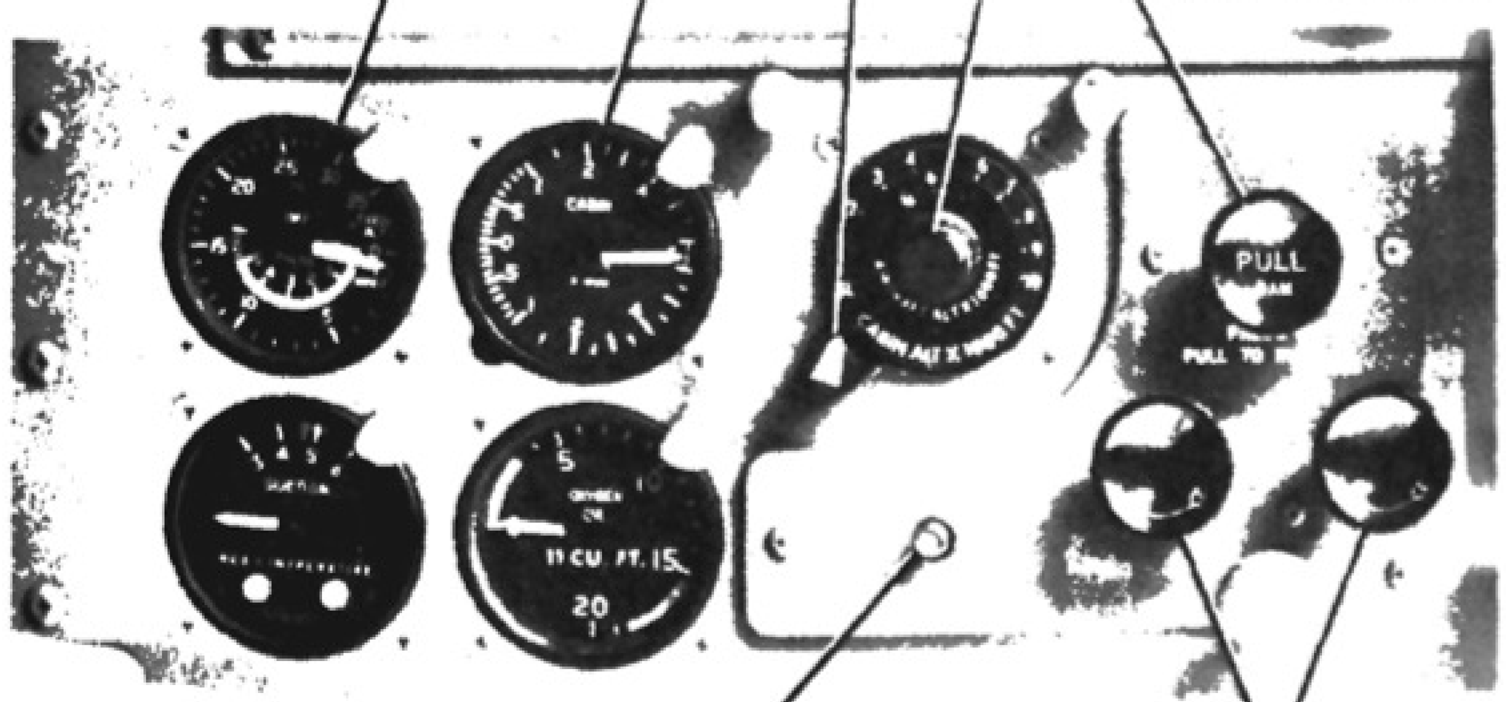



Figure 7-29

The above procedure is recommended because once the engines have been started and a source of vacuum is available, the pressure control system will begin to "climb" to the preset cabin altitude; thus, if cabin altitude required for cruise is selected too soon, the pressure control system will have climbed to an altitude approaching the desired cabin altitude before the airplane leaves the ground. Since the cabin pressure can never be less than outside ambient pressure, the cabin will be unpressurized until the airplane "catches up" with the pressure control system or the desired cabin altitude is reached, whichever occurs first. This will result in no cabin rate control being available as the cabin rate-of-climb will be equal to the airplane rate-of-climb.

The cabin differential pressure of 5.0 PSI is limited by the pressure regulator valve, see Figure 7-26, located in the aft portion of the cabin. This valve automatically permits air to leave the cabin to maintain the desired pressure. If the regulating valve should fail in the closed position, a dump valve, see Figure 7-26, also located in the aft portion of the cabin, operates as a safety valve to regulate maximum cabin differential pressure to 5.3 PSI. This is a dual function valve which also functions as a cabin dump when the DEPRESSURIZE position is selected with the cabin pressurization switch.

## OPTIONAL PRESSURIZATION SCHEDULE

| AIRPLANE ALTITUDE | CABIN ALTITUDE |
|---|---|
| SEA LEVEL TO 10,060 FEET | SEA LEVEL |
| 13,910 FEET | 2000 FEET |
| 16,850 FEET | 4000 FEET |
| 19,920 FEET | 6000 FEET |
| 23,120 FEET | 8000 FEET |
| 26,500 FEET | 10,000 FEET |
| 30,000 FEET | 11,950 FEET |

Figure 7-30

The aft cabin dump valve is used during ground operation to assure the cabin pressure differential is zero. The dump valve is opened automatically by the landing gear safety switch when the weight of the airplane is on the landing gear or can be opened manually by selecting the DEPRESSURIZE position of the cabin pressurization switch. Normally, the cabin pressurization switch can be left in the PRESSURIZE position. However, should a malfunction occur or if the cabin altitude is inadvertently set at a lower altitude than field pressure altitude, select the DEPRESSURIZE position. It is important, therefore, to select a cabin altitude approximately 500 feet above field pressure altitude and check cabin pressure differential at zero prior to landing. This will prevent any cabin pressure transients on landing and provide maximum passenger comfort.

NOTE

> The airplane cannot be pressurized on the ground as the landing gear safety switch circuit is interconnected with the aft cabin dump valve circuit.





The lowest cabin altitude which can be maintained at any given airplane altitude is shown in the chart in Figure 7-30.

## OXYGEN SYSTEM

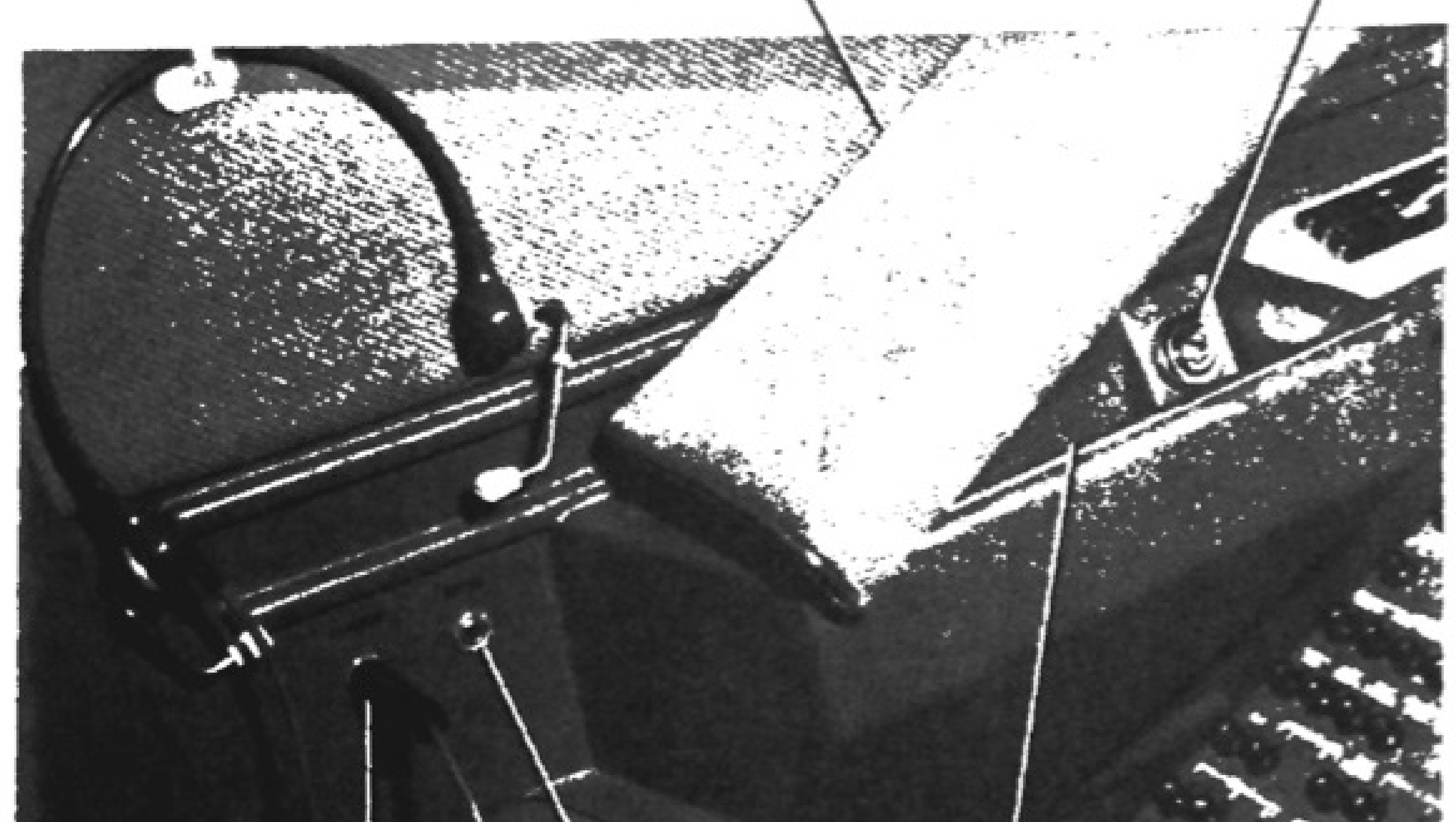
The oxygen system provides individual service for the pilot, copilot and each passenger. The oxygen supply is stored in either an 11.0 or 114.9 cubic foot bottle located in the nose compartment. Cabin plumbing, including outlets for each occupant, is standard with each airplane and will vary with individual airplane seating configuration. The oxygen control, pressure gage (see Figure 7-1), bottle, regulator and nose compartment plumbing are optional.

The oxygen system is activated by pulling the oxygen control knob, see Figure 7-1, to the ON position, allowing oxygen to flow from the regulator to all cabin outlets. A normally closed valve in each oxygen outlet is opened by inserting the connector of the mask and hose assembly. After flights using oxygen, the pilot should insure that the oxygen system has been deactivated by unplugging all masks and pushing the oxygen control knob completely to the OFF position.

NOTE

> If the oxygen control knob is left in an intermediate position between ON and OFF, it may allow low pressure oxygen to bleed through the regulator into the nose compartment of the airplane.

## COCKPIT OXYGEN OUTLETS



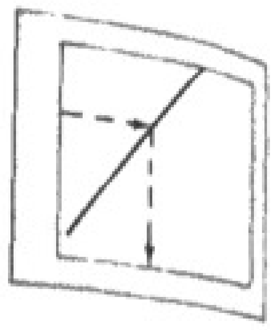

PILOT'S SIDE SHOWN; IDENTICAL CONTROLS ARE PROVIDED FOR THE COPILOT.

Figure 7-31

The oxygen system, with optional 114.9 cubic foot oxygen bottle, provides adequate oxygen flow rates up to 30,000 feet cabin altitude and is suitable for cruising at altitudes in excess of 25,000 feet for extended periods, see Figure 7-32. The oxygen outlets for the pilot and copilot are located inside the stowage compartment under the outboard armrests, see Figure 7-31. Oxygen outlets for passengers are located overhead of each seat position, see Figure 7-21. The pilot, copilot and passengers shall always use the blue hose assemblies.

## OXYGEN DURATION CHART

### 114.9 CUBIC FOOT OXYGEN SYSTEM



$$\frac{\text{OXYGEN DURATION IN HOURS}}{\text{NUMBER OF PERSONS}} = \text{TOTAL HOURS DURATION}$$

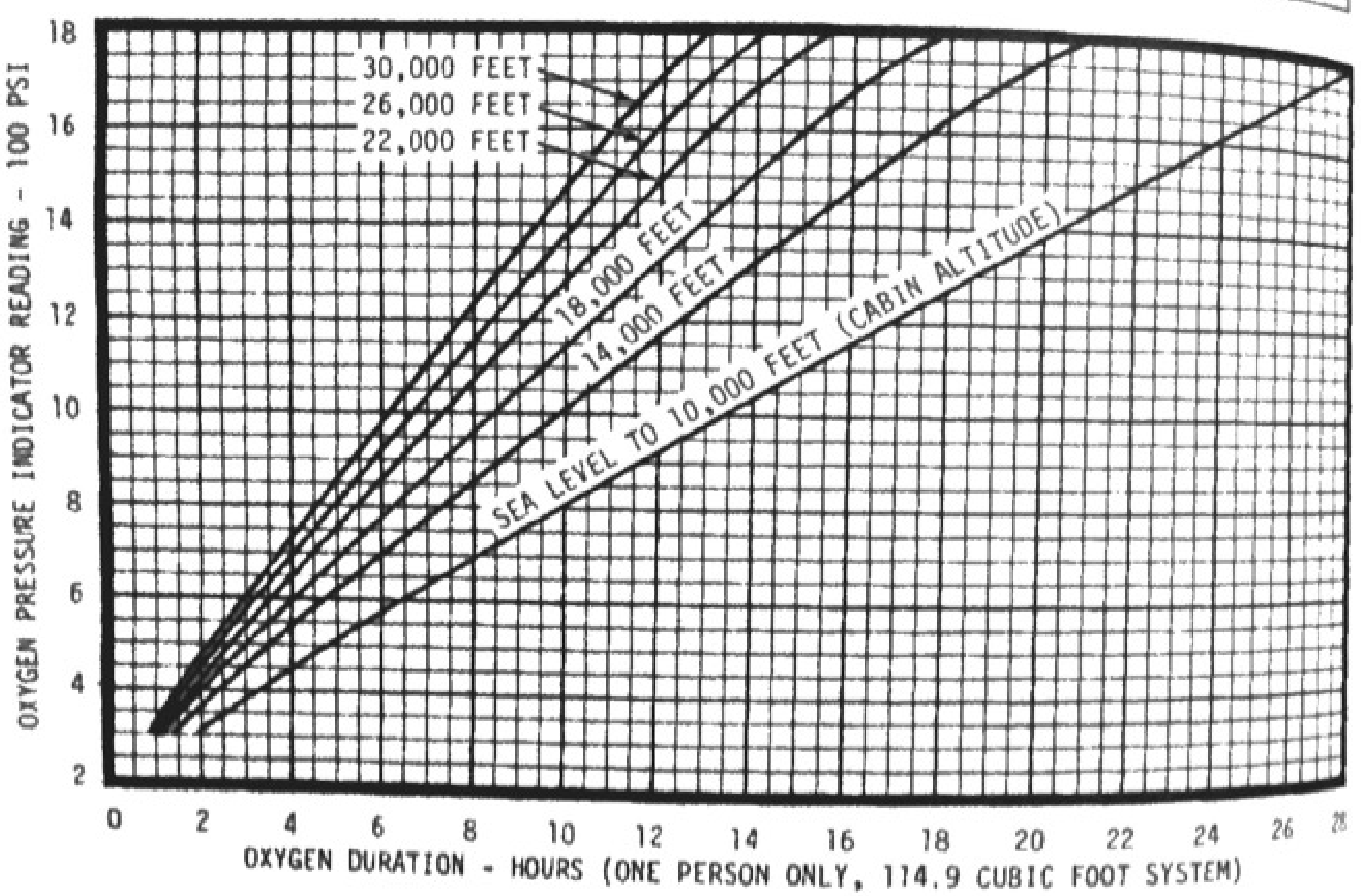



Figure 7-32





The oxygen system with optional 11.0 cubic foot bottle provides adequate oxygen flow rates up to 30,000 feet cabin altitude, see Figure 7-33. This system is designed solely to provide for emergency descents as described in Section 3. The system is calibrated for two different altitude ranges, which are: 14,000 to 22,000 feet cabin altitude and 22,000 to 30,000 feet cabin altitude. Selection of the desired altitude range is accomplished by appropriate selection of color-coded hose assemblies. The oxygen outlets for the pilot and copilot are located inside the stowage compartment under the outboard armrests, see Figure 7-31. Oxygen outlets for passengers are located overhead of each seat position, see Figure 7-21. The pilot shall always use the red hose assembly.

**NOTE**

> Some airplanes are delivered with red oxygen hose mask connectors only. If your airplane is so equipped, disregard all information pertaining to orange oxygen hose mask connectors.

## OXYGEN CONSUMPTION RATE CHART

### 11.0 CUBIC FOOT OXYGEN SYSTEM

OXYGEN DURATION CALCULATION:

TOTAL OXYGEN DURATION (HOURS) = OXYGEN PRESSURE INDICATOR READING ÷ [OXYGEN CONSUMPTION (PSI/HR) × NUMBER OF PASSENGERS + PILOT CONSUMPTION RATE].

| CABIN ALTITUDE RANGE-FEET | HOSE ASSEMBLY COLOR | CONSUMPTION PSI/HR |
|---|---|---|
| 14,000<br>22,000 | ORANGE | 965 |
| 22,000<br>30,000 | RED | 1352 |

Figure 7-33

## PASSENGER LOADING

Due to the differences in installed optional equipment on the airplane, a wide CG range exists. Under certain passenger loading conditions, it is possible to exceed the aft CG limits, which can lead to tail tipping. To prevent this from occurring, owners and pilots should study their airplane's weight and balance information to become familiar with the airplane's capabilities and limitations. It is recommended that the loading of passengers be as follows:

(1) Load the baggage in the nose and avionics compartments prior to boarding of the crew and passengers.
(2) Avoid carrying baggage in the aft cabin.
(3) When boarding people, have the pilot, or person who is to occupy the copilot seat, be the first to board with the remaining people filling the most forward seats first and the aft seats last. Arrange to have the heavier people occupy the most forward seats.
(4) When unloading the airplane, have one person remain in the copilot or pilot seat while the other flight deck occupant goes aft to open the door. Arrange to have the passengers in the aft seats be the first to deplane.

## BAGGAGE COMPARTMENTS

Six baggage locations, see Figure 1-3, are available: two in the fuselage nose section, two in the aft cabin area and one location in the aft portion of each engine nacelle.

These baggage areas are intended primarily for low-density items such as luggage and briefcases. The floors of the wing locker baggage areas are primary structure. Therefore, care should be exercised during loading and unloading to prevent damage. When loading high-density objects, insure that adequate protection is available to prevent damage to any of the airplane's primary structure. Without optional equipment installed, 120 pounds can be carried in each wing locker, 250 pounds in the avionics bay, 350 pounds in the nose baggage compartment, 400 pounds in the aft cabin Bay A and 100 pounds in the aft cabin Bay B. With optional equipment installed, refer to Section 2 or the loading placards in your airplane's baggage compartments.

**WARNING**

- The transportation of hazardous materials is discouraged. However, if transport of this material is necessary, it shall be done in accordance with FAR 103 and any other applicable regulations.
- Under no circumstances, allow the loading of people or animals in the nose baggage area or wing lockers. These areas do not qualify for carriage of animate objects.

## AIRPLANE TIE-DOWN PROVISIONS AND JACK POINTS

A wing tie-down fitting is provided on the lower surface of each wing aft of each main gear. The fittings retract into the wing when not in use. The empennage is secured at the tail tie-down fitting located on the fuselage bottom, below the elevator hinge line. In addition the nose gear can be secured with ropes attached to the nose gear assembly above the scissors linkage.

Three jack points are provided on the underside of the airplane. The main gear jack points are located inboard of an in-line with the wing flap hinge. The nose gear jack point is located aft of the left nose gear door hinge. Jack pads, which are provided with the airplane, are required to be installed in each wing jack point before the airplane can be jacked.





## SEATS, SEAT BELTS AND SHOULDER HARNESSES

### PILOT AND COPILOT PROVISIONS

The pilot and copilot seats are secured to seat pan assemblies which are attached to the forward main spar carry-thru structure. The seats are adjustable fore and aft on seat rails by lifting the handle located on the forward face of the seat.

Seat belts are provided for both seats and are attached to airplane structure on the floor. The shoulder harnesses attach aft and outboard of the pilot's and copilot's seats to overhead structure. The opposite end of each harness can be attached permanently to the outboard pilot's or copilot's seat belt. An adjustment is provided between the attach points With the optional shoulder harnesses, inertia reels are bolted to overhead structure aft and outboard of the pilot's and copilot's seats. The opposite end of the harnesses attach to the seat belts with a detachable fastener. The inertia reels allow normal fore and aft movement of the occupants until a violent movement occurs, at which time the reel will lock, restricting forward movement of the seat occupant.

### PASSENGER PROVISIONS

The passenger seats are attached to continuous seat rails located on each side of the cabin area. The seats are adjustable fore and aft, within the limits of the seat stops, by raising the handle located on the front of the seat. If the optional adjustable seats are installed, a second handle is provided on the front of the seat which allows reclining of the seat back. Insure the seat stop pins are engaged with the holes in the seat rails before takeoff and landing. Each seat is equipped with a seat belt which is attached to the seat structure. An optional stowage drawer may be installed beneath each seat.

## DOORS, WINDOWS AND EXITS

### CABIN DOOR

The main cabin door is a two-section, outward opening, airstair door. The lower section folds down to provide two steps for ease in boarding and deplaning passengers, while the top portion folds up.

**CAUTION**

When entering or exiting an airplane, equipped with a pneumatic lower door extender, ensure lower cabin door is fully extended before putting weight on steps.

The lower door handle is located such that the upper door must be open to gain access to it. In addition, the locking pin receptacles can be visually inspected for positive engagement, see Figure 7-34.

As an additional safety feature, a cabin door warning light is provided. This light is located in the annunciator panel, see Figure 7-3, and is illuminated when the cabin door is not securely latched.

Cabin door sealing is provided by a pneumatic tube door seal that is inflated by pressurization air from the left engine. With the left engine operating and the cabin door closed and locking pins fully engaged, the door seal is inflated to provide positive fuselage to door sealing. When the cabin door locking pins are disengaged, the door seal is depressurized to allow the door to be opened and closed easily.

## WINDOWS

Seven windows are provided on each side of the airplane. All windows are fixed except the foul weather windows located forward of the pilot's and copilot's side windows. These foul weather windows can be opened during all ground operations and in-flight operations with the cabin depressurized. Airspeed is not restricted with the foul weather windows open.

## EMERGENCY EXIT WINDOW

The forward oval cabin window on the right side of the passenger compartment can be removed for emergency exit. Pull off the plastic cover over the emergency release handle under the window. Turn the release handle counterclockwise to release the window retainers, then pull the window in and down.

## CABIN DOOR SAFETY AND LOCKING PINS

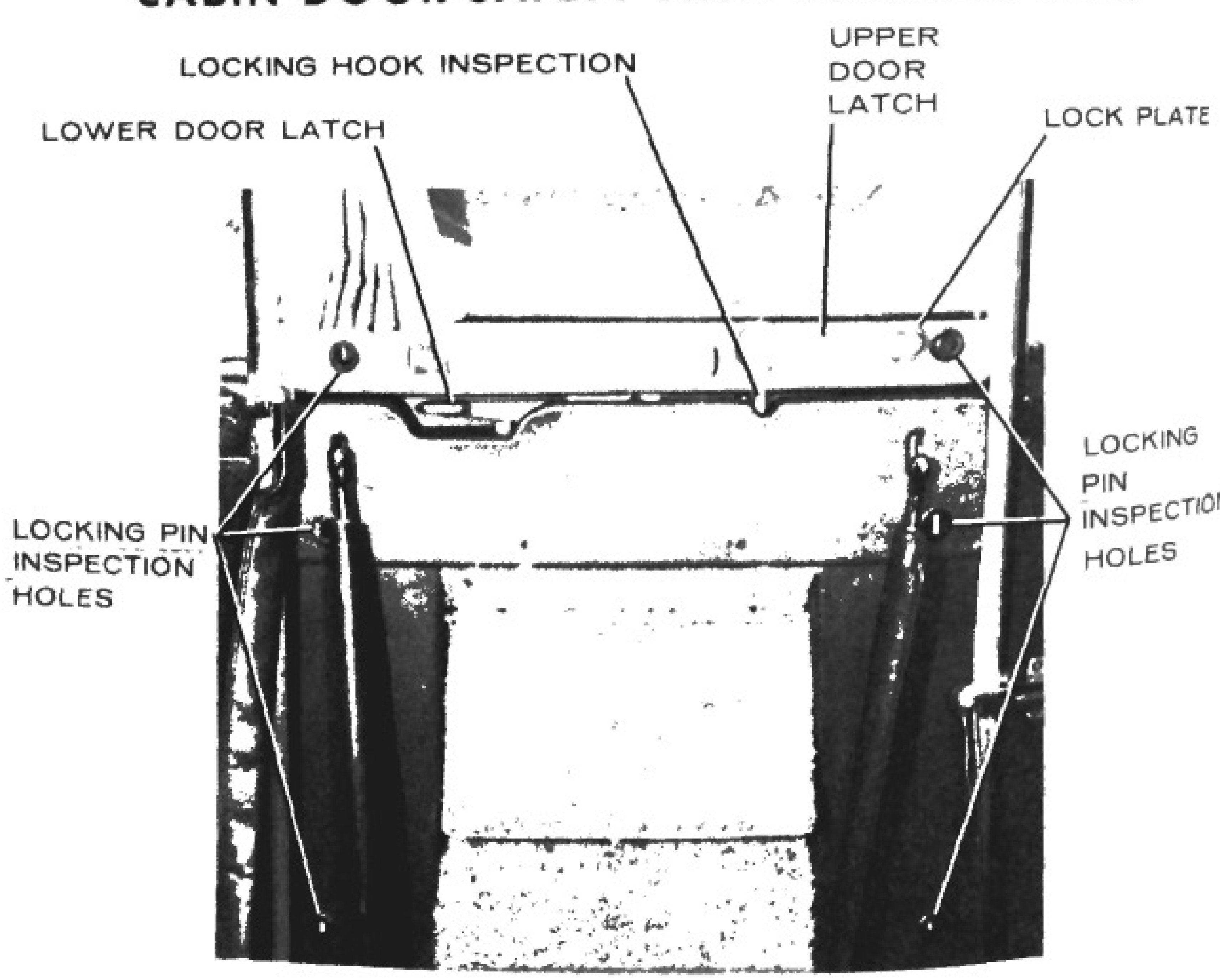



Figure 7-34





## CONTROL LOCKS

A control column lock is provided to restrict the control column from moving. This restriction holds the ailerons in a neutral position and the elevators approximately 10° down, thus preventing damage to the control surfaces in gusty wind conditions.

The rudder is secured with the optional rudder gust lock. To engage the lock, center the rudder, insure the elevator is fully down, then move the external rudder lock handle to the lock position. The rudder lock is disengaged by rotating the external rudder lock handle to the unlock position. The rudder lock handle is located above the left horizontal stabilizer in the side of the fuselage. If the optional rudder lock is not installed, the rudder can be secured by placing an external control surface lock over the vertical stabilizer and rudder. If neither rudder lock is available, caster the nosewheel to the full left or right position. This action will deflect the rudder against its stop, thus restricting rudder movement.

**WARNING**

Insure all control locks are removed before starting the engines.

## PROPELLERS

The airplane is equipped with all-metal, three-bladed, constant-speed, full-feathering, single-acting, governor-regulated propellers. Each propeller utilizes oil pressure which opposes the force of springs and counterweights to obtain correct pitch for engine load. Oil pressure from the propeller governor drives the blades toward low pitch (increasing RPM) while the springs and counterweights drive blades toward high pitch (decreasing RPM). The source of oil pressure for propeller operation is furnished by the engine oil system, boosted in pressure by the governor gear pump, and supplied to the propeller hub through the engine crankshaft flange.

To feather the propeller blades, the propeller control levers on the control pedestal must be placed in the feather position. Unfeathering the propeller is accomplished by positioning the propeller control lever to the increase RPM position. The optional unfeathering system uses accumulator air and oil to force the propeller out of feather and into the low pitch condition.

## PROPELLER SYNCHROPHASER

The optional propeller synchrophaser system (see Figure 7-35) senses the RPM of both engines, compares this data and makes required adjustments to control engine RPM exactly the same. The pilot, by varying the phase control knob, can select the most desirable propeller phase relationship for various flying conditions.

The synchrophaser system consists of two propeller governors incorporating magnetic transducers and electromagnetic control coils, electronic control box, on-off switch and indicator light and potentiometer to adjust phase settings. The transducers create one negative to positive pulse per revolution that is fed into the control box and is used to synchronize the engines by comparing the time of arrival between signals of the two governors. Any error in time between signal comparison causes the governor control coil to change fly weight positions, speeding up the RPM of the slower running engine to bring about synchronization. The pilot, by adjusting the potentiometer, varies propeller phase relationship by changing signal timing between governors.

When the system is initially turned on, only the slower turning propeller is adjusted to increase RPM. This feature keeps the system operating more closely to the manually selected RPM. Also, if an engine is feathered without shutting off the system, there will be no RPM loss by the operating engine below the manually selected RPM.

The on-off light is only an indicator that the system is on or off and in no way is it an indicator of system performance. If the bulb should happen to burn out or otherwise fail during operation, the system is still operative and the bulb may be replaced when convenient to do so. Refer to Section 8 for bulb replacement.

For best operation, it is important to guard against propeller control creeping by setting the quadrant friction lock tightly. On extended flights, it may be necessary to periodically switch to the OFF position, reset the propeller synchronization manually and reengage the synchrophaser.

NOTE

Manually synchronize propellers within 25 RPM prior to turning system on. After system is operating, RPM adjustment may be made by moving both propeller control levers together. This should keep both governor settings close enough to remain in the synchrophaser's operating range.

If the propellers should go out of synchronization, turn system off; manually synchronize the propellers and turn the system on.

This propeller synchrophaser may be ON for all flight operations including takeoff and landing; however, normal RPM variations during takeoff roll may exceed the synchrophaser capture range causing the synchrophaser to break lock.

## PROPELLER SYNCHROPHASER

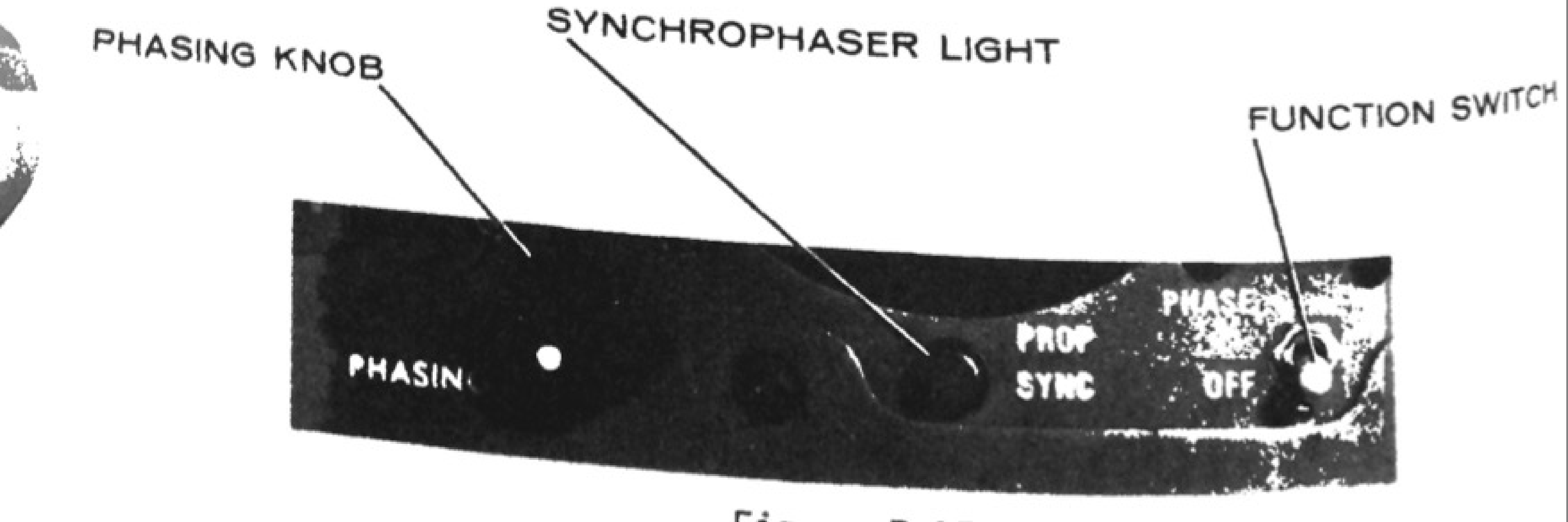



Figure 7-35