# SECTION I

# GENERAL

## 1.1 INTRODUCTION

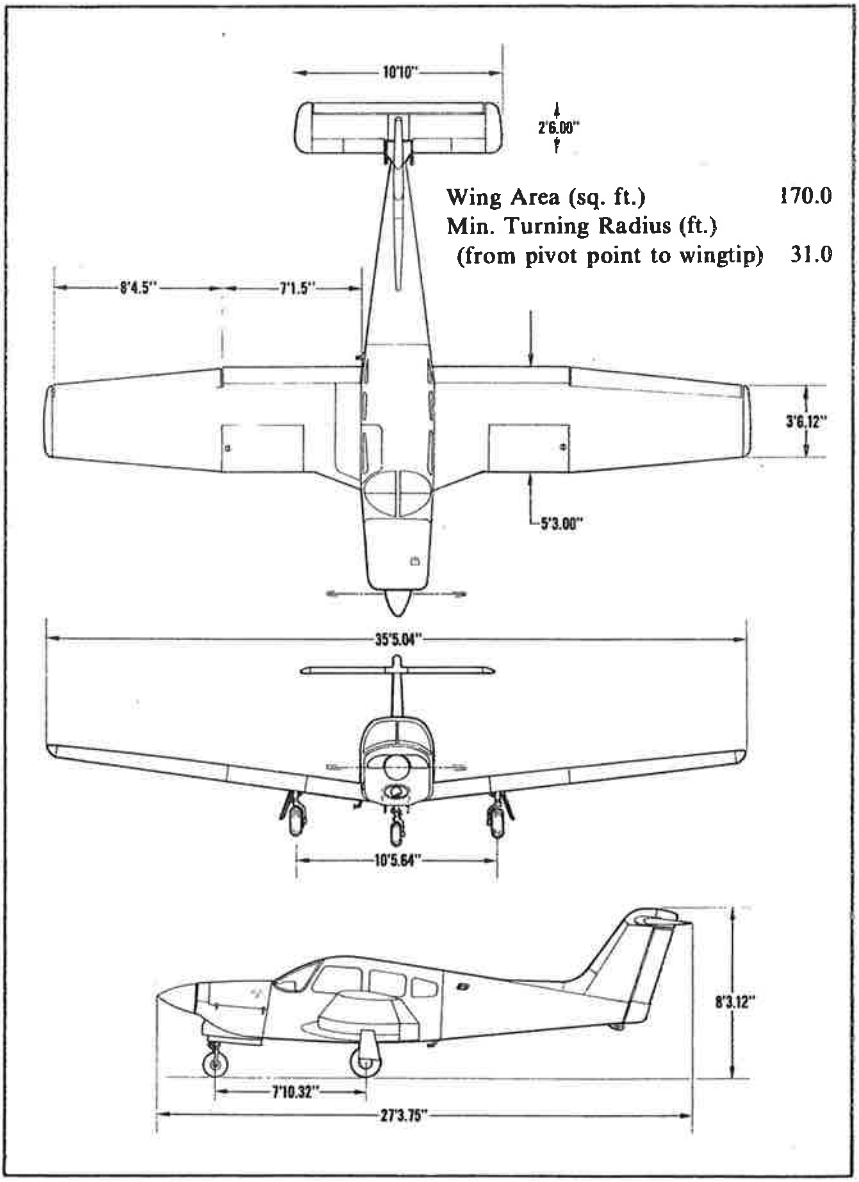
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by CAR 3 and FAR Part 21 Subpart J. It also contains supplemental data supplied by the airplane manufacturer.

This handbook is not designed as a substitute for adequate and competent flight instruction, knowledge of current airworthiness directives, applicable federal air regulations or advisory circulars. It is not intended to be a guide for basic flight instruction or a training manual and should not be used for operational purposes unless kept in a current status.

Assurance that the airplane is in an airworthy condition is the responsibility of the owner. The pilot in command is responsible for determining that the airplane is safe for flight. The pilot is also responsible for remaining within the operating limitations as outlined by instrument markings, placards, and this handbook.

Although the arrangement of this handbook is intended to increase its in-flight capabilities, it should not be used solely as an occasional operating reference. The pilot should study the entire handbook to familiarize himself with the limitations, performance, procedures and operational handling characteristics of the airplane before flight.

The handbook has been divided into numbered (arabic) sections, each provided with a "finger-tip" tab divider for quick reference. The limitations and emergency procedures have been placed ahead of the normal procedures, performance and other sections to provide easier access to information that may be required in flight. The "Emergency Procedures" Section has been furnished with a red tab divider to present an instant reference to the section. Provisions for expansion of the handbook have been made by the deliberate omission of certain paragraph numbers, figure numbers, item numbers and pages noted as being intentionally left blank.




**THREE VIEW**
Figure 1-1

## 1.3 ENGINES

| | |
|---|---|
| (a) Number of Engines | 1 |
| (b) Engine Manufacturer | Teledyne Continental |
| (c) Engine Model Number | TSIO-360-FB |
| (d) Rated Horsepower | 200 Sea Level to 12,000 Ft. Density Altitude |
| (e) Rated Speed (rpm) | 2575 |
| (f) Maximum Manifold Pressure (in. Hg) | 41 |
| (g) Bore (in.) | 4.438 |
| (h) Stroke (in.) | 3.875 |
| (i) Displacement (cu. in.) | 360 |
| (j) Compression Ratio | 7.5:1 |
| (k) Engine Type | Six Cylinder, Direct Drive, Horizontally Opposed, Air Cooled, Turbosupercharged and Fuel Injected |

## 1.5 PROPELLERS

STANDARD

| | |
|---|---|
| (a) Number of Propellers | 1 |
| (b) Propeller Manufacturer | Hartzell |
| (c) Blade Model | F8459A-8R |
| (d) Number of Blades | 2 |
| (e) Hub Model | BHC-C2YF-1( )F |
| (f) Propeller Diameter (in.) | |
| (1) Maximum | 76 |
| (2) Minimum | 75 |
| (g) Propeller Type | Constant Speed, Hydraulically Actuated |

OPTIONAL

| | |
|---|---|
| (a) Number of Propellers | 1 |
| (b) Propeller Manufacturer | Hartzell |
| (c) Blade Model | F7663-2R |
| (d) Number of Blades | 3 |
| (e) Hub Model | PHC-C3YF-1( )F |
| (f) Propeller Diameter (in.) | |
| (1) Maximum | 76 |
| (2) Minimum | 72 |
| (g) Propeller Type | Constant Speed, Hydraulically Actuated |

## 1.7 FUEL

AVGAS ONLY

| | |
|---|---|
| (a) Fuel Capacity (U.S. gal.) (total) | 77 |
| (b) Usable Fuel (U.S. gal.) (total) | 72 |
| (c) Fuel Grade, Aviation | |
| (1) Minimum Grade | 100 Green or 100LL Blue Aviation Grade |
| (2) Alternate Fuels | Refer to latest revision of Continental Service Bulletin "Fuel and Oil Grades" |

## 1.9 OIL

| | |
|---|---|
| (a) Oil Capacity (U.S. qts.) | 8 |
| (b) Oil Specification | MHS-24A |
| (c) Oil Viscosity | Refer to Section 8 - paragraph 8.19. |

## 1.11 MAXIMUM WEIGHTS

| | |
|---|---|
| (a) Maximum Takeoff Weight (lbs.) | 2900 |
| (b) Maximum Landing Weight (lbs.) | 2900 |
| (c) Maximum Ramp Weight (lbs.) | 2912 |
| (d) Maximum Weights in Baggage Compartment | 200 |

## 1.13 STANDARD AIRPLANE WEIGHTS

Refer to Figure 6-5 for the Standard Empty Weight and the Useful Load.

## 1.15 BAGGAGE SPACE

| | |
|---|---|
| (a) Compartment Volume (cu. ft.) | 24 |
| (b) Entry Width (in.) | 22 |
| (c) Entry Height (in.) | 20 |

## 1.17 SPECIFIC LOADINGS

| | |
|---|---|
| (a) Wing Loading (lbs. per sq. ft.) | 17 |
| (b) Power Loading (lbs. per hp) | 14.5 |

# SECTION 2

# LIMITATIONS

## 2.1 GENERAL

This section provides the "FAA Approved" operating limitations, instrument markings, color coding and basic placards necessary for operation of the airplane and its systems.

Limitations associated with those optional systems and equipment which require handbook supplements can be found in Section 9 (Supplements).

## 2.3 AIRSPEED LIMITATIONS

| SPEED | KIAS | KCAS |
|---|---|---|
| Never Exceed Speed (VNE) - Do not exceed this speed in any operation. | 193 | 186 |
| Maximum Structural Cruising Speed (VNO) - Do not exceed this speed except in smooth air and then only with caution. | 152 | 148 |
| Design Maneuvering Speed (VA) - Do not make full or abrupt control movements above this speed. | | |
| At 2900 lbs. G.W. | 124 | 121 |
| At 1893 lbs. G.W. | 97 | 97 |

*CAUTION*

Maneuvering speed decreases at lighter weight as the effects of aerodynamic forces become more pronounced. Linear interpolation may be used for intermediate gross weights. Maneuvering speed should not be exceeded while operating in rough air.

| SPEED | KIAS | KCAS |
|---|---|---|
| Maximum Flaps Extended Speed (VFE) - Do not exceed this speed with the flaps extended. | 108 | 104 |
| Maximum Landing Gear Extension Speed - Do not exceed this speed when extending the landing gear. | 133 | 130 |
| Maximum Landing Gear Retraction Speed - Do not exceed this speed when retracting the landing gear. | 111 | 109 |
| Maximum Landing Gear Extended Speed (VLE) - Do not exceed this speed with the landing gear extended. | 133 | 130 |

## 2.5 AIRSPEED INDICATOR MARKINGS

| MARKING | IAS |
|---|---|
| Red Radial Line (Never Exceed) | 193 KTS |
| Yellow Arc (Caution Range - Smooth Air Only) | 152 KTS to 193 KTS |
| Green Arc (Normal Operating Range) | 66 KTS to 152 KTS |
| White Arc (Flap Down) | 61 KTS to 108 KTS |

## 2.7 POWER PLANT LIMITATIONS

| | |
|---|---|
| (a) Number of Engines | 1 |
| (b) Engine Manufacturer | Teledyne Continental |
| (c) Engine Model No. | TSIO-360-FB |
| (d) Engine Operating Limits | |
| (1) Maximum Horsepower | 200 |
| (2) Maximum Rotation Speed (RPM) | 2575 |
| (3) Maximum Manifold Pressure (In. Mercury) | 41 |
| (4) Maximum Oil Temperature | 240°F |
| (e) Oil Pressure | |
| Minimum (red line) | 10 PSI |
| Maximum (red line) | 100 PSI |
| (f) Fuel Pressure | |
| Maximum (red line) | 19 PSI |
| (g) Fuel (AVGAS ONLY) (minimum grade) | 100 or 100LL Aviation Grade |
| (h) Number of Propellers | 1 |
| (i) Propeller Manufacturer | Hartzell |
| (j) Propeller Hub and Blade Model | |
| (1) Optional (Three Blade) | PHC-C3YF-1( )F/ F7663-2R |
| (2) Standard (Two Blade) | BHC-C2YF-1( )F/ F8459A-8R |
| (k) Propeller Diameter | |
| (1) Optional (Three Blade) | |
| Minimum | 72 |
| Maximum | 76 |
| (2) Standard (Two Blade) | |
| Minimum | 75 |
| Maximum | 76 |
| (l) Blade Angle Limits | |
| (1) Optional (Three Blade) | |
| Low Pitch Stop | 13.2 ± .2° |
| High Pitch Stop | 33 ± 1° |
| (2) Standard (Two Blade) | |
| Low Pitch Stop | 14.4 ± .2° |
| High Pitch Stop | 29 ± 1° |

| | |
|---|---|
| (m) RPM Restrictions (Two Bladed Propeller Only) | Avoid Continuous Ground Operation 1700-2100 RPM In Cross/Tail Wind Over 10 KTS. |
| | Avoid Continuous Operation 2000-2200 RPM Above 32 Inches Manifold Pressure. |

## 2.9 POWER PLANT INSTRUMENT MARKINGS

| | |
|---|---|
| (a) Tachometer | |
| Green Arc (Normal Operating Range) | 500 to 2575 RPM |
| Red Line (Maximum Continuous Power) | 2575 RPM |
| (b) Oil Temperature | |
| Green Arc (Normal Operating Range) | 100° to 240°F |
| Red Line (Maximum) | 240°F |
| (c) Oil Pressure | |
| Green Arc (Normal Operating Range) | 30 PSI to 80 PSI |
| Yellow Arc (Caution Range) (Idle) | 10 PSI to 30 PSI |
| Yellow Arc (Caution Range) (Start and Warm-Up) | 80 PSI to 100 PSI |
| Red Line (Minimum) | 10 PSI |
| Red Line (Maximum) | 100 PSI |
| (d) Fuel Pressure | |
| Green Arc (Normal Operating Range) | 3.5 PSI to 19 PSI |
| Red Line (Maximum) | 19 PSI |
| (e) Exhaust Gas Temperature (EGT) | |
| Green Arc (Normal Operating Range) | 1200°F to 1650°F |
| Red Line (Maximum) | 1650°F |
| (f) Manifold Pressure | |
| Green Arc (Normal Operating Range) | 10 IN. to 41 IN. HG |
| Red Line (Maximum) | 41 IN. HG |

## 2.11 WEIGHT LIMITS

| | |
|---|---|
| (a) Maximum Weight | 2900 LBS. |
| (b) Maximum Ramp Weight | 2912 LBS. |
| (c) Maximum Baggage | 200 LBS. |

NOTE

Refer to Section 5 (Performance) for maximum weight as limited by performance.

## 2.13 CENTER OF GRAVITY LIMITS

| Weight Pounds | Forward Limit Inches Aft of Datum | Rearward Limit Inches Aft of Datum |
|---|---|---|
| 2900 | 89.0 | 93.0 |
| 2400 | 85.0 | 93.0 |

NOTES

Straight line variation between points given.

The datum used is 78.4 inches ahead of the wing leading edge at the intersection of the straight and tapered section.

It is the responsibility of the airplane owner and the pilot to insure that the airplane is properly loaded. See Section 6 (Weight and Balance) for proper loading instructions.

## 2.15 MANEUVER LIMITS

No acrobatic maneuvers including spins approved.

## 2.17 FLIGHT LOAD FACTORS

| | |
|---|---|
| (a) Positive Load Factor (Maximum) | 3.8 G |
| (b) Negative Load Factor (Maximum) | No inverted maneuvers approved |

## 2.19 TYPES OF OPERATIONS

The airplane is approved for the following operations when equipped in accordance with FAR 91 or FAR 135.

(a) Day V.F.R.
(b) Night V.F.R.
(c) Day I.F.R.
(d) Night I.F.R.
(e) Non Icing

## 2.21 FUEL LIMITATIONS

| | |
|---|---|
| (a) Total Capacity | 77 U.S. GAL. |
| (b) Unusable Fuel<br>The unusable fuel for this airplane has been determined as 2.5 gallons in each wing tank in critical flight attitudes. | 5 U.S. GAL. |
| (c) Usable Fuel<br>The usable fuel in this airplane has been determined as 36.0 gallons in each wing tank. | 72 U.S. GAL. |
| (d) Fuel remaining when the quantity indicators read zero cannot be used safely in flight. | |

## 2.23 OPERATING ALTITUDE LIMITATIONS

Flight above 20,000 feet is not approved. Flight up to and including 20,000 feet is approved if equipped with oxygen in accordance with FAR 23.1441 and avionics in accordance with FAR 91 or FAR 135.

## 2.25 NOISE LEVEL

The noise level of this aircraft is 69.4 d B(A) for two bladed propeller installations and 72.8 d B(A) for three bladed propeller installations.

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

The above statement not withstanding the noise level stated above has been verified by and approved by the Federal Aviation Administration in noise level test flights conducted in accordance with FAR 36, Noise Standards - Aircraft Type and Airworthiness Certification. This aircraft model is in compliance with all FAR 36 noise standards applicable to this type.

## 2.27 PLACARDS

In full view of the pilot:

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

THIS AIRCRAFT APPROVED FOR NIGHT I.F.R. NON-ICING FLIGHT WHEN EQUIPPED IN ACCORDANCE WITH FAR 91 OR FAR 135.

In full view of the pilot, the following Takeoff Check List and one of the following Landing Check Lists will be installed:

TAKEOFF CHECK LIST

Fuel on Proper Tank
Auxiliary Fuel Pump Off
Engine Gauges Checked
Alternate Air Closed
Seat Backs Erect
Mixture Set
Propeller Set
Fasten Belts/Harness
Flaps Set
Trim Tab Set
Controls Free
Doors Latched
Air Conditioner Off

LANDING CHECK LIST

Fuel on Proper Tank
Seat Backs Erect
Fasten Belts/Harness
Aux. Fuel Pump Off
Mixture Rich
Propeller Set
Gear Down (133 KIAS Max.)
Flaps Set (108 KIAS Max.)
Air Conditioner Off

LANDING CHECK LIST

Fuel on Proper Tank
Seat Backs Erect
Fasten Belts/Harness
Aux. Fuel Pump Off
Mixture Rich
Propeller Set
Gear Down
Flaps Set (White Arc)
Air Conditioner Off

The "Air Conditioner Off" item in the above Takeoff and Landing Check Lists is mandatory for air conditioned aircraft only.

On the instrument panel in full view of the pilot:

MANEUVERING SPEED 124 KIAS
AT 2900 LBS. (SEE A.F.M.)
or
VA 124 AT 2900 LBS. (SEE P.O.H.)

On the instrument panel in full view of the pilot:

DEMONSTRATED CROSSWIND COMPONENT 17 KTS
or
DEMO. X-WIND 17 KTS

In full view of the pilot:

NO ACROBATIC MANEUVERS,
INCLUDING SPINS, APPROVED

On the instrument panel in full fiew of the pilot:

| | |
|---|---|
| GEAR DOWN | 133 KIAS (MAX.) |
| GEAR UP | 111 KIAS (MAX.) |
| EXTENDED | 133 KIAS (MAX.) |

or

VLO 133 DN, 111 UP VLE 133 MAX.

Near emergency gear lever:

EMERGENCY DOWN

Near emergency gear lever (aircraft equipped with backup gear extender):

OVERRIDE ENGAGED AUTO-EXT-OFF
LOCK PIN ON SIDE
TO ENGAGE OVERRIDE:
PULL LEVER FULL UP, PUSH LOCK PIN
TO RELEASE OVERRIDE:
PULL LEVER FULL UP & RELEASE

Near gear selector switch:

| | |
|---|---|
| GEAR UP | 111 KIAS MAX. |
| DOWN | 133 KIAS MAX. |

Adjacent to upper door latch:

ENGAGE LATCH BEFORE FLIGHT

In full view of the pilot:

WARNING

TURN OFF STROBE LIGHTS WHEN IN CLOSE PROXIMITY TO GROUND OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE.

In full view of the pilot, in the area of the air conditioner controls when the air conditioner is installed:

WARNING

AIR CONDITIONER MUST BE OFF TO INSURE NORMAL TAKEOFF CLIMB PERFORMANCE.

On inside of baggage compartment door:

BAGGAGE MAXIMUM 200 LBS. SEE WEIGHT AND BALANCE DATA FOR BAGGAGE LOADING BETWEEN 150 LBS. AND 200 LBS.

In full view of the pilot:

FUEL REMAINING WHEN QUANTITY INDICATOR READS ZERO CANNOT BE USED SAFELY IN FLIGHT.

On the instrument panel in full view of the pilot in aircraft with two bladed propeller installations only:

AVOID CONTINUOUS GROUND OPERATION 1700-2100 RPM IN CROSS/TAIL WIND OVER 10 KTS.

AVOID CONTINUOUS OPERATION 2000-2200 RPM ABOVE 32" MANIFOLD PRESSURE.

On the aft baggage closeout:

MAXIMUM BAGGAGE 200 LBS. NO HEAVY OBJECTS ON HAT SHELF.

Adjacent to fuel tank filler caps (Prior to serial number 28R-8031031):

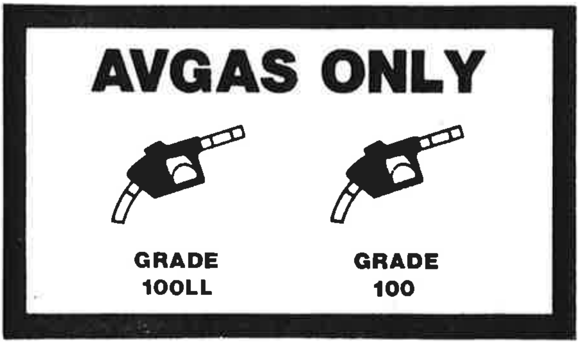
FUEL - 100/130 AVIATION GRADE - MIN. USABLE CAPACITY 36 GAL.

USABLE CAPACITY TO BOTTOM OF FILLER NECK INDICATOR 25 GAL.

Adjacent to fuel tank filler caps (Serial numbers 28R-8031031 and up):

FUEL - 100 OR 100LL AVIATION GRADE

(Serial numbers 28R-8331015 and up)



# SECTION 3

# EMERGENCY PROCEDURES

## 3.1 GENERAL

The recommended procedures for coping with various types of emergencies and critical situations are provided by this section. All of the required (FAA regulations) emergency procedures and those necessary for operation of the airplane as determined by the operating and design features of the airplane are presented.

Emergency procedures associated with those optional systems and equipment which require handbook supplements are provided in Section 9 (Supplements).

The first portion of this section consists of an abbreviated emergency check list which supplies an action sequence for critical situations with little emphasis on the operation of systems.

The remainder of the section is devoted to amplified emergency procedures containing additional information to provide the pilot with a more complete understanding of the procedures.

These procedures are suggested as a course of action for coping with the particular condition described, but are not a substitute for sound judgment and common sense. Pilots should familiarize themselves with the procedures given in this section and be prepared to take appropriate action should an emergency arise.

Most basic emergency procedures, such as power off landings, are a normal part of pilot training. Although these emergencies are discussed here, this information is not intended to replace such training, but only to provide a source of reference and review, and to provide information on procedures which are not the same for all aircraft. It is suggested that the pilot review standard emergency procedures periodically to remain proficient in them.

## 3.3 EMERGENCY PROCEDURES CHECK LIST

### ENGINE FIRE DURING START

Starter ............................................. crank engine
Mixture ............................................. idle cut-off
Throttle ............................................. open
Primer ............................................. OFF
Fuel selector ............................................. OFF
Abandon if fire continues.

### ENGINE POWER LOSS DURING TAKEOFF

If sufficient runway remains for a normal landing, leave gear down and land straight ahead.

If area ahead is rough, or if it is necessary to clear obstructions:
Gear selector switch ............................................. UP
Emergency gear lever (aircraft equipped
with backup gear extender) .................. locked in OVERRIDE ENGAGED position

If sufficient altitude has been gained to attempt a restart:
Maintain safe airspeed.
Fuel selector ............................................. switch to tank containing fuel
Auxiliary fuel pump ............................................. unlatch, HI
Mixture ............................................. check RICH
Alternate air ............................................. OPEN
Emergency gear lever ............................................. as required
If power is not regained, proceed with power off landing.

### ENGINE POWER LOSS IN FLIGHT

Fuel selector ............................................. switch to tank containing fuel
Auxiliary fuel pump ............................................. unlatch, HI
Mixture ............................................. RICH
Alternate air ............................................. OPEN
Engine gauges .................................. check for indication of cause of power loss
If no fuel pressure is indicated, check tank selector position to be sure it is on a tank containing fuel.

When power is restored:
Alternate air ........................................ CLOSED
Auxiliary fuel pump ........................................ OFF
If power is not restored prepare for power off landing.
Trim for 97 KIAS.

## POWER OFF LANDING

On aircraft equipped with the backup gear extender, lock emergency gear lever in OVERRIDE ENGAGED position before airspeed drops to 106 KIAS to prevent the landing gear from free falling.
Trim for 97 KIAS.
Locate suitable field.
Establish spiral pattern.
1000 ft. above field at downwind position for normal landing approach.
When field can easily be easily reached slow to 75 KIAS for shortest landing.

## GEAR DOWN EMERGENCY LANDING

Touchdowns should normally be made at lowest possible airspeed with full flaps.

When committed to landing:
Landing gear selector ........................................ Down
Throttle ........................................ close
Mixture ........................................ idle cut-off
Ignition ........................................ OFF
Master switch ........................................ OFF
Fuel selector ........................................ OFF
Seat belt and harness ........................................ tight

## GEAR UP EMERGENCY LANDING

In the event a gear up landing is required, proceed as follows:
Flaps ........................................ as desired
Throttle ........................................ close
Mixture ........................................ idle cut-off
Ignition switches ........................................ OFF
Master switch ........................................ OFF
Fuel selector ........................................ OFF
Seat belt and harness ........................................ tight
Contact surface at minimum possible airspeed.

## FIRE IN FLIGHT

Source of fire .......................................... check

Electrical fire (smoke in cabin):
Master switch .......................................... OFF
Vents .......................................... open
Cabin heat .......................................... OFF
Land as soon as practicable.

Engine fire:
Fuel selector .......................................... OFF
Throttle .......................................... CLOSED
Mixture .......................................... idle cut-off
Auxiliary fuel pump .......................................... check OFF
Heater and defroster .......................................... OFF
Proceed with power off landing procedure.

## LOSS OF OIL PRESSURE

Land as soon as possible and investigate cause.
Prepare for power off landing.

## LOSS OF FUEL PRESSURE

Auxiliary fuel pump .......................................... unlatch, HI
Fuel selector .......................................... check on full tank

## ENGINE DRIVEN FUEL PUMP FAILURE

Throttle .......................................... retard
Auxiliary fuel pump .......................................... unlatch, HI
Throttle .......................................... reset (75% power or below)

*CAUTION*

If normal engine operation and fuel flow is not immediately re-established, the auxiliary fuel pump should be turned off. The lack of a fuel flow indication while in the HI auxiliary fuel pump position could indicate a leak in the fuel system, or fuel exhaustion.

*CAUTIONS*

DO NOT actuate the auxiliary fuel pump unless vapor suppression is required (LO position) or the engine-driven fuel pump fails (HI position). The auxiliary pump has no standby function. Actuation of the HI switch position when the engine is operating normally may cause engine roughness and/or power loss.

If the auxiliary fuel pump switch or primer switch fails causing the auxiliary fuel pump to be activated in the HI mode while the engine-driven fuel pump is operating normally, engine roughness and/or power loss could occur. Should this condition exist, pull out the fuel pump pull-type circuit breaker, if so equipped, or shut off the master switch.

## HIGH OIL TEMPERATURE

Land at nearest airport and investigate the problem.
Prepare for power off landing.

## ELECTRICAL FAILURES

ALT annunciator light illuminated
Ammeter .......................................... check to verify inop. alt.

If ammeter shows zero
ALT switch .......................................... OFF

Reduce electrical loads to minimum
ALT circuit breaker .......................................... check and reset as required
ALT switch .......................................... ON

If power not restored
ALT switch .......................................... OFF

If alternator output cannot be restored, reduce electrical loads and land as soon as practical. The battery is the only remaining source of electrical power.

**ELECTRICAL OVERLOAD (alternator over 20 amps above known electrical load)**

FOR AIRPLANES WITH INTERLOCKED BAT AND ALT SWITCH OPERATION

Electrical load .......................................... reduce

If alternator loads are not reduced
ALT switch .......................................... OFF

Land as soon as practical. The battery is the only remaining source of power. Anticipate complete electrical failure.

FOR AIRPLANES WITH SEPARATE BAT AND ALT SWITCH OPERATION

ALT switch .......................................... ON
BAT switch .......................................... OFF

If alternator loads are reduced
Electrical load .................................. reduce to minimum

Land as soon as practical.

NOTE

Due to increased system voltage and radio frequency noise, operation with ALT switch ON and BAT switch OFF should be made only when required by an electrical system failure.

If alternator loads are not reduced
ALT switch .......................................... OFF
BAT switch .......................................... as required

Land as soon as possible. Anticipate complete electrical failure.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative.

## PROPELLER OVERSPEED

Throttle .......................................... retard
Oil pressure .......................................... check
Prop control .......................................... full DECREASE rpm, then set if any control available
Airspeed .......................................... reduce
Throttle .......................................... as required to remain below 2575 rpm

## EMERGENCY LANDING GEAR EXTENSION

Prior to emergency extension procedure:
Master switch .......................................... check ON
Circuit breakers .......................................... check
Panel lights .......................................... OFF (in daytime)
Gear indicator bulbs .......................................... check

If landing gear does not check down and lock:
Airspeed .......................................... reduce below 88 KIAS
Landing gear selector switch .......................................... gear DOWN position
If gear has failed to lock down on aircraft equipped with the backup gear extender, raise emergency gear lever to OVERRIDE ENGAGED position.
If gear has still failed to lock down, move emergency lever to "Emergency Down" position.
If gear has still failed to lock down, yaw the airplane abruptly from side to side with the rudder.

If the nose gear will not lock down using the above procedure, slow the aircraft to the lowest safe speed attainable using the lowest power setting required for safe operation and accomplish the following:

Emergency gear lever (aircraft equipped with backup gear extender).............. OVERRIDE ENGAGED
Landing gear selector switch....................gear DOWN position
If landing gear does not check down, recycle gear through up position, and then select gear DOWN.

## SPIN RECOVERY

Rudder ........................................ full opposite to direction of rotation
Control wheel ................................full forward while neutralizing ailerons
Throttle ............................................ idle
Rudder ......................... neutral (when rotation stops)
Control wheel ...........................as required to smoothly regain level flight attitude

## OPEN DOOR

If both upper and side latches are open, the door will trail slightly open and and airspeeds will be reduced slightly.

To close the door in flight:
Slow airplane to 87 KIAS.
Cabin vents ........................................ close
Storm window........................................ open

If upper latch is open.................................... latch
If side latch is open ........................pull on armrest while moving latch handle to latched position

If both latches are open.......................... latch side latch then top latch

## EMERGENCY DESCENT

A malfunction of the oxygen system requires an immediate descent to an altitude at or below 12,500 feet.

NOTE

Time of useful consciousness at 20,000 ft. is approximately 10 minutes. In the event an emergency descent becomes necessary, CLOSE the throttle and move the propeller control full FORWARD. Adjust the mixture control as necessary to attain smooth operation. Extend the landing gear and flaps at 103 KIAS and maintain this airspeed.

## 3.5 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

The following paragraphs are presented to supply additional information for the purpose of providing the pilot with a more complete understanding of the recommended course of action and probable cause of an emergency situation.

## 3.7 ENGINE FIRE DURING START

Engine fires during start are usually the result of overpriming. The first attempt to extinguish the fire is to try to start the engine and draw the excess fuel back into the induction system.

If a fire is present before the engine has started, move the mixture control to idle cut-off, open the throttle and crank the engine. This is an attempt to draw the fire back into the engine.

If the engine has started, continue operating to try to pull the fire into the engine.

In either case (above), if fire continues more than a few seconds, the fire should be extinguished by the best available external means.

The fuel selector valves should be OFF and the mixture at idle cut-off if an external fire extinguishing method is to be used.

## 3.9 ENGINE POWER LOSS DURING TAKEOFF

The proper action to be taken if loss of power occurs during takeoff will depend on the circumstances of the particular situation.

If sufficient runway remains to complete a normal landing, leave the landing gear down and land straight ahead.

If the area ahead is rough, or if it is necessary to clear obstructions, move the gear selector switch to the UP position. On aircraft equipped with the backup gear extender, lock the emergency gear lever in the OVERRIDE ENGAGED position.

If sufficient altitude has been gained to attempt a restart, maintain a safe airspeed and switch the fuel selector to another tank containing fuel. Place the auxiliary fuel pump to HI*. Check that the mixture is RICH. The alternate air should be OPEN.

On aircraft equipped with the backup gear extender, the landing gear will extend automatically when engine power fails at speeds below approximately 103 KIAS. The glide distance with the landing gear extended is roughly halved. If the situation dictates, the landing gear can be retained in the retracted position by locking the emergency lever in the OVERRIDE ENGAGED position.

If engine failure was caused by fuel exhaustion, power will not be regained after switching fuel tanks until the empty fuel lines are filled. This may require up to ten seconds.

If power is not regained, proceed with the Power Off Landing procedure (refer to the emergency check list and Paragraph 3.13).

## 3.11 ENGINE POWER LOSS IN FLIGHT

Complete engine power loss is usually caused by fuel flow interruption and power will be restored shortly after fuel flow is restored. If power loss occurs at a low altitude, the first step is to prepare for an emergency landing (refer to Paragraph 3.13). An airspeed of at least 97 KIAS should be maintained.

If altitude permits, switch the fuel selector to another tank containing fuel and turn the auxiliary fuel pump to HI*. Move the mixture control to RICH and the alternate air to OPEN. Check the engine gauges for an indication of the cause of the power loss. If no fuel pressure is indicated, check the tank selector position to be sure it is on a tank containing fuel.

When power is restored move the alternate air to the "CLOSED" position and turn OFF the auxiliary fuel pump.

If the preceding steps do not restore power, prepare for an emergency landing.

*The HI position on the auxiliary fuel pump switch is guarded and must be unlatched before it can be activated.

If time permits, turn the ignition switch to "L" then to "R" then back to "BOTH" to check magneto grounding. Move the throttle and mixture control levers to different settings. This may restore power if the problem is too rich or too lean a mixture or if there is a partial fuel system restriction. Try the other fuel tank. Water in the fuel could take some time to be used up, and allowing the engine to windmill may restore power. If power loss is due to water, fuel pressure indications will be normal.

If engine failure was caused by fuel exhaustion power will not be restored after switching fuel tanks until the empty fuel lines are filled. This may require up to ten seconds.

If power is not regained, proceed with the Power Off Landing procedure (refer to emergency check list and Paragraph 3.13).

## 3.13 POWER OFF LANDING

If loss of power occurs at altitude, lock emergency gear lever in "Override Engaged" position before airspeed drops to 106 KIAS to prevent the landing gear from inadvertently free falling on aircraft equipped with the backup gear extender. Trim the aircraft for best gliding angle (97 KIAS, Air Cond. off) and look for a suitable field. If measures taken to restore power are not effective, and if time permits, check your charts for airports in the immediate vicinity; it may be possible to land at one if you have sufficient altitude. At best gliding angle, with the engine windmilling, and the propeller control in full DECREASE rpm, the aircraft will travel approximately 1.6 miles for each thousand feet of altitude. If possible, notify the FAA by radio of your difficulty and intentions. If another pilot or passenger is aboard, let him help.

When you have located a suitable field, establish a spiral pattern around this field. Try to be at 1000 feet above the field at the downwind position, to make a normal landing approach. When the field can easily be reached, slow to 75 KIAS with flaps down for the shortest landing. Excess altitude may be lost by widening your pattern, using flaps or slipping, or a combination of these.

Whether to attempt a landing with gear up or down depends on many factors. If the field chosen is obviously smooth and firm, and long enough to bring the plane to a stop, the gear should be down. If there are stumps or rocks or other large obstacles in the field, the gear in the down position will better protect the occupants of the aircraft. If, however, the field is suspected to be excessively soft or short, or when landing in water of any depth, a wheels-up landing will normally be safer and do less damage to the airplane.

On aircraft equipped with the backup gear extender, the landing gear will free fall at airspeeds below approximately 103 KIAS, and will take six to eight seconds to be down and locked. If a gear up landing is desired, it will be necessary to lock the override lever in the OVERRIDE ENGAGED position before the airspeed drops to 106 KIAS to prevent the landing gear from inadvertently free falling.

Touchdown should normally be made at the lowest possible airspeed.

(a) Gear Down Emergency Landing

When committed to a gear down emergency landing, select landing gear "down", close the throttle control and shut OFF the master and ignition switches. Flaps may be used as desired. Turn the fuel selector valve to OFF and move the mixture to idle cut-off. The seat belts and shoulder harness (if installed) should be tightened. Touchdown should be normally made at the lowest possible airspeed.

NOTE

If the master switch is OFF, the gear cannot be retracted.

(b) Gear Up Emergency Landing

On aircraft equipped with the backup gear extender, lock the emergency gear lever in OVERRIDE ENGAGED position before the airspeed drops tc 106 KIAS prevent the landing gear from inadvertently free falling. Wing flaps should be extended as desired.

When committed to a gear up landing, CLOSE the throttle and shut OFF the master and ignition switches. Turn OFF the fuel selector valve.

Touchdowns should normally be made at the lowest possible airspeed with full flaps.

## 3.15 FIRE IN FLIGHT

The presence of fire is noted through smoke, smell and heat in the cabin. It is essential that the source of the fire be promptly identified through instrument readings, character of the smoke, or other indications since the action to be taken differs somewhat in each case.

Check for the source of the fire first.

If an electrical fire is indicated (smoke in the cabin), the master switch should be turned OFF. The cabin vents should be opened and the cabin heat turned OFF. A landing should be made as soon as possible.

If an engine fire is present, switch the fuel selector to OFF and close the throttle. The mixture should be at idle cut-off. Turn the auxiliary fuel pump OFF. In all cases, the heater and defroster should be OFF. If radio communication is not required select master switch OFF. If the terrain permits, a landing should be made immediately.

NOTE

The possibility of an engine fire in flight is extremely remote. The procedure given is general and pilot judgment should be the determining factor for action in such an emergency.

## 3.17 LOSS OF OIL PRESSURE

Loss of oil pressure may be either partial or complete. A partial loss of oil pressure usually indicates a malfunction in the oil pressure regulating system, and a landing should be made as soon as possible to investigate the cause and prevent engine damage.

A complete loss of oil pressure indication may signify oil exhaustion or may be the result of a faulty gauge. In either case, proceed toward the nearest airport, and be prepared for a forced landing. If the problem is not a pressure gauge malfunction, the engine may stop suddenly. Maintain altitude until such time as a dead stick landing can be accomplished. Don't change power settings unnecessarily, as this may hasten complete power loss.

Depending on the circumstances, it may be advisable to make an off airport landing while power is still available, particularly if other indications of actual oil pressure loss, such as sudden increases in temperatures, or oil smoke, are apparent, and an airport is not close.

If engine stoppage occurs, proceed with Power Off Landing.

## 3.19 LOSS OF FUEL PRESSURE

The most probable cause of loss of fuel pressure is either fuel depletion in the fuel tank selected, or failure of the engine driven fuel pump. If loss of fuel pressure occurs, check that the fuel selector is on a tank containing fuel; place auxiliary fuel pump on "HI" until fuel pressure recovers, then turn OFF.

If loss of fuel pressure is due to failure of the engine driven fuel pump, the auxiliary fuel pump system can supply sufficient fuel pressure for engine power up to approximately 75%. Any combination of RPM and Manifold Pressure defined in the Power Setting Table may be used, but leaning may be required for smooth operation at altitudes above 15,000 feet, or for RPM below 2300. Normal cruise, descent and approach procedures should be used.

If failure of the engine driven fuel pump is suspected, retard throttle and unlatch the auxiliary fuel pump and place in "HI" position. The throttle can then be reset at 75% power or below.

*CAUTION*

If normal engine operation and fuel flow is not immediately re-established, the auxiliary fuel pump should be turned off. The lack of a fuel flow indication while on the HI auxiliary fuel pump position could indicate a leak in the fuel system, or fuel exhaustion.

DO NOT actuate the auxilary fuel pump unless vapor suppression is required (LO position) or the engine driven fuel pump fails (HI position). The auxiliary pump has no standy function. Actuation of the HI switch position when the engine is operating normally may cause engine roughness and/or power loss.

## 3.21 ENGINE-DRIVEN FUEL PUMP FAILURE

If an engine-driven fuel pump failure is indicated, immediately retard the throttle. The auxiliary fuel pump switch should be unlatched and the HI position selected. The throttle should then be reset at 75% power or below.

*CAUTIONS*

If normal engine operation and fuel flow is not immediately re-established, the auxiliary fuel pump should be turned off. The lack of a fuel flow indication while on the HI auxiliary fuel pump position could indicate a leak in the fuel system or fuel exhaustion.

DO NOT actuate the auxiliary fuel pump unless vapor suppression is required (LO position) or the engine-driven fuel pump fails (HI position). The auxiliary pump has no standby function. Actuation of the HI switch position when the engine is operating normally may cause engine roughness and/or power loss.

If the auxiliary fuel pump switch or primer switch fails causing the auxiliary fuel pump to be activated in the HI mode while the engine-driven fuel pump is operating normally, engine roughness and/or power loss could occur. Should this condition exist, pull out the fuel pump pull-type circuit breaker, if so equipped, or shut off the master switch.

## 3.23 HIGH OIL TEMPERATURE

An abnormally high oil temperature indication may be caused by a low oil level, an obstruction in the oil cooler, damaged or improper baffle seals, a defective gauge, or other causes. Land as soon as practical at an appropriate airport and have the cause investigated.

A steady, rapid rise in oil temperature is a sign of trouble. Land at the nearest airport and let a mechanic investigate the problem. Watch the oil pressure gauge for an accompanying loss of pressure.

## 3.25 ELECTRICAL FAILURES

Loss of alternator output is detected through zero reading on the ammeter. Before executing the following procedure, insure that the reading is zero and not merely low by actuating an electrically powered device, such as the landing light. If no increase in the ammeter reading is noted, alternator failure can be assumed.

The electrical load should be reduced as much as possible. Check the alternator circuit breakers for a popped circuit.

The next step is to attempt to reset the overvoltage relay. This is accomplished by moving the ALT switch to OFF for one second and then to ON. If the trouble was caused by a momentary overvoltage condition (16.5 volts and up) this procedure should return the ammeter to a normal reading.

If the ammeter continues to indicate "0" output, or if the alternator will not remain reset, turn off the ALT switch, maintain minimum electrical load and land as soon as practical. All electrical load is being supplied by the battery.

## 3.26 ELECTRICAL OVERLOAD (Alternator over 20 amps above known electrical load)

If abnormally high alternator output is observed (more than 20 amps above known electrical load for the operating conditions) it may be caused by a low battery, a battery fault or other abnormal electrical load. If the cause is a low battery, the indication should begin to decrease toward normal within 5 minutes. If the overload condition persists attempt to reduce the load by turning off nonessential equipment. For airplanes with interlocked BAT and ALT switch operation, when the electrical load cannot be reduced turn the ALT switch OFF and land as soon as practical. The battery is the only remaining source of electrical power. Also anticipate complete electrical failure.

For airplanes with separate BAT and ALT switch operations, turn the BAT switch OFF and the ammeter should decrease. Turn the BAT switch ON and continue to monitor the ammeter. If the alternator output does not decrease within 5 minutes, turn the BAT switch OFF and land as soon as practical. All electrical loads are being supplied by the alternator.

NOTE

Due to higher voltage and radio frequency noise, operation with the ALT switch ON and the BAT switch OFF should be made only when required by an electrical failure.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative.

## 3.27 PROPELLER OVERSPEED

Propeller overspeed is caused by a malfunction in the propeller governor or low oil pressure which allows the propeller blades to rotate to full low pitch.

If propeller overspeed should occur, retard the throttle and check the oil pressure. The propeller control should be moved to full "DECREASE rpm" and then set if any control is available. Airspeed should be reduced and throttle used to maintain 2575 RPM.

## 3.29 EMERGENCY LANDING GEAR EXTENSION

Prior to initiating the emergency extension procedure check to insure that the master switch is ON and that the circuit breakers have not opened. If it is daytime the panel lights should be turned OFF. Check the landing gear indicators for faulty bulbs.

NOTE

Refer to Para. 4.47 for differences when emergency extension procedure is performed for training purposes.

If the landing gear does not check down and locked, reduce the airspeed below 88 KIAS. Move the landing gear selector switch to the DOWN position. If the gear has failed to lock down on aircraft equipped with the backup gear extender, raise the emergency gear lever to the OVERRIDE ENGAGED position.

If the gear has still failed to lock down, move the emergency gear lever to the EMERGENCY DOWN position.

If the gear has still failed to lock down, yaw the airplane abruptly from side to side with the rudder.

If the nose gear will not lock down using the above procedure, slow the airplane to the lowest safe speed attainable using the lowest power setting required for safe operation and raise the emergency gear lever to the OVERRIDE ENGAGE position on aircraft equipped with the backup gear extender. Move the landing gear selector switch to the gear DOWN position. If the landing gear does not check down, recycle the gear through the UP position and then select the "DOWN" position.

## 3.31 SPIN RECOVERY

Intentional spins are prohibited in this airplane. If a spin is inadvertently entered, immediately apply full rudder opposite to the direction of rotation. Move the control wheel full forward while neutralizing the ailerons. Move the throttle to IDLE. When the rotation stops, neutralize the rudder and ease back on the control wheel as required to smoothly regain a level flight attitude.

## 3.33 OPEN DOOR

The cabin door is double latched, so the chances of its springing open in flight at both the top and bottom are remote. However, should you forget the upper latch, or not fully engage the side latch, the door may spring partially open. This will usually happen at takeoff or soon afterward. A partially open door will not affect normal flight characteristics, and a normal landing can be made with the door open.

If both upper and side latches are open, the door will trail slightly open, and airspeed will be reduced slightly.

To close the door in flight, slow the airplane to 87 KIAS, close the cabin vents and open the storm window. If the top latch is open, latch it. If the side latch is open, pull on the arm rest while moving the latch handle to the latched position. If both latches are open, close the side latch then the top latch.

## 3.35 ENGINE ROUGHNESS

Engine roughness may be caused by dirt in the injector nozzles, induction system icing, or ignition problems.

First adjust the mixture for maximum smoothness. The engine will run rough if the mixture is too rich or too lean.

Move the alternate air to OPEN.

Switch the fuel selector to another tank to see if fuel contamination is the problem.

Check the engine gauges for abnormal readings. If any gauge readings are abnormal proceed accordingly.

The magneto switch should then be moved to "L" then "R," then back to "BOTH." If operation is satisfactory on either magneto, proceed on that magneto at reduced power with full RICH mixture to a landing at the first available airport.

If roughness persists, prepare for a precautionary landing at pilot's discretion.

## 3.37 EMERGENCY DESCENT

A malfunction of the oxygen system requires an immediate descent to an altitude at or below 12,500 feet.

NOTE

Time of useful consciousness at 20,000 ft. is approximately 10 minutes. In the event an emergency descent becomes necessary, CLOSE the throttle and move the propeller control full FORWARD. Adjust the mixture control as necessary to attain smooth operation. Extend the landing gear and flaps at 103 KIAS and maintain this airspeed.

# SECTION 4

# NORMAL PROCEDURES

## 4.1 GENERAL

This section describes the recommended procedures for the conduct of normal operations for the Turbo Arrow IV. All of the required (FAA regulations) procedures and those necessary for operation of the airplane as determined by the operating and design features of the airplane are presented.

Normal procedures associated with those optional systems and equipment which require handbook supplements are provided in Section 9 (Supplements).

These procedures are provided to present a source of reference and review and to supply information on procedures which are not the same for all aircraft. Pilots should familiarize themselves with the procedures given in this section in order to become proficient in the normal operations of the airplane.

The first portion of this section consists of a short form check list which supplies an action sequence for normal operations with little emphasis on the operation of the systems.

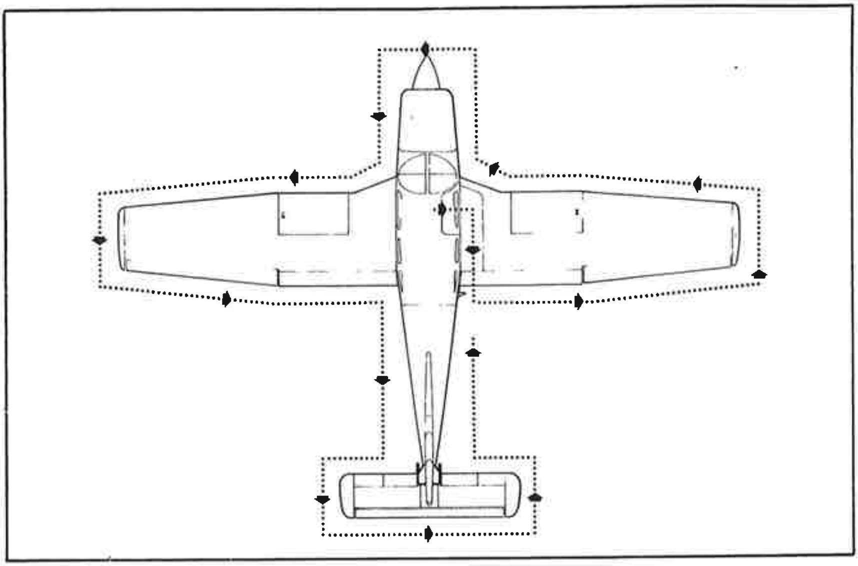
The remainder of the section is devoted to amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an in-flight reference due to the lengthly explanations. The short form check list should be used for this purpose.

## 4.3 AIRSPEEDS FOR SAFE OPERATIONS

The following airspeeds are those which are significant to operation of the airplane. These figures are for standard airplanes flown at gross weight under standard conditions at sea level.

Performance for a specific airplane may vary from published figures depending upon the equipment installed, the condition of the engine, airplane and equipment, atmospheric conditions and piloting technique.

| | |
|---|---|
| (a) Best Rate of Climb Speed | |
| gear up, flaps up | 97 KIAS |
| gear down, flaps up | 79 KIAS |
| (b) Best Angle of Climb Speed | |
| gear up, flaps up | 79 KIAS |
| gear down, flaps up | 73 KIAS |
| (c) Turbulent Air Operating Speed (See Subsection 2.3) | 124 KIAS |
| (d) Maximum Flap Speed | 108 KIAS |
| (e) Landing Final Approach Speed (Flaps 40°) | 75 KIAS |
| (f) Maximum Demonstrated Crosswind Velocity | 17 KTS |



**WALK-AROUND**
Figure 4-1

## 4.5 NORMAL PROCEDURES CHECK LIST

### PREFLIGHT CHECK

COCKPIT

Control wheel .................................... release restraints
Parking brake .................................................. set
All switches ................................................. OFF
Mixture ............................................ idle cut-off
Master switch ................................................ ON
Fuel gauges .................................... check quantity
Annunciator panel ......................................... check
Master switch ................................................ OFF
Primary flight controls .......................... proper operation
Flaps ........................................... proper operation
Trim ....................................................... neutral
Pitot and static systems ..................................... drain
Windows ................................................ check clean

Required papers .......... check on board
Tow bar and baggage .......... stow properly - secure
Baggage door .......... close and secure

RIGHT WING

Surface condition .......... clear of ice, frost, snow
Flap and hinges .......... check
Aileron and hinges .......... check
Wing tip and lights .......... check
Fuel tank .......... check supply visually - secure cap
Fuel tank vent .......... clear
Fuel tank sump .......... drain and check for water, sediment and proper fuel
Tie down and chock .......... remove
Main gear strut .......... proper inflation (2.5 ± .25 in.)
Tire .......... check
Brake block and disc .......... check
Fresh air inlet .......... clear

NOSE SECTION

General condition .......... check
Cowling .......... secure
Windshield .......... clean
Propeller and spinner .......... check
Air inlets .......... clear
Alternator belt .......... check tension
Chock .......... remove
Nose gear strut .......... proper inflation (2.75 ± .25 in.)
Nose wheel tire .......... check
Engine baffle seals .......... check
Oil .......... check quantity
Dipstick .......... properly seated
Oil filler cap .......... secure
Fuel strainer .......... drain

LEFT WING

Surface condition .......... clear of ice, frost, snow
Fresh air inlet .......... clear

Chock ........................................ remove
Main gear strut ........................................ proper inflation (2.5 ± .25 in.)
Tire ........................................ check
Brake block and disc ........................................ check
Fuel tank ........................................ check supply visually - secure cap
Fuel tank vent ........................................ clear
Fuel tank sump ........................................ drain and check for water, sediment and proper fuel
Tie down ........................................ remove
Pitot/static head ........................................ remove cover - holes clear
Wing tip and lights ........................................ check
Aileron and hinges ........................................ check
Flap and hinges ........................................ check

FUSELAGE

Antennas ........................................ check
Empennage ........................................ clear of ice, frost, snow
Fresh air inlet ........................................ clear
Stabilator and trim tab ........................................ check
Tie down ........................................ remove
Master switch ........................................ ON
Cockpit lighting ........................................ check
Nav and strobe lights ........................................ check
Stall warning ........................................ check
Pitot heat ........................................ check
All switches ........................................ OFF
Passengers ........................................ board
Cabin door ........................................ close and secure
Seat belts and harness ........................................ fasten/adjust check inertia reel

## BEFORE STARTING ENGINE

Avionics switch ........................................ OFF
Parking brake ........................................ set
Propeller ........................................ full INCREASE rpm
Fuel selector ........................................ desired tank
Alternate air ........................................ OFF

## STARTING ENGINE (AIRPLANE EQUIPPED WITH STANDARD ENGINE PRIMER SYSTEM)

Fuel selector .............................................. ON
Mixture .............................................. RICH
Throttle .............................................. half travel
Propeller.............................................. FORWARD
Master switch .............................................. ON
Propeller.............................................. clear
Starter.............................................. engage
Primer button .............................. ON as required
Throttle .............................. retard when engine starts
Oil pressure .............................................. check
Alternator .............................................. check
Gyro vacuum.............................................. check

## STARTING ENGINE (AIRPLANE EQUIPPED WITH OPTIONAL ENGINE PRIMER SYSTEM)

Fuel selector .............................................. ON
Mixture .............................................. full RICH
Throttle .............................................. full FORWARD
Prop control .............................................. full FORWARD
Master switch .............................................. ON
Auxiliary fuel pump .............................................. OFF
Primer.............................................. ON
See Figure 4-3 for
Priming Time
Throttle .............................................. CLOSE
Starter.............................................. engage immediately
At temperatures below +20° F continue priming while cranking until engine starts.

When engine starts firing - open throttle very slowly to raise engine speed to 1000 RPM. As engine speed accelerates through 500 RPM, release starter.
Primer.............................................. release
Auxiliary fuel pump .............................. low only as necessary
to obtain smooth engine
operation (1-3 minutes
will be required when
temp. is below 20° F)

Oil pressure .................... check
Alternator .................... check
Gyro vacuum .................... check

## STARTING ENGINE WHEN FLOODED

Mixture .................... idle cut-off
Throttle .................... full FORWARD
Propeller .................... FORWARD
Master switch .................... ON
Auxiliary fuel pump .................... OFF
Propeller .................... clear
Starter .................... engage

When engine fires:
Throttle .................... retard
Mixture .................... advance slowly

## STARTING ENGINE IN COLD WEATHER (AIRPLANE EQUIPPED WITH STANDARD ENGINE PRIMER SYSTEM)

Fuel selector .................... ON
Mixture .................... IDLE CUT-OFF
Throttle .................... full FORWARD
Prop control .................... full FORWARD
Master switch .................... ON
Auxiliary fuel pump .................... ON HIGH BOOST
Starter .................... engage
Mixture .................... full FORWARD for 3 sec.
Throttle .................... full FORWARD to full AFT
Mixture .................... full FORWARD for 3 sec.
full AFT for 3 sec.
full FORWARD for 3 sec.

When engine fires:
Starter .................... leave engaged
Auxiliary fuel pump .................... ON LOW BOOST
Primer button .................... tap until rhythmic firing
Starter .................... release
Throttle .................... half travel
Oil pressure .................... check

If engine begins to falter:
Primer button .......................................... tap
Throttle .......................................... 1000 RPM
Auxiliary fuel pump .......................... OFF after start complete

## STARTING WITH EXTERNAL POWER SOURCE

Master switch .......................................... OFF
All electrical equipment .......................................... OFF
Terminals .......................................... connect
External power plug .......................... insert in fuselage

Proceed with normal start
Throttle .......................... lowest possible RPM
External power plug .......................... disconnect from fuselage
Master switch .......................... ON - check ammeter
Oil pressure .......................................... check

## WARM-UP

Throttle .......................................... 900 to 1200 RPM

## TAXIING

Chocks .......................................... removed
Taxi area .......................................... clear
Parking brake .......................................... release
Throttle .......................................... apply slowly
Prop .......................................... high RPM
Brakes .......................................... check
Steering .......................................... check

## GROUND CHECK

Parking brake .......................................... set
Propeller .......................................... full INCREASE
Throttle .......................................... 1800 to 2000 RPM
Magnetos .......................... max. drop 150 RPM -
max. diff. 50 RPM
Vacuum .......................................... 4.8" Hg. to 5.1" Hg.

Oil temperature .......... check
Oil pressure .......... check
Air conditioner .......... check
Annunciator panel .......... press-to-test
Propeller .......... exercise - then full INCREASE
Alternate air .......... check
Engine is warm for takeoff when oil temperature is at least 100 °F.
Auxiliary fuel pump .......... OFF
Fuel pressure .......... check
Throttle .......... retard
Manifold pressure line .......... drain

## BEFORE TAKEOFF

Master switch .......... ON
Flight instruments .......... check
Fuel selector .......... proper tank
Auxiliary fuel pump .......... OFF
Engine gauges .......... check
Alternate air .......... CLOSED
Seat backs .......... erect
Mixture .......... set
Prop .......... set
Belts/harness .......... fastened/adjusted
Empty seats .......... seat belts snugly fastened
Flaps .......... set
Trim tab .......... set
Controls .......... free
Doors .......... latched
Air conditioner .......... OFF
Parking brake .......... release

## TAKEOFF

### NORMAL

Flaps .......... set
Tab .......... set
Accelerate to 70 to 77 KIAS.
Control wheel .......... back pressure to rotate to climb attitude

## SHORT FIELD, OBSTACLE CLEARANCE

Flaps .................................... 25° (second notch)
Accelerate to 53 to 64 KIAS depending on aircraft weight.
Control wheel ................................ back pressure to rotate to climb attitude
After breaking ground, accelerate to 59 to 68 KIAS depending on aircraft weight.
Gear (OVERRIDE ENGAGED on aircraft equipped with backup gear extender) ................................ UP
Accelerate to best flaps up angle of climb speed - 79 KIAS, slowly retract the flaps and climb past the obstacle.
Accelerate to best flaps up rate of climb speed - 97 KIAS.

## SOFT FIELD

Flaps .................................... 25° (second notch)
Accelerate to 53 to 64 KIAS depending on aircraft weight.
Control wheel ................................ back pressure to rotate to climb attitude
After breaking ground, accelerate to 59 to 68 KIAS depending on aircraft weight.
Gear (OVERRIDE ENGAGED on aircraft equipped with backup gear extender) ................................ UP
Accelerate to best flaps up rate of climb speed 97 KIAS.
Flaps .................................... retract slowly

## TAKEOFF CLIMB

Mixture .................................... full RICH
Prop speed .................................... 2575 RPM
Manifold pressure .................... DO NOT EXCEED 41 in. Hg.
Climb speed
  Best angle .................................... 79 KIAS
  Best rate .................................... 97 KIAS
Auxiliary fuel pump .................................... LO - if required

## CRUISE CLIMB

Mixture .................................... full RICH
Prop speed .................................... 2450 RPM
Manifold pressure .................................... 33 in. Hg.
Climb speed .................................... 104 KIAS
Auxiliary fuel pump .................................... LO - if required

## CRUISING

Reference performance charts, Teledyne Continental Operator's Manual and power setting table.

Normal max power .................................... 75%
Power ....................................... set per power table
Mixture ........................................... adjust
Auxiliary fuel pump ........................... LO - if required

## APPROACH AND LANDING

Fuel selector ...................................... proper tank
Seat backs ............................................ erect
Belts/harness ...................................... fasten/adjust
Mixture ................................................ set
Propeller ............................................... set
Gear ..................................... down - 133 KIAS max
Flaps ....................................... set - 108 KIAS max
Air conditioner ....................................... OFF
Trim to 75 KIAS.

## STOPPING ENGINE

Flaps ................................................ retract
Air conditioner ....................................... OFF
Radios ................................................. OFF
Propeller ........................................ full INCREASE
Throttle .............................................. full aft
Mixture ............................................. idle cut-off
Magnetos ............................................. OFF
Master switch ........................................ OFF

## PARKING

Parking brake ......................................... set
Control wheel ............................... secured with belts
Flaps ................................................ full up
Wheel chocks ......................................... in place
Tie downs ............................................. secure

## 4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)

The following paragraphs are provided to supply detailed information and explanations of the normal procedures necessary for operation of the airplane.

## 4.9 PREFLIGHT CHECK

The airplane should be given a thorough preflight and walk-around check. The preflight should include a check of the airplane's operational status, computation of weight and C.G. limits, takeoff and landing distances, and in-flight performance. A weather briefing should be obtained for the intended flight path, and any other factors relating to a safe flight should be checked before takeoff.

*CAUTION*

The flap position should be noted before boarding the airplane. The flaps must be placed in the UP position before they will lock and support weight on the step.

COCKPIT

Upon entering the cockpit, release the seat belts securing the control wheel and set the parking brake. Insure that all electrical switches and the magneto switch are OFF and the mixture is in idle cut-off. Turn ON the master switch, check the fuel quantity gauges for adequate supply and check that the annunciator panel illuminates. Turn OFF the master switch. Check the primary flight controls and flaps for proper operation and set the trim to neutral. Open the pitot and static drains to remove any moisture that has accumulated in the lines. Check the windows for cleanliness and that the required papers are on board. Properly stow and secure the tow bar and baggage. Close and secure the baggage door.

RIGHT WING

Begin the walk-around at the trailing edge of the right wing by checking that the wing surface and control surfaces are clear of ice, frost, snow or other extraneous substances. Check the flap, aileron and hinges for damage and operational interference. Static wicks should be firmly attached and in good condition. Check the wing tip and lights for damage.

Open the fuel cap and visually check the fuel supply. The quantity should match the indication that was on the fuel quantity gauge. Replace cap securely. The fuel tank vent should be clear of obstructions.

Place a container under the quick drain. Drain the fuel tank through the quick drain located at the lower inboard rear corner of the tank, making sure that enough fuel has been drained to verify the proper fuel and insure that all water and sediment is removed. The fuel system should be drained daily prior to the first flight and after each refueling.

*CAUTION*

When draining any amount of fuel, care should be taken to insure that no fire hazard exists before starting engine.

Remove the tie down and chock.

Next, a complete check of the landing gear. Check the gear strut for proper inflation, there should be 2.5 ± .25 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. Make a visual check of the brake block and disc.

Check that the fresh air inlet is clear of foreign matter.

NOSE SECTION

Check the general condition of the nose section, look for oil or fluid leakage and that the cowling is secure. Check the windshield and clean if necessary. The propeller and spinner should be checked for detrimental nicks, cracks, or other defects. The air inlets should be clear of obstructions and check the alternator belt for proper tension. The landing light should be clean and intact.

Remove the chock and check the nose gear strut for proper inflation, there should be 2.75 ± .25 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. Check the engine baffle seals. Check the oil level, make sure that the dipstick has been properly seated and the oil filler cap properly secured.

Open the fuel strainer located on the left side of the firewall long enough to remove any accumulation of water and sediment.

LEFT WING

The wing surface should be clear of ice, frost, snow, or other extraneous substances. Check that the fresh air inlet is clear of foreign matter and remove the chock. Check the main gear strut for proper inflation, there should be 2.5 ± .25 inches of strut exposure under a normal static load. Check the tire and the brake block and disc.

Open the fuel cap and visually check the fuel supply. The quantity should match the indication that was on the fuel quantity gauge. Replace cap securely. The fuel tank vent should be clear of obstructions. Place a container under the quick drain. Drain enough fuel to verify the proper fuel and to insure that all water and sediment has been removed.

Remove tie down and remove the cover from the pitot/static head on the underside of the wing. Make sure the holes are open and clear of obstructions. Check the wing tip and lights for damage. Check the aileron, flap, and hinges for damage and operational interference and that the static wicks are firmly attached and in good condition.

FUSELAGE

Check the condition and security of the antennas. The empennage should be clear of ice, frost, snow, or other extraneous substances and the fresh air inlet at the top of the fin should be clear of foreign matter. Check the stabilator and trim tab for damage and operational interference, the trim tab should move in the same direction as stabilator. Remove the tie down.

Upon returning to the cockpit, an operational check of the interior lights, exterior lights, stall warning system, and pitot heat should now be made. Turn the master switch and the appropriate switches ON. Check the panel lighting and the overhead flood light. Visually confirm that exterior lights are operational. Lift the stall detector on the leading edge of the left wing and determine that the warning horn is activated. With the pitot heat switch ON the pitot head will be hot to the touch. After these checks are complete the master switch and all electrical switches should be turned OFF.

Board the passengers and close and secure the cabin door. Fasten the seat belts and shoulder harness and check the function of the inertia reel by pulling sharply on the strap. Fasten seat belts on empty seats.

NOTE

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selector, flaps, trim, etc., while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

## 4.11 BEFORE STARTING ENGINE

Before starting the engine the avionics switch should be set OFF, the parking brake should be set and the propeller lever moved to the full INCREASE rpm position. The fuel selector should then be moved to the desired tank.

## 4.13 STARTING ENGINE (AIRPLANE EQUIPPED WITH STANDARD ENGINE PRIMER SYSTEM)

The first step in starting is to move the fuel selector to the ON position. Advance the mixture control to full RICH, open the throttle half travel and move the propeller control full FORWARD. Turn ON the master switch. After ensuring that the propellers are clear, engage the starter by rotating the magneto switch clockwise. The primer button should be used (ON) as required. For cold weather starts, refer to Paragraph 4.19 - Starting Engines In Cold Weather. When the engine starts, retard the throttle and monitor the oil pressure gauge. If no oil pressure is indicated within 30 seconds, shut down the engine and have it checked. In cold weather it may take somewhat longer for an oil pressure indication. After the engine has started, check the alternator for sufficient output and the gyro pressure gauge for a reading between 4.8 and 5.1 in. Hg.

NOTE

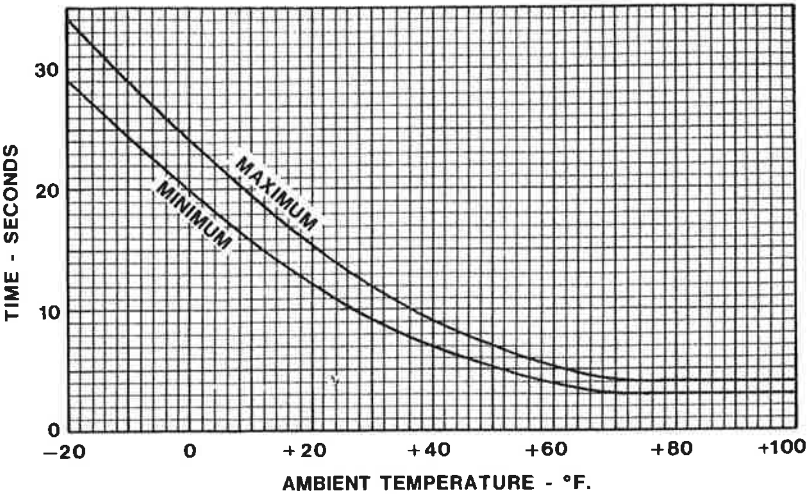
To prevent starter damage, limit starter cranking to 30 second periods. If the engine does not start within that time, allow a cooling period of several minutes before engaging starter again. Do not engage the starter immediately after releasing it. This practice may damage the starter mechanism.

## 4.15 STARTING ENGINE (AIRPLANE EQUIPPED WITH OPTIONAL ENGINE PRIMER SYSTEM)

NOTE

Engine starts can be accomplished down to ambient temperatures of +20°F with engine equipped with standard (massive electrode) spark plugs. Below that temperature fine wire spark plugs are highly recommended to ensure engine starts, and are a necessity at +10°F and below. In addition, the use of external electrical power source is also recommended when ambient temperatures are below +20°F.

Upon entering the cockpit, begin starting procedure by moving the fuel selector to ON. Advance the mixture to full RICH and the throttle and prop controls to full FORWARD. Turn the master switch ON. The electric fuel boost pump should be OFF. Push primer switch and hold for the required priming time (see Figure 4-3). Close throttle and immediately engage starter by rotating the magneto switch clockwise. With ambient temperatures above +20°F, starts may be made by discontinuing priming before engaging starter. With ambient temperatures below +20°F, starts should be made by continuing to prime during cranking period. Do not release starter until engine accelerates through 500 RPM, then SLOWLY advance throttle to obtain 1000 RPM. Release primer and immediately place auxiliary fuel pump switch to LO. Auxiliary fuel pump operation will be required for one to three minutes initial engine warm-up.




**OPTIONAL ENGINE PRIMER SYSTEM - PRIMING TIME VS. AMBIENT TEMPERATURE**
Figure 4-3

NOTE

When cold weather engine starts are made without the use of engine preheating or other precautions (refer to TCM Operator's Manual), longer than normal elapsed time may be required before an oil pressure indication is observed.

## 4.17 STARTING ENGINE WHEN FLOODED

If an engine is flooded, move the mixture control to idle cut-off and advance the throttle and propeller controls full forward. Turn ON the master switch. The auxiliary fuel pump should be OFF. After ensuring that the propeller is clear, engage the starter by rotating the magneto switch clockwise. When the engine fires, retard the throttle and advance the mixture slowly.

## 4.19 STARTING ENGINE IN COLD WEATHER (AIRPLANE EQUIPPED WITH STANDARD ENGINE PRIMER SYSTEM)

NOTE

As cold weather engine operations are decidedly more demanding, it may become necessary to utilize the starting procedure listed below in low ambient temperatures. (See Continental Engine Operator's Manual for Cold Weather Operating Recommendations.)

NOTE

It may be necessary to apply an external power source to facilitate engine cranking if the aircraft's battery is deficient of charge.

Prior to attempting the start, turn the propellers through by hand three times. Upon entering the cockpit, begin the starting procedure by moving the fuel selector to ON. Advance the throttle and prop controls to full forward. Move the mixture control to idle cut-off. Turn ON the master switch. The auxiliary fuel pump should be ON in the HIGH position. Engage the starter (rotate magneto switch clockwise) and advance the mixture control to full RICH simultaneously. Begin moving the throttle control back and forth from full forward to full aft. Place the mixture control in idle cut-off after about 3 seconds of cranking. Leave the mixture control in idle cut-off for 3 seconds of cranking and then advance to full RICH for about 3 seconds. Repeat this procedure until the engine begins to fire.

When the engine begins firing, place the auxiliary fuel pump switch to the LOW position, leave the starter engaged and tap the primer periodically until a rhythmic firing pattern is observed. When a rhythmic pattern is attained, release the starter switch and position the throttle at half travel. Tap the primer button if the engine begins to falter during this period and adjust the throttle to a 1,000 RPM idle speed.

The auxiliary fuel pump may be turned OFF as soon as it is determined that the engine will continue to run without it.

## 4.21 STARTING WITH EXTERNAL POWER SOURCE

An optional feature called the Piper External Power (PEP) allows the operator to use an external battery to crank the engine without having to gain access to the airplane's battery.

Turn the master switch OFF and turn all electrical equipment OFF. Connect the RED lead of the PEP kit jumper cable to the POSITIVE (+) terminal of an external 12-volt battery and the BLACK lead to the NEGATIVE (-) terminal. Insert the plug of the jumper cable into the socket located on the fuselage. Note that when the plug is inserted, the electrical system is ON. Proceed with the normal starting technique.

After the engine has started, reduce power to the lowest possible RPM, to reduce sparking, and disconnect the jumper cable from the aircraft. Turn the master switch ON and check the alternator ammeter for an indication of output. DO NOT ATTEMPT FLIGHT IF THERE IS NO INDICATION OF ALTERNATOR OUTPUT.

NOTE

For all normal operations using the PEP jumper cables, the master switch should be OFF, but it is possible to use the ship's battery in parallel by turning the master switch ON. This will give longer cranking capabilities, but will not increase the amperage.

*CAUTION*

Care should be exercised because if the ship's battery has been depleted, the external power supply can be reduced to the level of the ship's battery. This can be tested by turning the master switch ON momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply.

## 4.23 WARM-UP

Warm-up the engine at 900 to 1200 RPM. Avoid prolonged idling at low RPM, as this practice may result in fouled spark plugs.

Takeoff may be made as soon as the ground check is completed, provided that the oil temperature is at least 100°F and throttle may be opened to 41 inches manifold pressure without backfiring or skipping, and without a reduction in engine oil pressure.

Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.

## 4.25 TAXIING

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Ascertain that the propeller back blast and taxi areas are clear. Release the parking brake.

Power should be applied slowly to start the taxi roll. Taxi a few feet forward and apply the brakes to determine their effectiveness. Taxi with the propeller set in low pitch, high RPM setting. While taxiing, make slight turns to ascertain the effectiveness of the steering.

Observe wing clearances when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.

Avoid holes and ruts when taxiing over uneven ground.

Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.

## 4.27 GROUND CHECK

Set the parking brake. The magnetos should be checked at 1800 to 2000 RPM with the propeller set at high RPM. Drop off on either magneto should not exceed 150 RPM and the difference between the magnetos should not exceed 50 RPM. Operation on one magneto should not exceed 10 seconds.

Check the vacuum gauge; the indicator should read between 4.8 and 5.1 inches Hg at 2000 RPM.

Check the annunciator panel lights with the press-to-test button. Also check the air conditioner and the alternate air.

The propeller control should be moved through its complete range to check for proper operation, and then placed in full "INCREASE" rpm for takeoff. To obtain maximum rpm, push the pedestal mounted control fully forward on the instrument panel. Do not allow a drop of more than 200 RPM to 300 RPM during this check. In cold weather the propeller control should be cycled from high to low RPM at least three times before takeoff to make sure that warm engine oil has circulated.

Drain the manifold pressure line by running the engine at 1000 RPM and depressing the drain valve located behind and below the manifold pressure gauge for 5 seconds. Do not depress the valve when the manifold pressure exceeds 25 inches Hg.

## 4.29 BEFORE TAKEOFF

All aspects of each particular takeoff should be considered prior to executing the takeoff procedure.

After takeoff, on aircraft equipped with the backup gear extender, if the gear selector switch is placed in the gear up position before reaching the airspeed at which the system no longer commands gear down*, the gear will not retract. For obstacle clearance on takeoff and for takeoffs from high altitude airports, the landing gear can be retracted after lift-off at the pilot's discretion by placing the gear selector switch in the "UP" position and then locking the emergency gear lever in the "OVERRIDE ENGAGED" position. If desired, the "OVERRIDE ENGAGED" position can be selected and locked before takeoff, and the gear will then retract as soon as the gear selector switch is placed in the "UP" position. Care should always be taken not to retract the gear prematurely, or the aircraft could settle back onto the runway. If the override lock is used for takeoff, it should be disengaged as soon as sufficient airspeed and terrain clearance are obtained, to return the gear system to normal operation. For normal operation, the pilot should extend and retract the gear with the gear selector switch located on the instrument panel, just as he would if the back-up gear extender system were not installed.

After all aspects of the takeoff are considered, a pretakeoff check procedure must be performed.

*Approximately 78 KIAS at sea level to approximately 97 KIAS at 20,000 ft. with a straight line variation between.

Turn "ON" the master switch and check and set all of the flight instruments as required. Check the fuel selector to make sure it is on the proper tank (fullest). Check the engine gauges. The alternate air should be in the "CLOSED" position.

All seat backs should be erect.

NOTE

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selector, flaps, trim, etc., while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

The mixture and propeller control levers should be set and the seat belts and shoulder harness fastened. Fasten the seat belts snugly around the empty seats.

Exercise and set the flaps and trim tab. Insure proper flight control movement and response.

All doors should be properly secured and latched and the parking brake released.

On air conditioned models, the air conditioner must be "OFF" to insure normal takeoff performance.

## 4.31 TAKEOFF

To achieve the takeoff performance specified in Section 5 it is necessary to set rated power (2575 RPM, 41 In. Hg.) prior to brake release.

NOTE

At altitudes below 12,000 feet, normal takeoffs are made with less than full throttle setting. Use the throttle as required to obtain 41 In. Hg. manifold pressure. DO NOT EXCEED 41 IN. HG. MANIFOLD PRESSURE. The overboost warning light will illuminate when manifold pressure approaches the maximum limit.

Illumination of the yellow overboost warning light on the annunciator panel does not indicate a malfunction. The light should be monitored during takeoff to insure that an overboost condition does not persist.

The normal takeoff technique is conventional for the Turbo Arrow IV. The tab should be set slightly aft of neutral, with the exact setting determined by the loading of the airplane. Allow the airplane to accelerate to 70 to 77 KIAS depending on the weight of the aircraft and ease back on the control wheel to rotate to climb attitude.

The procedure used for a short field takeoff with an obstacle clearance or a soft field takeoff differs slightly from the normal technique. The flaps should be lowered to 25° (second notch). Allow the aircraft to accelerate to 53 to 64 KIAS depending on the aircraft weight and rotate the aircraft to climb attitude. After breaking ground, accelerate to 59 to 68 KIAS, depending on aircraft weight and select gear up*. Continue to climb while accelerating to the flaps-up rate of climb speed, 97 KIAS if no obstacle is present or 79 KIAS if obstacle clearance is a consideration. Slowly retract the flaps while climbing out.

*If desired, on aircraft equipped with the backup gear extender, the OVERRIDE ENGAGED position can be selected and locked before takeoff, and the gear will then retract as soon as the gear selector switch is placed in the up position. In this case care should be taken not to retract the gear prematurely, or the aircraft could settle back onto the runway. If the override lock is used for takeoff, it should be disengaged as soon as sufficient terrain clearance is obtained, to return the gear system to normal operation.

## 4.33 CLIMB

On climb-out after takeoff, it is recommended that the best angle of climb speed (79 KIAS) be maintained only if obstacle clearance is a consideration. The best rate of climb speed (97 KIAS) should be maintained with full power until adequate terrain clearance is obtained. At this point, engine power should be reduced to 33 inches manifold pressure and 2450 RPM (approximately 75% power) for cruise climb. A cruise climb speed of 104 KIAS or higher is also recommended. This combination of reduced power and increased climb speed provides better engine cooling, less engine wear, reduced fuel consumption, lower cabin noise level, and better forward visibility.

When reducing power the throttle should be retarded first, followed by the propeller control. The mixture control should remain at full rich during the climb. Cylinder head temperatures should be monitored during climb and should be kept below 460° at all times. During climbs under hot weather conditions, it may be necessary to use LO auxiliary fuel pump for vapor suppression. Presence of fuel vapor may be indicated by a fluctuating fuel flow indicator.

Consistent operational use of cruise climb power settings is strongly recommended since this practice will make a substantial contribution to fuel economy and increased engine life, and will reduce the incidence of premature engine overhauls.

NOTE

On aircraft equipped with the backup gear extender, during climbs at best angle of climb speed at any altitude and best rate of climb speed above approximately 15,000 feet density altitude it may be necessary to select OVERRIDE ENGAGED to prevent the landing gear from extending automatically during the climb. This altitude decreases with reduced climb power and increases with increased climb airspeed.

## 4.35 CRUISING

When leveling off at cruise altitude, the pilot may reduce to a cruise power setting in accordance with the Power Setting Table in this Manual. The mixture should be leaned in accordance with the recommendations for the engine in the Teledyne Continental Operator's Manual which is provided with the aircraft. If cylinder head temperatures become too high during flight, reduce them by enriching the mixture, by reducing power, or by use of any combination of these methods. During cruise under hot weather and/or high altitude conditions, it may be necessary to use LO auxiliary fuel pump for vapor suppression. Presence of fuel vapor may be indicated by a fluctuating fuel flow indicator.

Following level-off for cruise, the airplane should be trimmed.

The pilot should monitor weather conditions while flying and should be alert to conditions which might lead to icing. If induction system icing is expected, place the alternate air control in the "ON" position.

During flight, keep account of time and fuel used in connection with power settings to determine how the fuel flow and fuel quantity gauging systems are operating. If the fuel flow indication is considerably higher than the fuel actually being consumed, a fuel nozzle may be clogged and require cleaning.

There are no mechanical uplocks in the landing gear system. In the event of a hydraulic system malfunction, the landing gear will free-fall to the gear down position. The true airspeed with gear down is approximately 75% of the gear retracted airspeed for any given power setting. Allowances for the reduction in airspeed and range should be made when planning extended flight between remote airfields or flight over water.

In order to keep the airplane in best lateral trim during cruise flight, the fuel should be used alternately from each tank at one hour intervals.

## 4.37 APPROACH AND LANDING

Check to insure the fuel selector is on the proper (fullest) tank and that the seat backs are erect. The seat belts and shoulder harness should be fastened and the inertia reel checked.

NOTE

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selector, flaps, trim, etc., while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

Turn "OFF" the air conditioner. The mixture should be set in the full "RICH" position. Set the propeller at full "INCREASE" rpm to facilitate ample power for an emergency go-around.

The landing gear may be extended at speeds below 133 KIAS. The airplane should be trimmed to a final approach speed of about 75 KIAS with flaps extended. The flaps can be lowered at speeds up to 108 KIAS, if desired.

The mixture control should be kept in full "RICH" position to insure maximum acceleration if it should be necessary to open the throttle again.

The amount of flap used during landings and the speed of the aircraft at contact with the runway should be varied according to the landing surface and conditions of wind and airplane loading. It is generally good practice to contact the ground at the minimum possible safe speed consistent with existing conditions.

Normally, the best technique for short and slow landings is to use full flap and enough power to maintain the desired airspeed and approach flight path. Mixture should be full "RICH," fuel on the fullest tank. Reduce the speed during the flareout and contact the ground close to the stalling speed. After ground contact hold the nose wheel off as long as possible. As the airplane slows down, gently lower the nose and apply the brakes. Braking is most effective when flaps are raised and back pressure is applied to the control wheel, putting most of the aircraft weight on the main wheels. In high wind conditions, particularly in strong crosswinds, it may be desirable to approach the ground at higher than normal speeds with partial or no flaps.

## 4.39 STOPPING ENGINE

At the pilot's discretion, the flaps should be raised.

NOTE

The flaps must be placed in the "UP" position for the flap step to support weight. Passengers should be cautioned accordingly.

The air conditioner and radios should be turned "OFF," the propeller set in the full "INCREASE" position, and the engine stopped by disengaging the mixture control lock and pulling the mixture control back to idle cut-off. The throttle should be left full aft to avoid engine vibration while stopping. Then the magneto and master switches must be turned "OFF."

## 4.41 PARKING

Set the parking brake. If necessary, the airplane should be moved on the ground with the aid of the nose wheel tow bar provided with each airplane and secured behind the rear seats. The aileron and stabilator controls should be secured by looping the safety belt through the control wheel and pulling it snug. The flaps are locked when in the "UP" position and should be left retracted.

Tie downs can be secured to rings provided under each wing and to the tail skid. The rudder is held in position by its connections to the nose wheel steering and normally does not have to be secured.

## 4.43 STALLS

The stall characteristics of the Turbo Arrow IV are conventional. An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall.

The gross weight stalling speed of the Turbo Arrow IV with power off and full flaps is 61 KIAS. With the flaps up this speed is increased 5 KTS. Loss of altitude during stalls can be as great as 300 feet, depending on configuration and power.

NOTE

The stall warning system is inoperative with the master switch "OFF."

During preflight, the stall warning system should be checked by turning the master switch "ON," lifting the detector and checking to determine if the horn is actuated. The master switch should be returned to the "OFF" position after the check is complete.

## 4.45 TURBULENT AIR OPERATION

In keeping with good operating practice used in all aircraft, it is recommended that when turbulent air is encountered or expected, the airspeed be reduced to maneuvering speed to reduce the structural loads caused by gusts and to allow for inadvertent speed build-ups which may occur as a result of the turbulence or of distractions caused by the conditions.

## 4.47 LANDING GEAR

Some aircraft are equipped with an airspeed - power sensing system (backup gear extender) which extends the landing gear under low airspeed - power conditions* even though the pilot may not have selected gear down. This system will also prevent retraction of the landing gear by normal means when the airspeed - power values are below a predetermined minimum. To override this system or to hold the emergency gear lever in the "OVERRIDE ENGAGED" position without maintaining manual pressure on the emergency gear lever, pull the lever full up and push the lock pin in. To release the override, pull lever up and then release. For normal operation, the pilot should extend and retract the gear with the gear selector switch located on the instrument panel, just as he would if the back-up gear extender system were not installed.

The pilot should become familiar with the function and significance of the landing gear position indicators and warning lights.

*Approximately 103 KIAS at any altitude, power off.

The red gear warning light on the instrument panel and the horn operate simultaneously in flight when the throttle is reduced to where the manifold pressure is approximately 14 inches of mercury or below, and the gear selector switch is not in the "DOWN" position. On aircraft equipped with the backup gear extender, this warning will also occur during flight when the system has lowered the landing gear and the gear selector switch is not in the "DOWN" position and the manifold pressure is reduced below approximately 14 inches of mercury. The red gear warning light on the instrument panel and the horn will also operate simultaneously on the ground when the master switch is "ON" and the gear selector switch is in the "UP" position and the throttle is in the retarded position.

The three green lights on the instrument panel operate individually as each associated gear is locked in the extended position.

***WARNING***

**Panel lights' dimmer switch must be off to obtain gear and overboost lights full intensity during daytime flying. When aircraft is operated at night and panel lights' dimmer switch is turned on, gear lights and overboost light will automatically dim.**

On aircraft equipped with the backup gear extender the yellow "Auto Ext. OFF" light immediately below the gear selector switch flashes whenever the emergency gear lever is in the "OVERRIDE ENGAGED" position.

When the Emergency Landing Gear Extension Procedure (Par. 3.29) is performed for training purposes, the following changes must be made to the procedure in order to prevent the hydraulic pump from activating during the procedure. On aircraft equipped with the backup gear extender the landing gear selector must be left in the UP position until all gear position indicators are green. On aircraft which do NOT have the backup gear extender a pull type LANDING GEAR PUMP circuit breaker is installed and must be pulled prior to executing the emergency extension procedure. The circuit breaker must be reset after completion of the procedure to allow normal gear system operation.

## 4.49 WEIGHT AND BALANCE

It is the responsibility of the owner and pilot to determine that the airplane remains within the allowable weight vs. center of gravity envelope while in flight.

For weight and balance data, refer to Section 6 (Weight and Balance).

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# SECTION 5

# PERFORMANCE

## 5.1 GENERAL

All of the required (FAA regulations) and complementary performance information applicable to the Turbo Arrow IV is provided in this section.

Performance information associated with those optional systems and equipment that require handbook supplements is provided in Section 9 (Supplements).

## 5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING

The performance information presented in this section is based on measured Flight Test Data corrected to I.C.A.O. standard day conditions and analytically expanded for the various parameters of weight, altitude, temperature, etc.

The performance charts are unfactored and do not make any allowance for varying degrees of pilot proficiency or mechanical deterioration of the aircraft. This performance, however, can be duplicated by following the stated procedures in a properly maintained airplane.

Effects of conditions not considered on the charts must be evaluated by the pilot, such as the effect of soft or grass runway surface on takeoff and landing performance, or the effect of winds aloft on cruise and range performance. Endurance can be grossly affected by improper leaning procedures, and inflight fuel flow and quantity checks are recommended.

REMEMBER! To get chart performance, follow the chart procedures.

The information provided by paragraph 5.5 (Flight Planning Example) outlines a detailed flight plan using the performance charts in this section. Each chart includes its own example to show how it is used.

*WARNING*

Performance information derived by extrapolation beyond the limits shown on the charts should not be used for flight planning purposes.

## 5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

The first step in planning the flight is to calculate the airplane weight and center of gravity by utilizing the information provided by Section 6 (Weight and Balance) of this handbook.

The basic empty weight for the airplane as licensed at the factory has been entered in Figure 6-5. If any alterations to the airplane have been made effecting weight and balance, reference to the aircraft logbook and Weight and Balance Record (Figure 6-7) should be made to determine the current basic empty weight of the airplane.

Make use of the Weight and Balance Loading Form (Figure 6-11) and the C.G. Range and Weight graph (Figure 6-15) to determine the total weight of the airplane and the center of gravity position.

After proper utilization of the information provided, the following weights have been determined for consideration in the flight planning example.

The landing weight cannot be determined until the weight of the fuel to be used has been established [refer to item (g)(1)].

| | | |
|---|---|---|
| (1) | Basic Empty Weight | 1810 lbs. |
| (2) | Occupants (2 x 170 lbs.) | 340 lbs. |
| (3) | Baggage and Cargo | 158 lbs. |
| (4) | Fuel (6 lb./gal. x 72) | 432 lbs. |
| (5) | Takeoff Weight | 2740 lbs. |
| (6) | Landing Weight (a)(5) minus (g)(1), (2740 lbs. minus 366 lbs.) | 2374 lbs. |

The takeoff weight is below the maximum of 2900 lbs., and the weight and balance calculations have determined the C.G. position within the approved limits.

(b) Takeoff and Landing

After determining the aircraft loading, all aspects of takeoff and landing must be considered.

All of the existing conditions at the departure and destination airport must be acquired, evaluated and maintained throughout the flight.

Apply the departure airport conditions and takeoff weight to the appropriate Takeoff Performance and Takeoff Ground Roll graph (Figures 5-5, 5-7, 5-9 and 5-11) to determine the length of runway necessary for the takeoff and/or the barrier distance.

The landing distance calculations are performed in the same manner using the existing conditions at the destination airport and, when established, the landing weight.

The conditions and calculations for the example flight are listed below. The takeoff and landing distances required for the example flight have fallen well below the available runway lengths.

| | Departure Airport | Destination Airport |
|---|---|---|
| (1) Pressure Altitude | 4990 ft. | 2000 ft. |
| (2) Temperature | 20°C | 30°C |
| (3) Wind Component | 6 KTS | 3 KTS |
| (4) Runway Length Available | 5000 ft. | 4600 ft. |
| (5) Runway Required | 2480 ft.* | 1470 ft.** |

NOTE

The remainder of the performance charts used in this flight planning example assume a no wind condition. The effect of winds aloft must be considered by the pilot when computing climb, cruise and descent performance.

*reference Figure 5-9
**reference Figure 5-35

(c) Climb

The next step in the flight plan is to determine the necessary climb segment components.

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the Fuel, Time and Distance to Climb graph (Figure 5-17). After the fuel, time and distance for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to the graph (Figure 5-17). Now, subtract the values obtained from the graph for the field of departure conditions from those for the cruise pressure altitude.

The remaining values are the true fuel, time and distance components for the climb segment of the flight plan corrected for field pressure altitude and temperature.

The following values were determined from the above instructions in the flight planning example.

| | |
|---|---|
| (1) Cruise Pressure Altitude | 8500 ft. |
| (2) Cruise OAT | 10°C |
| (3) Time to Climb (10 min. minus 4 min.) | 6 min.* |
| (4) Distance to Climb (17 naut. miles minus 9 naut. miles) | 8 naut. miles* |
| (5) Fuel to Climb (4 gal. minus 2.0 gal.) | 2 gal.* |

(d) Descent

The descent data will be determined prior to the cruise data to provide the descent distance for establishing the total cruise distance.

Utilizing the cruise pressure altitude and OAT, determine the basic fuel, time and distance for descent (Figure 5-31). These figures must be adjusted for the field pressure altitude and temperature at the destination airport. To find the necessary adjustment values, use the existing pressure altitude and temperature conditions at the destination airport as variables to find the fuel, time and distance

*reference Figure 5-17

values from the graph (Figure 5-31). Now, subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find the true fuel, time and distance values needed for the flight plan.

The values obtained by proper utilization of the graphs for the descent segment of the example are shown below.

| | |
|---|---|
| (1) Time to Descend (8.5 min. minus 2 min.) | 6.5 min.* |
| (2) Distance to Descend (19.5 naut. miles minus 4.5 naut. miles) | 15 naut. miles* |
| (3) Fuel to Descend (2 gal. minus .5 gal.) | 1.5 gal.* |

(e) Cruise

Using the total distance to be traveled during the flight, subtract the previously calculated distance to climb and distance to descend to establish the total cruise distance. Refer to the Power Setting Table (Figure 5-19) when selecting the cruise power setting. The established pressure altitude and temperature values and the selected cruise power should now be utilized to determine the true airspeed from the appropriate Speed Power graph (Figure 5-23).

Calculate the cruise fuel flow for the cruise power setting (75% - High Speed Power for this example) from the information provided by the Range - Cruise Power chart (Figure 5-27).

The cruise time is found by dividing the cruise distance by the cruise speed and the cruise fuel is found by multiplying the cruise fuel flow by the cruise time.

The cruise calculations established for the cruise segment of the flight planning example are as follows:

| | |
|---|---|
| (1) Total Distance | 745 naut. miles |
| (2) Cruise Distance (e)(1) minus (c)(4) minus (d)(2), (745 naut. miles minus 8 naut. miles minus 15 naut. miles) | 722 naut. miles |

*reference Figure 5-31

(3) Cruise Power — 75% High Speed
(4) Cruise Speed — 151 KTS TAS*
(5) Cruise Fuel Consumption — 12 GPH**
(6) Cruise Time
(e)(2) divided by (e)(4), (722 naut. miles divided by 151 KTS) — 4.78 hrs. (4 hrs. 47 min.)
(7) Cruise Fuel
(e)(5) multiplied by (e)(6), (12 GPH mulitiplied by 4.78 hrs.) — 57.5 gal.

(f) Total Flight Time

The total flight time is determined by adding the time to climb, the time to descend and the cruise time. Remember! The time values taken from the climb and descent graphs are in minutes and must be converted to hours before adding them to the cruise time.

The following flight time is required for the flight planning example.

(1) Total Flight Time
(c)(3) plus (d)(1) plus (e)(6),
(.10 hrs. plus .11 hrs. plus 4.78 hrs.)
(6 min. plus 6.5 min. plus 4 hrs. & 47 min.) — 4.99 hrs.

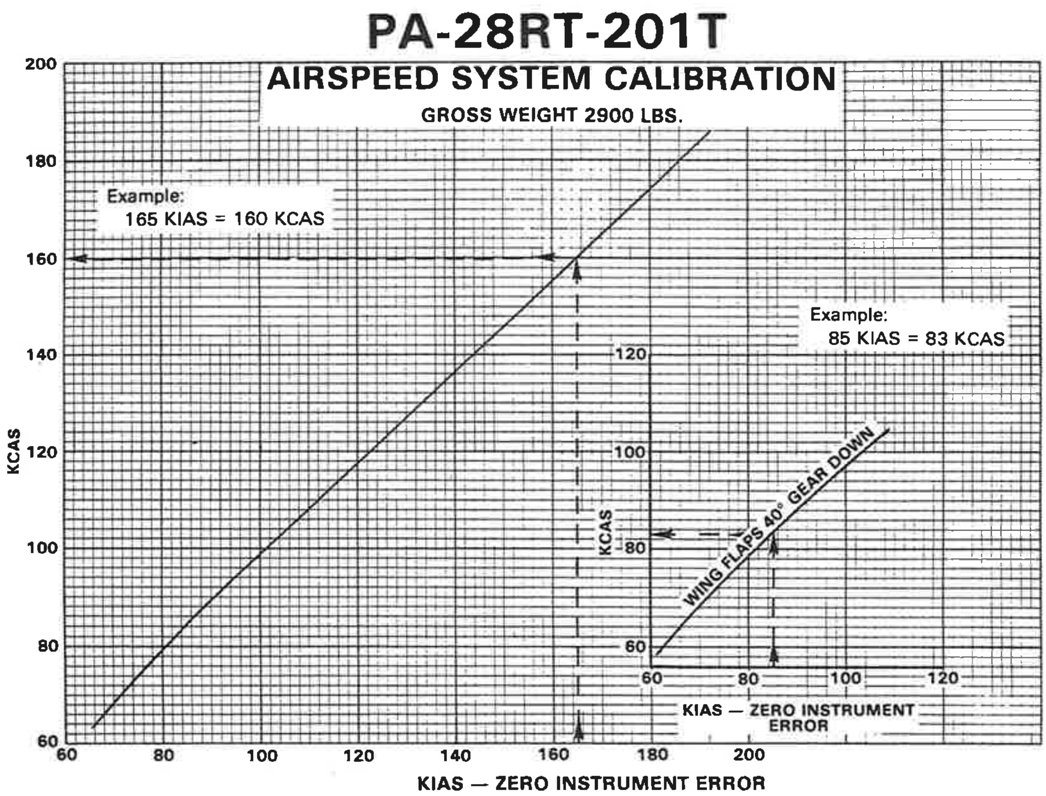
(g) Total Fuel Required

Determine the total fuel required by adding the fuel to climb, the fuel to descend and the cruise fuel. When the total fuel (in gallons) is determined, multiply this value by 6 lb./gal. to determine the total fuel weight used for the flight.

The total fuel calculations for the example flight plan are shown below.

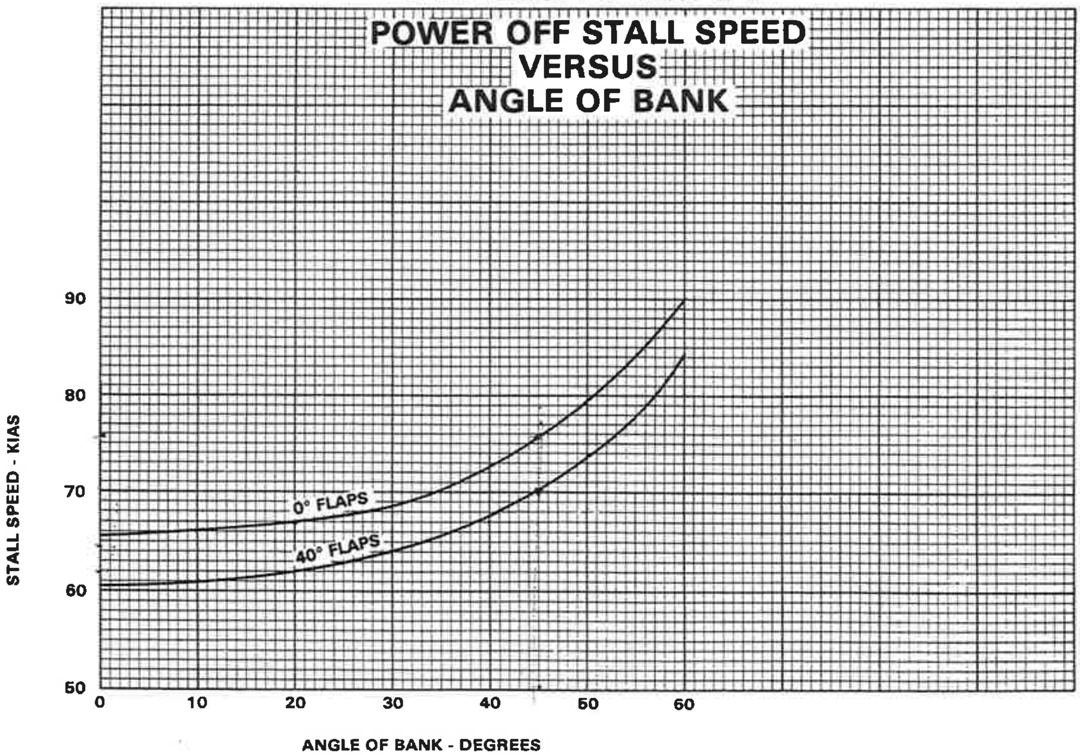
(1) Total Fuel Required
(c)(5) plus (d)(3) plus (e)(7),
(2 gal. plus 1.5 gal. plus 57.5 gal.) — 61 gal.
(61 gal. multiplied by 6 lb./gal.) — 366 lbs.

*reference Figure 5-23
**reference Figure 5-27

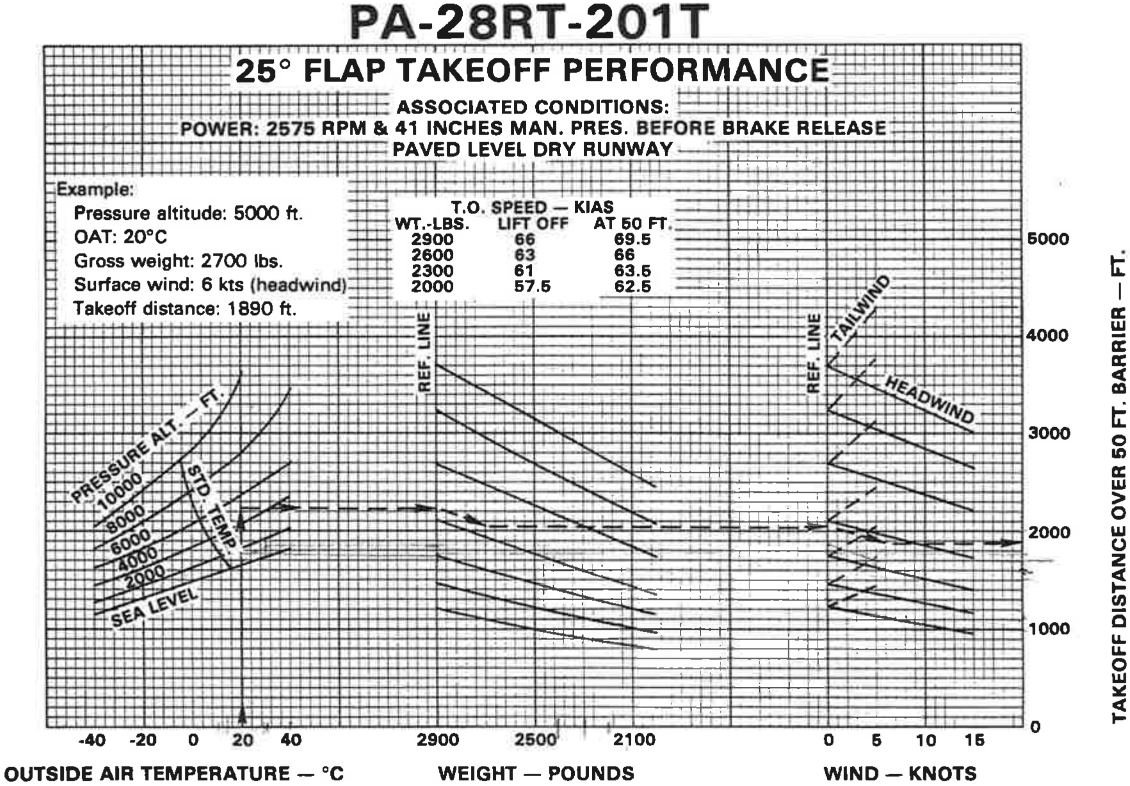



AIRSPEED SYSTEM CALIBRATION
Figure 5-1

# PA-28RT-201T

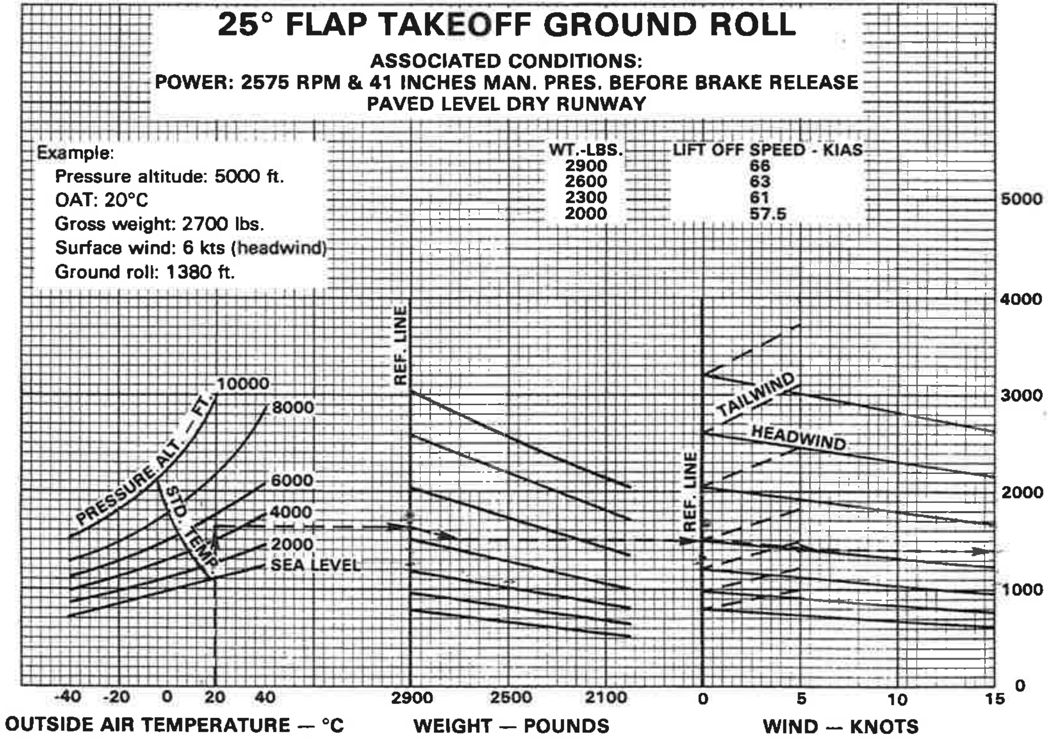



POWER OFF STALL SPEED VS. ANGLE OF BANK
Figure 5-3

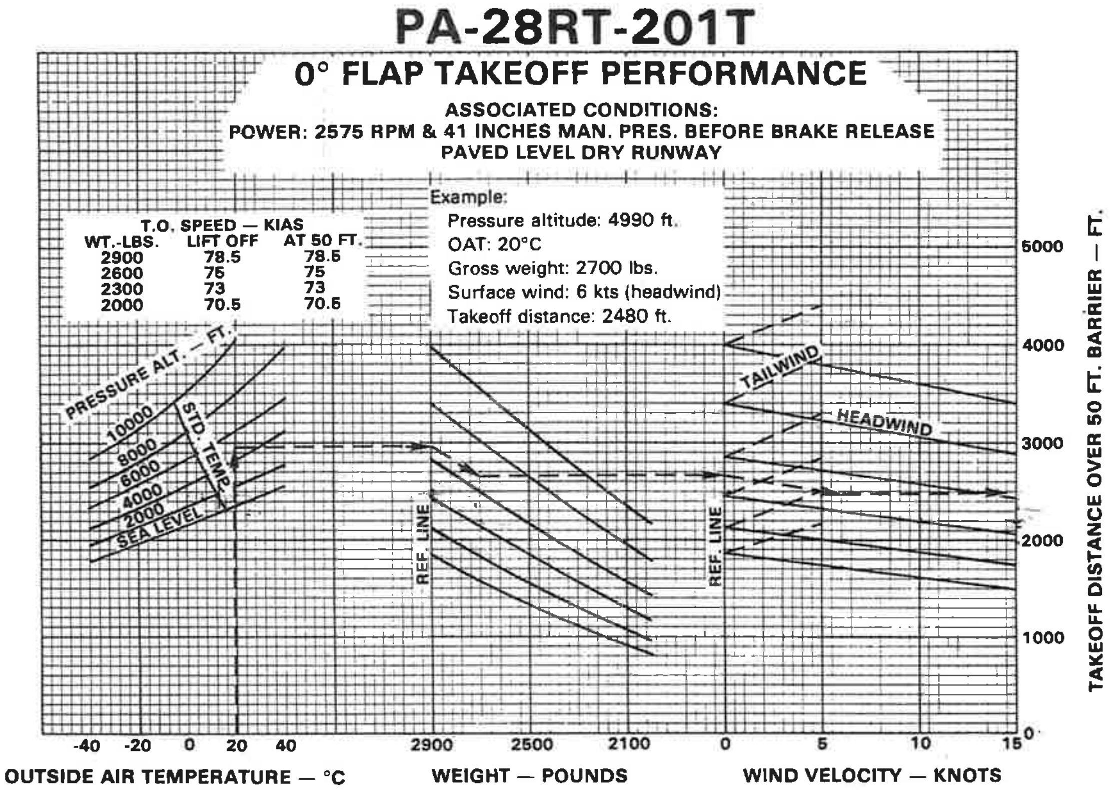



25° FLAP TAKEOFF PERFORMANCE
Figure 5-5

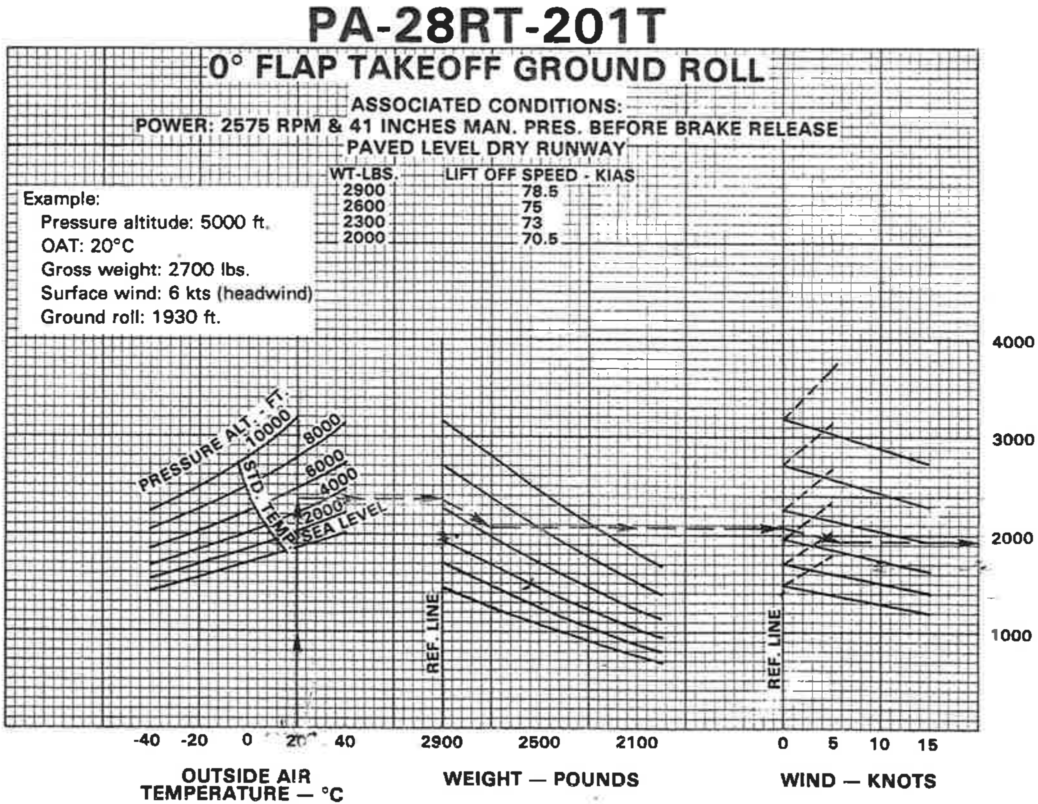
# PA-28RT-201T



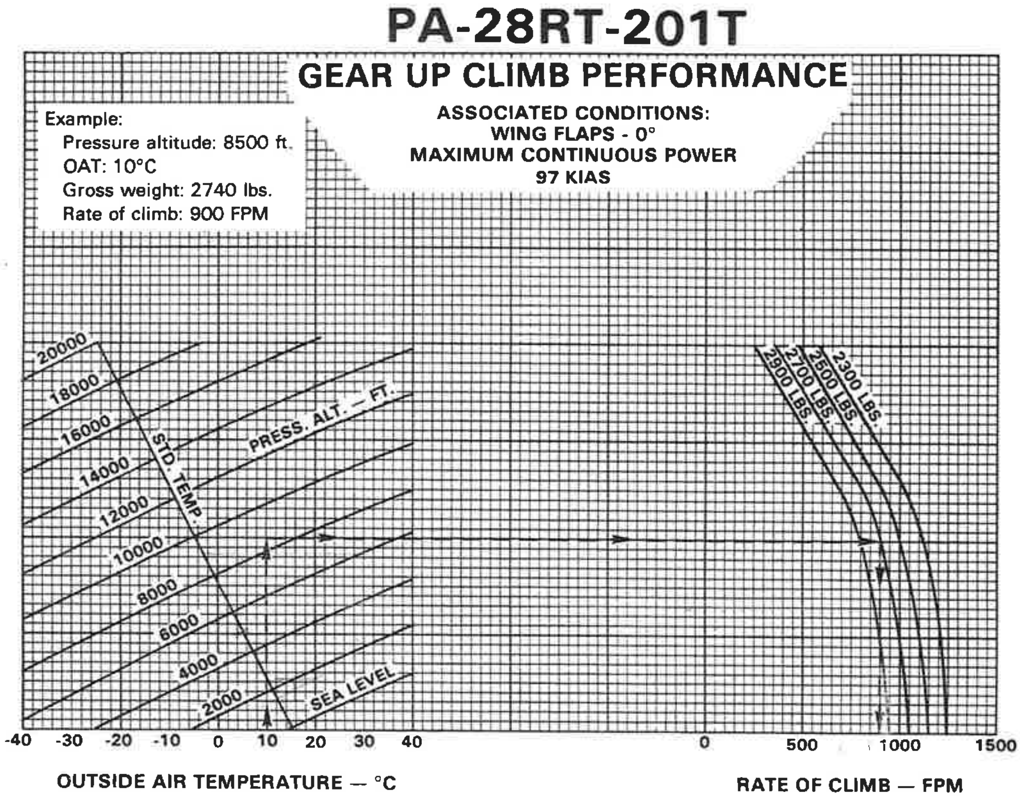

25° FLAP TAKEOFF GROUND ROLL
Figure 5-7



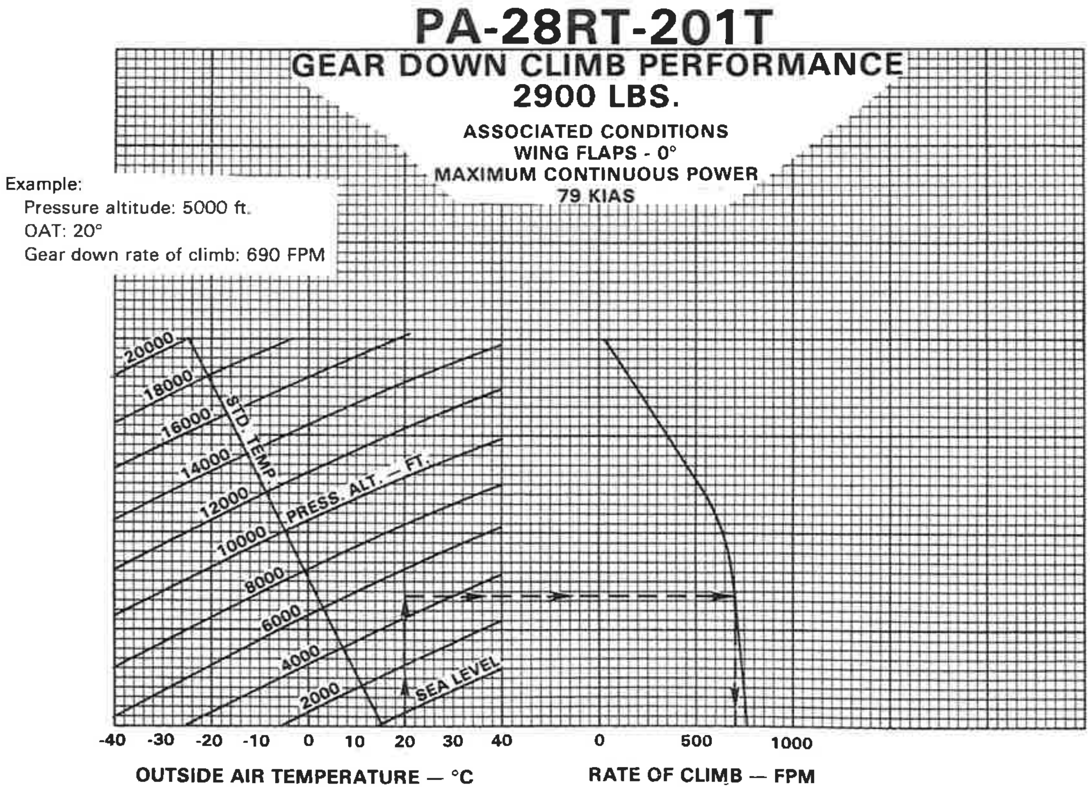

0° FLAP TAKEOFF PERFORMANCE
Figure 5-9




0° FLAP TAKEOFF GROUND ROLL
Figure 5-11

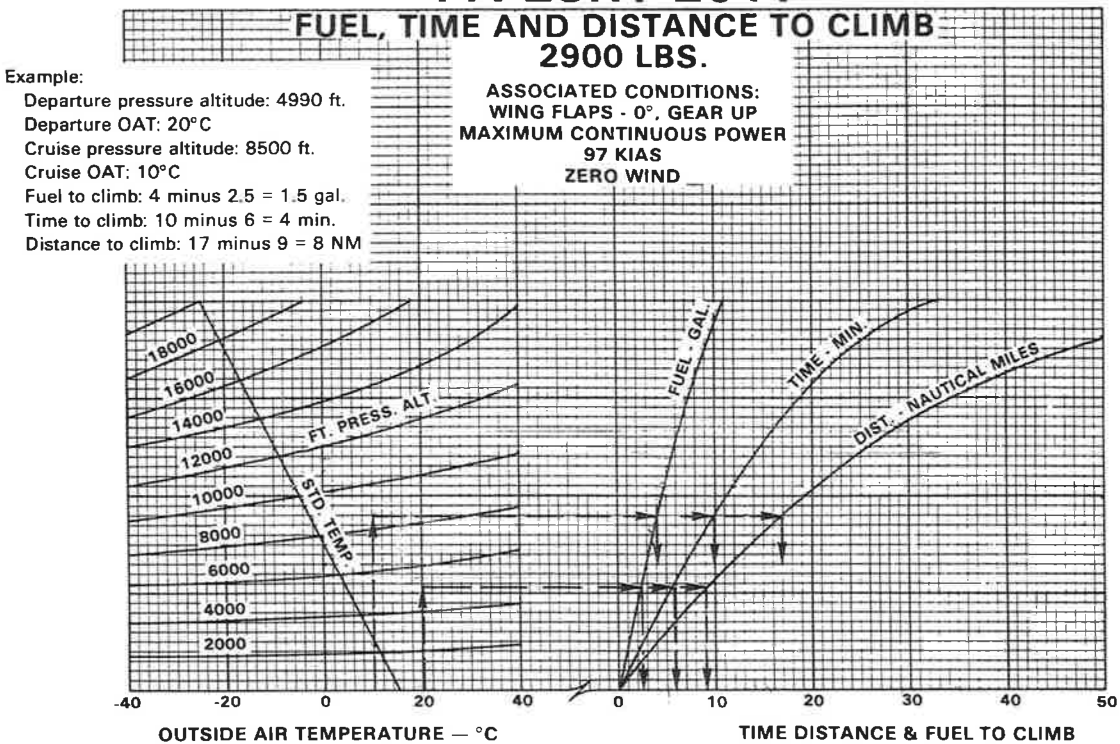



GEAR UP CLIMB PERFORMANCE
Figure 5-13




GEAR DOWN CLIMB PERFORMANCE
Figure 5-15

# PA-28RT-201T




FUEL, TIME AND DISTANCE TO CLIMB
Figure 5-17

# POWER SETTING TABLE — T.C.M. TSIO 360FB SERIES

| PRESS. ALT. FEET | STD. ALT. TEMP. °C | 55% POWER | | | | | 65% POWER | | | | | 75% POWER | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RPM | 2200 | 2300 | 2400 | 2500 | 2575 | 2200 | 2300 | 2400 | 2500 | 2575 | 2200 | 2300 | 2400 | 2500 | 2575 |
| | | MANIFOLD PRESSURE — INCHES MERCURY | | | | | | | | | | | | | | |
| S.L. | 15 | 29.0 | 27.7 | 26.8 | 26.0 | 25.0 | 32.8 | 31.1 | 30.0 | 29.2 | 28.2 | | 34.8 | 33.8 | 32.8 | 31.5 |
| 2000 | 11 | 29.0 | 27.7 | 26.8 | 26.0 | 25.0 | 32.8 | 31.1 | 30.0 | 29.2 | 28.2 | | 34.8 | 33.8 | 32.8 | 31.5 |
| 4000 | 7 | 29.0 | 27.7 | 26.8 | 26.0 | 25.0 | 32.8 | 31.1 | 30.0 | 29.2 | 28.2 | | 34.8 | 33.8 | 32.8 | 31.5 |
| 6000 | 3 | 29.0 | 27.7 | 26.8 | 26.0 | 25.0 | 32.8 | 31.1 | 30.0 | 29.2 | 28.2 | | 34.8 | 33.8 | 32.8 | 31.5 |
| 8000 | -1 | 29.0 | 27.7 | 26.8 | 26.0 | 25.0 | — | 31.1 | 30.0 | 29.2 | 28.2 | | — | 33.8 | 32.8 | 31.5 |
| 10000 | -5 | 29.0 | 27.7 | 26.8 | 26.0 | 25.0 | — | 31.1 | 30.0 | 29.2 | 28.2 | | — | 33.8 | 32.8 | 31.5 |
| 12000 | -9 | — | 27.7 | 26.8 | 26.0 | 25.0 | — | — | 30.0 | 29.2 | 28.2 | | — | — | 32.8 | 31.5 |
| 14000 | -13 | — | 27.7 | 26.8 | 26.0 | 25.0 | — | — | 30.0 | 29.2 | 28.2 | | — | — | 32.8 | 31.5 |
| 16000 | -17 | — | — | 26.8 | 26.0 | 25.0 | — | — | — | 29.2 | 28.2 | | — | — | — | 31.5 |
| 18000 | -21 | — | — | — | 26.0 | 25.0 | — | — | — | 29.2 | 28.2 | | — | — | — | 31.5 |
| 20000 | -25 | — | — | — | 26.0 | 25.0 | — | — | — | — | 28.2 | | — | — | — | 31.5 |

To maintain constant power, add approximately 1% for each 6°C above standard, subtract approximately 1% for each 6°C below standard.

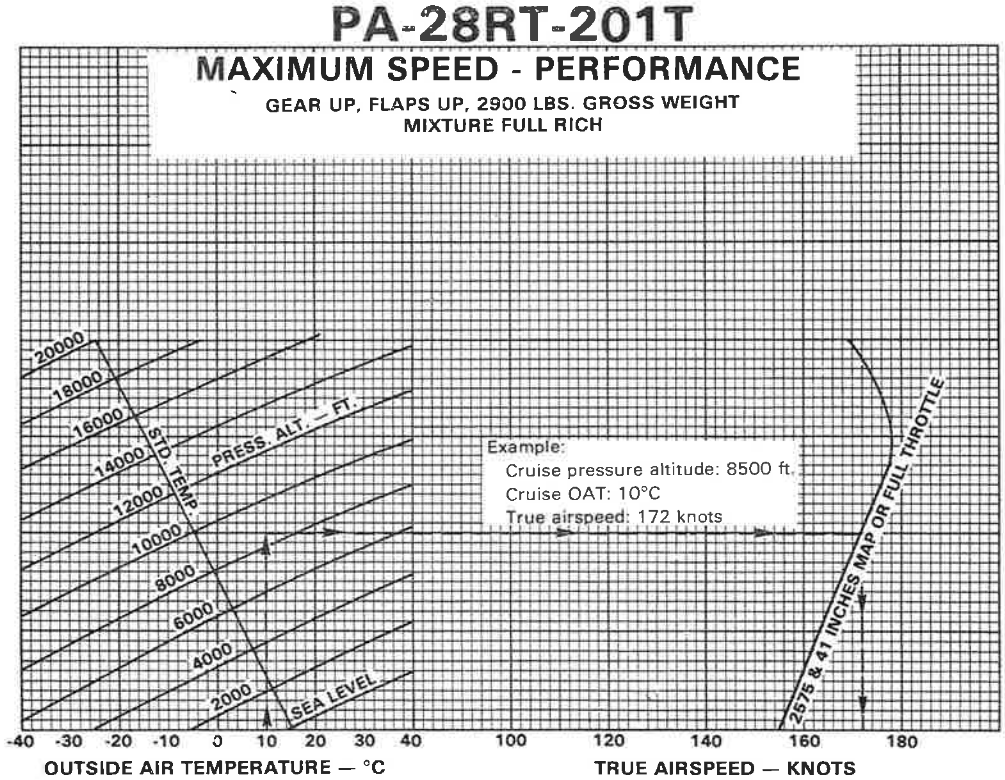
APPROXIMATE FUEL FLOW

CRUISE POWER

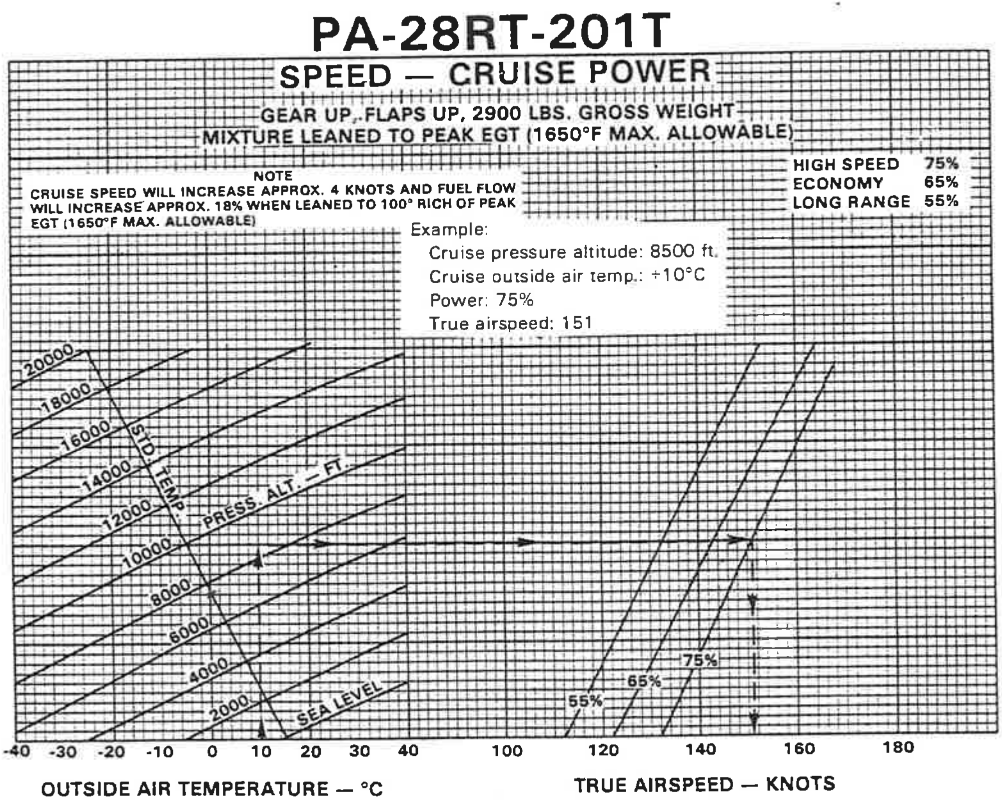
55% Power 9.2 GPH
65% Power 10.8 GPH
75% Power 12.0 GPH

NOTE: Fuel flow will vary with altitude; therefore, cruise fuel control must be accomplished by adjusting EGT (peak EGT for best economy and peak EGT plus 100°F rich for best power) rather than leaning to an indicated fuel flow.

POWER SETTING TABLE
Figure 5-19




MAXIMUM SPEED - PERFORMANCE
Figure 5-21



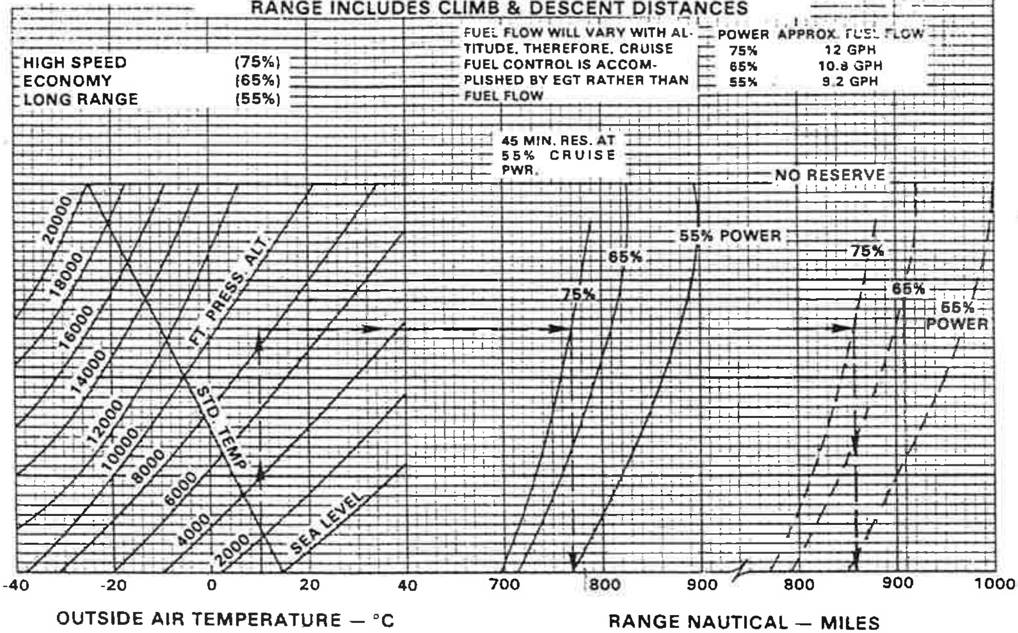

SPEED - CRUISE POWER
Figure 5-23

Example
Cruise pressure altitude: 8500 ft.
Cruise outside air temp.: −10°C
Power: 75%
Range with reserve 770 N.M.
Range no reserve 858 N.M.

# PA-28RT-201T

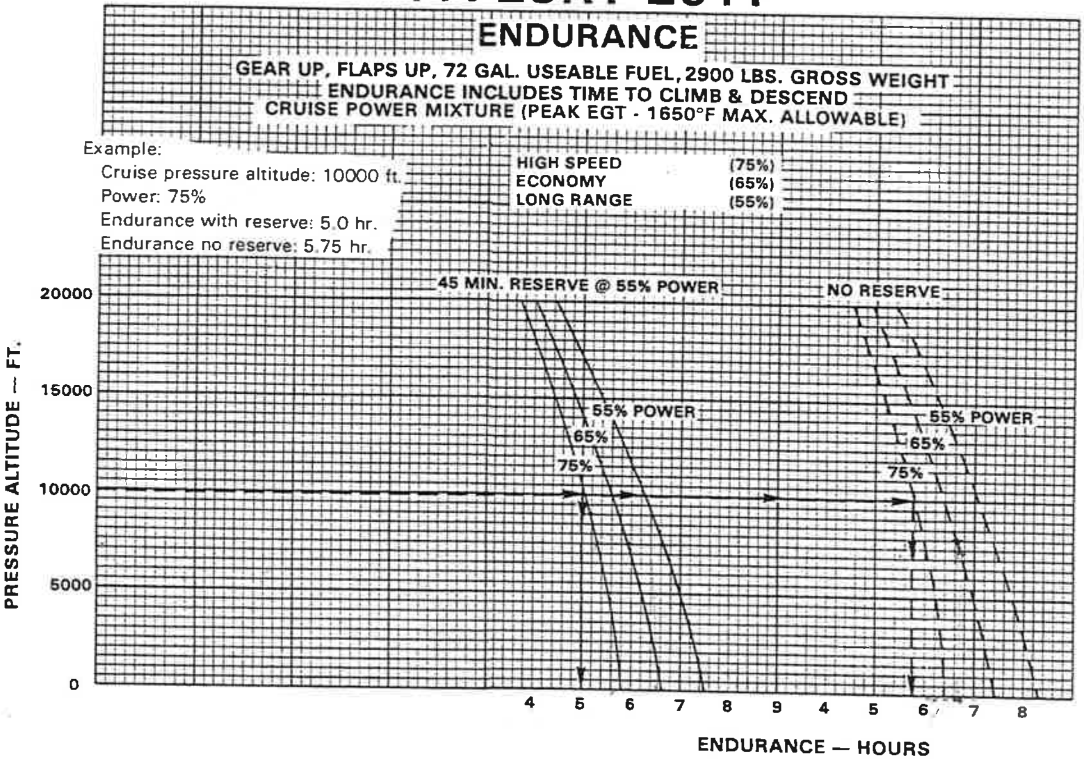
## RANGE — CRUISE POWER

MIXTURE LEANED TO PEAK EGT
GEAR UP, FLAPS UP, 2900 LBS. GROSS WEIGHT, ZERO WIND
72 GAL. USABLE FUEL
RANGE INCLUDES CLIMB & DESCENT DISTANCES

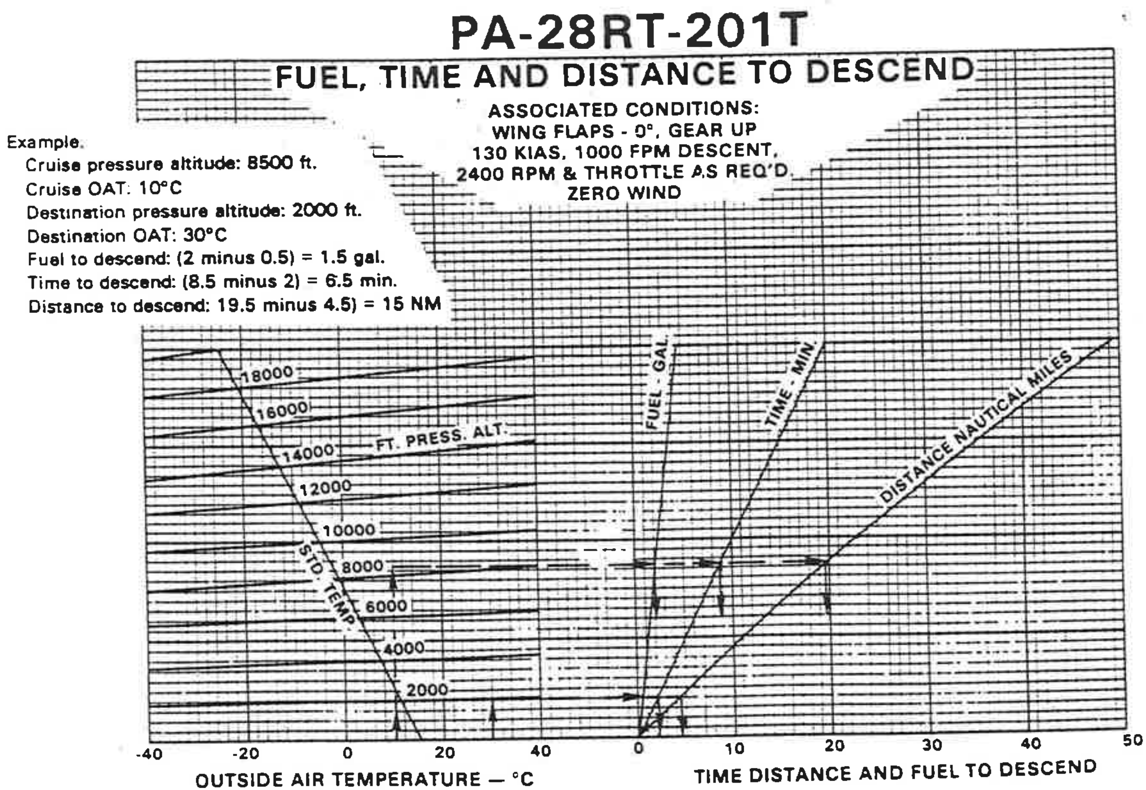



RANGE - CRUISE POWER
Figure 5-27

# PA-28RT-201T

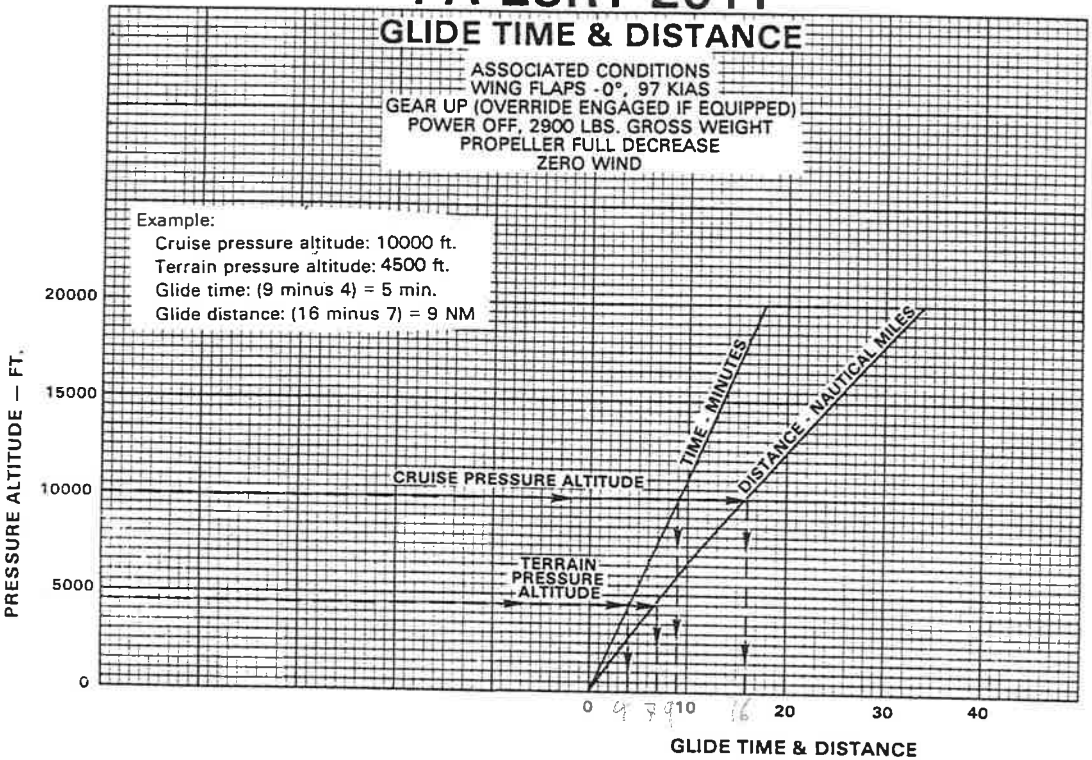



ENDURANCE
Figure 5-29

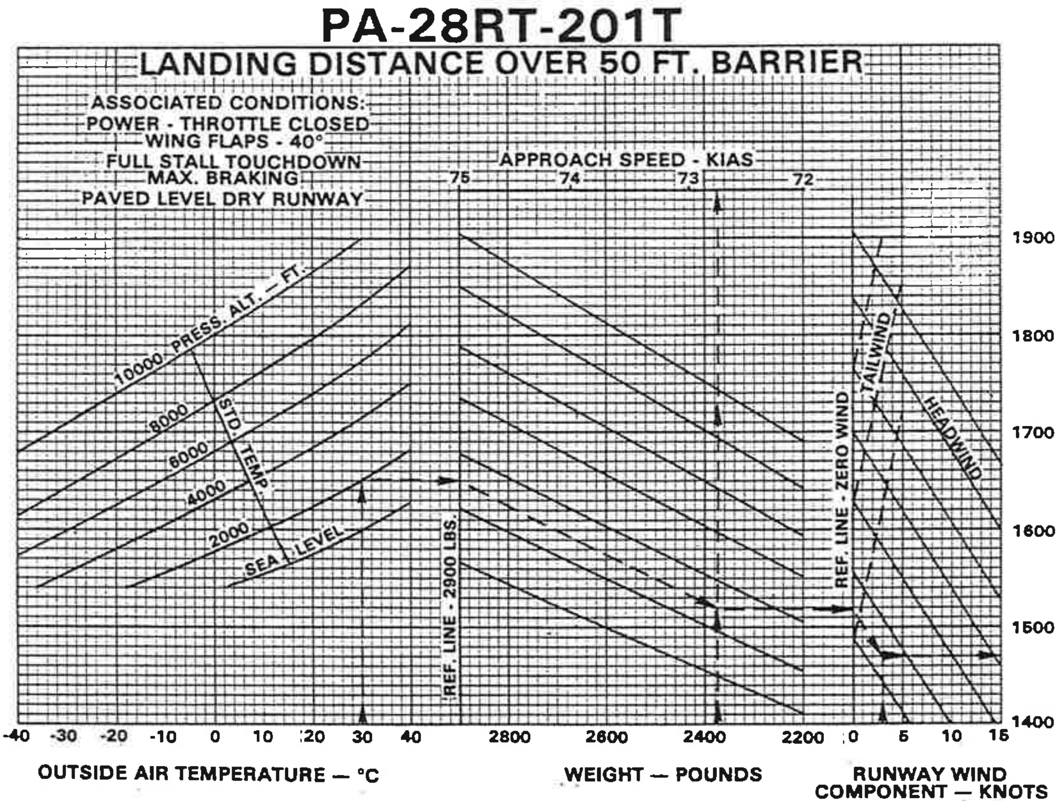



FUEL, TIME AND DISTANCE TO DESCEND
Figure 5-31

# PA-28RT-201T




GLIDE TIME AND DISTANCE
Figure 5-33



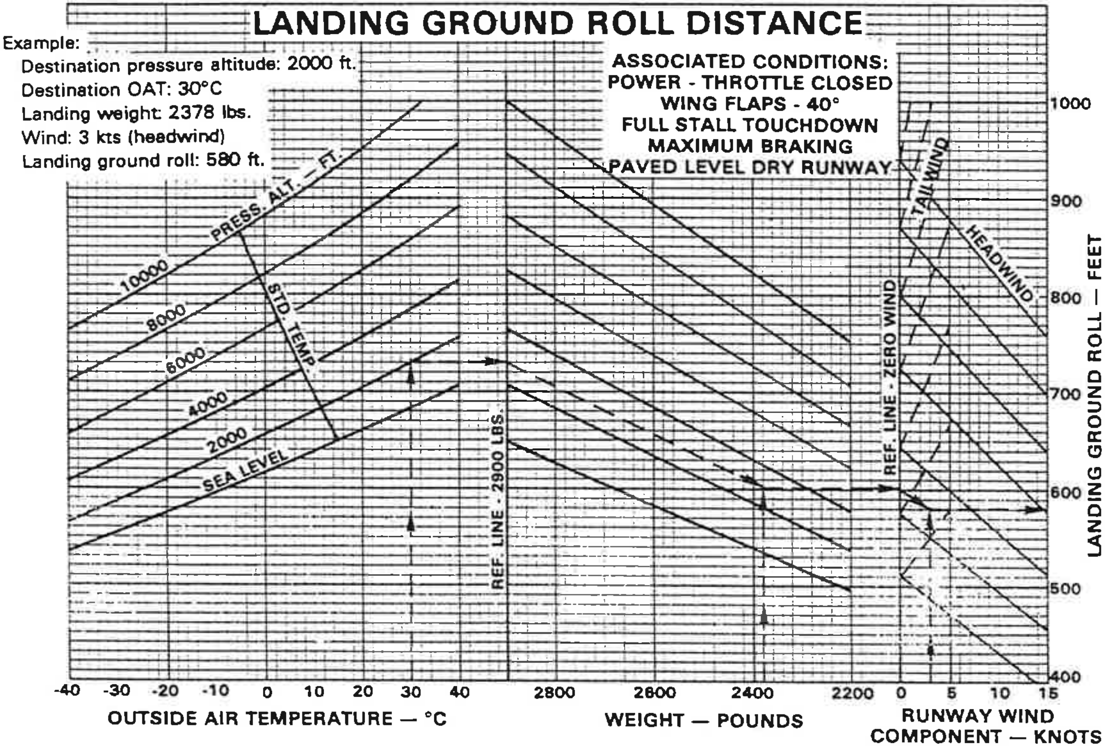

Example:

Destination pressure altitude: 2000 ft.
Destination OAT: 30°C

Landing weight: 2378 lbs.; approach speed: 72.6 KIAS
Wind: 3 knots (headwind)
Landing distance: 1470 ft.

LANDING DISTANCE OVER 50 FT.
Figure 5-35

# PA-28RT-201T




LANDING GROUND ROLL DISTANCE
Figure 5-37

# SECTION 6

# WEIGHT AND BALANCE

## 6.1 GENERAL

In order to achieve the performance and flying characteristics which are designed into the airplane, it must be flown with the weight and center of gravity (C.G.) position within the approved operating range (envelope). Although the airplane offers a flexibility of loading, it cannot be flown with the maximum number of adult passengers, full fuel tanks and maximum baggage. With the flexibility comes responsibility. The pilot must insure that the airplane is loaded within the loading envelope before he makes a takeoff.

Misloading carries consequences for any aircraft. An overloaded airplane will not take off, climb or cruise as well as a properly loaded one. The heavier the airplane is loaded, the less climb performance it will have.

Center of gravity is a determining factor in flight characteristics. If the C.G. is too far forward in any airplane, it may be difficult to rotate for takeoff or landing. If the C.G. is too far aft, the airplane may rotate prematurely on takeoff or tend to pitch up during climb. Longitudinal stability will be reduced. This can lead to inadvertent stalls and even spins; and spin recovery becomes more difficult as the center of gravity moves aft of the approved limit.

A properly loaded airplane, however, will perform as intended. Before the airplane is licensed, it is weighed, and a basic empty weight and C.G. location is computed (basic empty weight consists of the standard empty weight of the airplane plus the optional equipment). Using the basic empty weight and C.G. location, the pilot can determine the weight and C.G. position for the loaded airplane by computing the total weight and moment and then determining whether they are within the approved envelope.

The basic empty weight and C.G. location are recorded in the Weight and Balance Data Form (Figure 6-5) and the Weight and Balance Record (Figure 6-7). The current values should always be used. Whenever new equipment is added or any modification work is done, the mechanic responsible for the work is required to compute a new basic empty weight and C.G. position and to write these in the Aircraft Log Book and the Weight and Balance Record. The owner should make sure that it is done.

A weight and balance calculation is necessary in determining how much fuel or baggage can be boarded so as to keep within allowable limits. Check calculations prior to adding fuel to insure against improper loading.

The following pages are forms used in weighing an airplane in production and in computing basic empty weight, C.G. position, and useful load. Note that the useful load includes usable fuel, baggage, cargo and passengers. Following this is the method for computing takeoff weight and C.G.

## 6.3 AIRPLANE WEIGHING PROCEDURE

At the time of licensing, Piper Aircraft Corporation provides each airplane with the basic empty weight and center of gravity location. This data is supplied by Figure 6-5.

The removal or addition of equipment or airplane modifications can affect the basic empty weight and center of gravity. The following is a weighing procedure to determine this basic empty weight and center of gravity location:

(a) Preparation

(1) Be certain that all items checked in the airplane equipment list are installed in the proper location in the airplane.

(2) Remove excessive dirt, grease, moisture, foreign items such as rags and tools from the airplane before weighing.

(3) Defuel airplane. Then open all fuel drains until all remaining fuel is drained. Operate engine on each tank until all undrainable fuel is used and engine stops. Then add the unusable fuel (5.0 gallons total, 2.5 gallons each wing).

*CAUTION*

Whenever the fuel system is completely drained and fuel is replenished it will be necessary to run the engine for a minimum of 3 minutes at 1000 RPM on each tank to insure no air exists in the fuel supply lines.

(4) Fill with oil to full capacity.

(5) Place pilot and copilot seats in fourth (4th) notch, aft of forward position. Put flaps in the fully retracted position and all control surfaces in the neutral position. Tow bar should be in the proper location and all entrance and baggage doors closed.

(6) Weigh the airplane inside a closed building to prevent errors in scale readings due to wind.

(b) Leveling

(1) With airplane on scales, block main gear oleo pistons in the fully extended position.

(2) Level airplane (refer to Figure 6-3) deflating nose wheel tire, to center bubble on level.

(c) Weighing - Airplane Basic Empty Weight

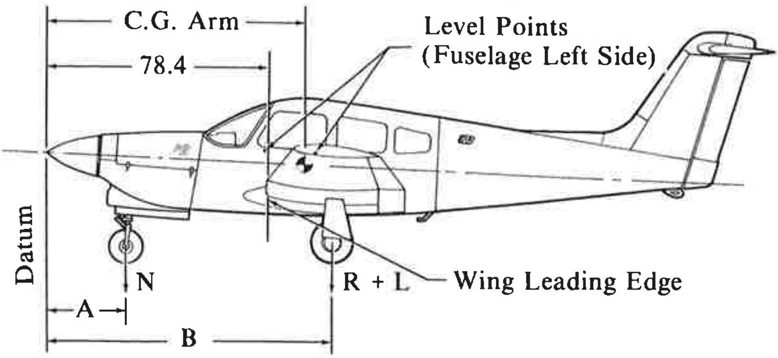
(1) With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

| Scale Position and Symbol | | Scale Reading | Tare | Net Weight |
|---|---|---|---|---|
| Nose Wheel | (N) | | | |
| Right Main Wheel | (R) | | | |
| Left Main Wheel | (L) | | | |
| Basic Empty Weight, as Weighed (T) | | | | |

**WEIGHING FORM**
Figure 6-1

(d) Basic Empty Weight Center of Gravity

(1) The following geometry applies to the PA-28RT-201T airplane when it is level. Refer to Leveling paragraph 6.3 (b).




A = 15.6
B = 109.7

The datum is 78.4 inches ahead of the wing leading edge at the intersection of the straight and tapered section.

**LEVELING DIAGRAM**
Figure 6-3

(2) The basic empty weight center of gravity (as weighed including optional equipment, full oil and unusable fuel) can be determined by the following formula:

$$\text{C.G. Arm} = \frac{N\,(A) + (R + L)\,(B)}{T} \quad \text{inches}$$

Where: $T = N + R + L$

## 6.5 WEIGHT AND BALANCE DATA AND RECORD

The Basic Empty Weight, Center of Gravity Location and Useul Load listed in Figure 6-5 are for the airplane as licensed at the factory. These figures apply only to the specific airplane serial number and registration number shown.

The basic empty weight of the airplane as licensed at the factory has been entered in the Weight and Balance Record (Figure 6-7). This form is provided to present the current status of the airplane basic empty weight and a complete history of previous modifications. Any change to the permanently installed equipment or modification which affects weight or moment must be entered in the Weight and Balance Record.

## 6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

(a) Add the weight of all items to be loaded to the basic empty weight.
(b) Use the Loading Graph (Figure 6-13) to determine the moment of all items to be carried in the airplane.
(c) Add the moment of all items to be loaded to the basic empty weight moment.
(d) Divide the total moment by the total weight to determine the C.G. location.
(e) By using the figures of item (a) and item (d) (above), locate a point on the C.G. range and weight graph (Figure 6-15). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.

| | Weight (Lbs) | Arm Aft Datum (Inches) | Moment (In-Lbs) |
|---|---|---|---|
| Basic Empty Weight | 1896.0 | 88.2 | 167227 |
| Pilot and Front Passenger | 340.0 | 80.5 | 27370 |
| Passengers (Rear Seats) | 340.0 | 118.1 | 40154 |
| Fuel (72 Gallons Maximum) | 312.0 | 95.0 | 29640 |
| Baggage (200 Lbs. Maximum) | 24.0 | 142.8 | 3427 |
| Ramp Weight (2912 Lbs. Maximum) | 2912.0 | 92.0 | 267818 |
| Fuel allowance for engine start, taxi, and run-up | -12 | 95.0 | -1140 |
| Takeoff Weight (2900 Lbs. Maximum) | 2900.0 | 92.0 | 266678 |

The center of gravity (C.G.) of this sample loading problem is at 92.0 inches aft of the datum line. Locate this point (92.0) on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

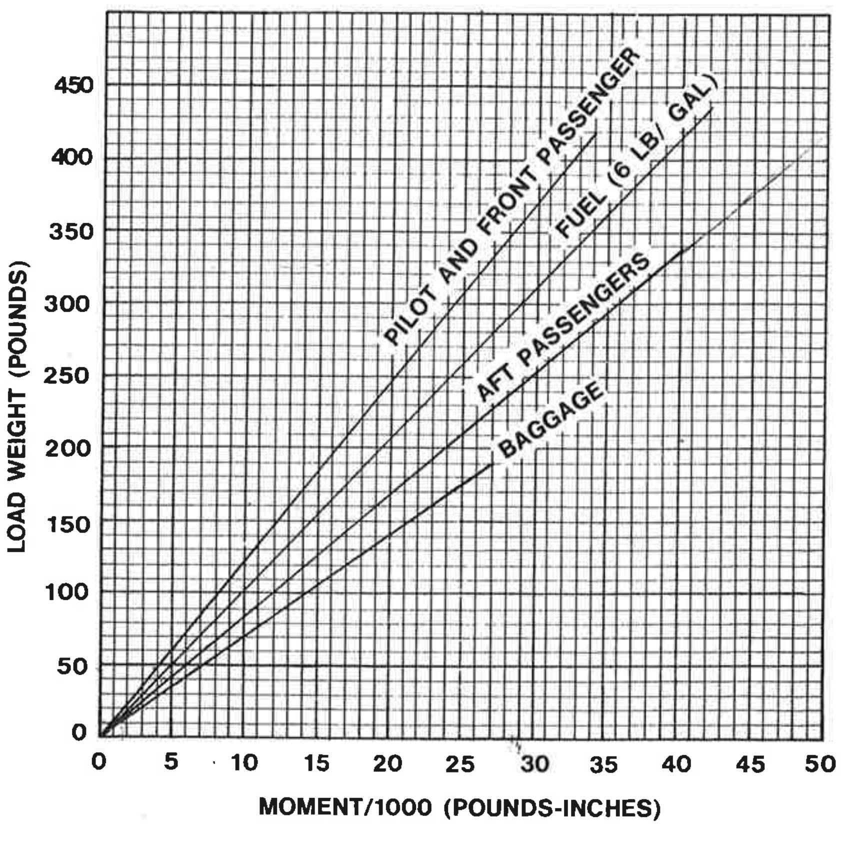
IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO INSURE THAT THE AIRPLANE IS LOADED PROPERLY.

**SAMPLE LOADING PROBLEM (NORMAL CATEGORY)**
Figure 6-9

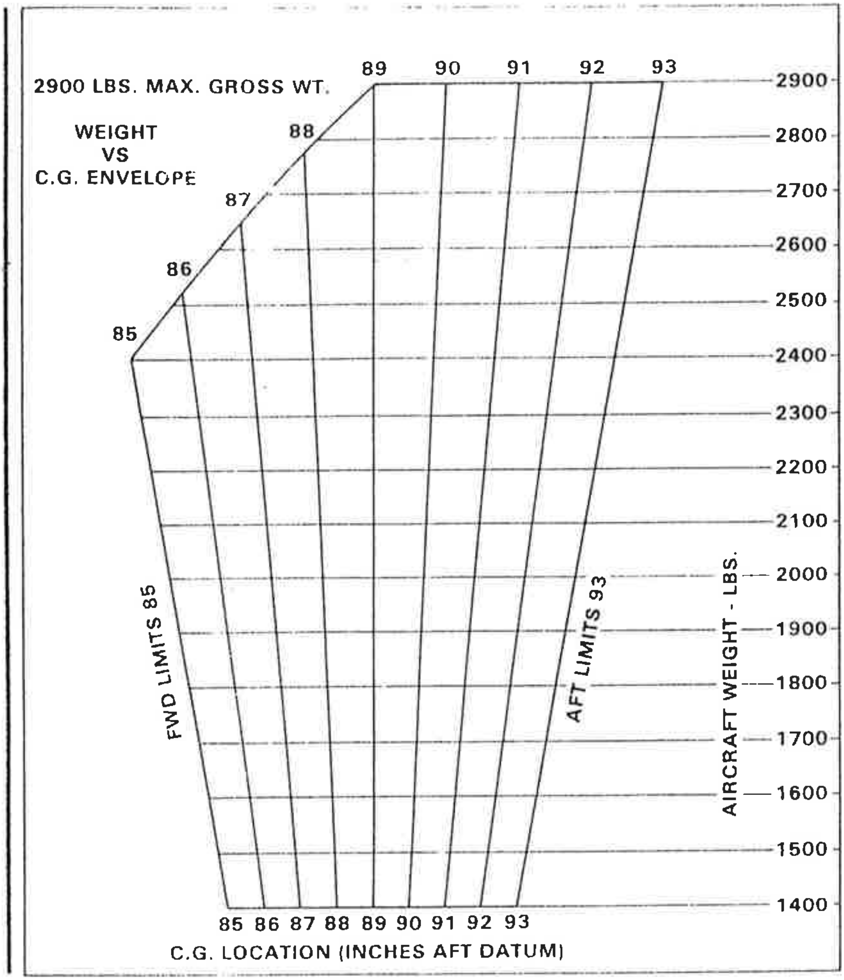
| | Weight (Lbs) | Arm Aft Datum (Inches) | Moment (In-Lbs) |
|---|---|---|---|
| Basic Empty Weight | | | |
| Pilot and Front Passenger | | 80.5 | |
| Passengers (Rear Seats) | | 118.1 | |
| Fuel (72 Gallons Maximum) | | 95.0 | |
| Baggage (200 Lbs. Maximum) | | 142.8 | |
| Ramp Weight (2912 Lbs. Maximum) Fuel allowance for engine start, taxi, and run-up | -12 | 95.0 | -1140 |
| Total Loaded Airplane (2900 Lbs. Maximum) | | | |

Totals must be within approved weight and C.G. limits. It is the responsibility of the airplane owner and the pilot to insure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Weight and Balance Data Form (Figure 6-5). If the airplane has been altered, refer to the Weight and Balance Record for this information.

**WEIGHT AND BALANCE LOADING FORM**
Figure 6-11




**LOADING GRAPH**
Figure 6-13




C.G. RANGE AND WEIGHT
Figure 6-15

## 6.9 INSTRUCTIONS FOR USING THE WEIGHT AND BALANCE PLOTTER

This plotter is provided to enable the pilot quickly and conveniently to:

(a) Determine the total weight and C.G. position.
(b) Decide how to change his load if his first loading is not within the allowable envelope.

Heat can warp or ruin the plotter if it is left in the sunlight. Replacement plotters may be purchased from Piper dealers and distributors.

The "Basic Empty Weight and Center of Gravity" location is taken from the Weight and Balance Form (Figure 6-5), the Weight and Balance Record (Figure 6-7) or the latest FAA major repair or alteration form.

The plotter enables the user to add weights and corresponding moments graphically. The effect of adding or disposing of useful load can easily be seen. The plotter does not cover the situation where cargo is loaded in locations other than on the seats or in the baggage compartments.

Brief instructions are given on the plotter itself. To use it, first plot a point on the grid to locate the basic weight and C.G. location. This can be put on more or less permanently because it will not change until the airplane is modified. Next, position the zero weight end of any one of the loading slots over this point. Using a pencil, draw a line along the slot to the weight which will be carried in that location. Then position the zero weight end of the next slot over the end of this line and draw another line representing the weight which will be located in this second position. When all the loads have been drawn in this manner, the final end of the segmented line locates the total load and the C.G. position of the airplane for takeoff. If this point is not within the allowable envelope it will be necessary to remove fuel, baggage, or passengers and/or to rearrange baggage and passengers to get the final point to fall within the envelope.

Fuel burn-off and gear movement do not significantly affect the center of gravity.

## SAMPLE PROBLEM

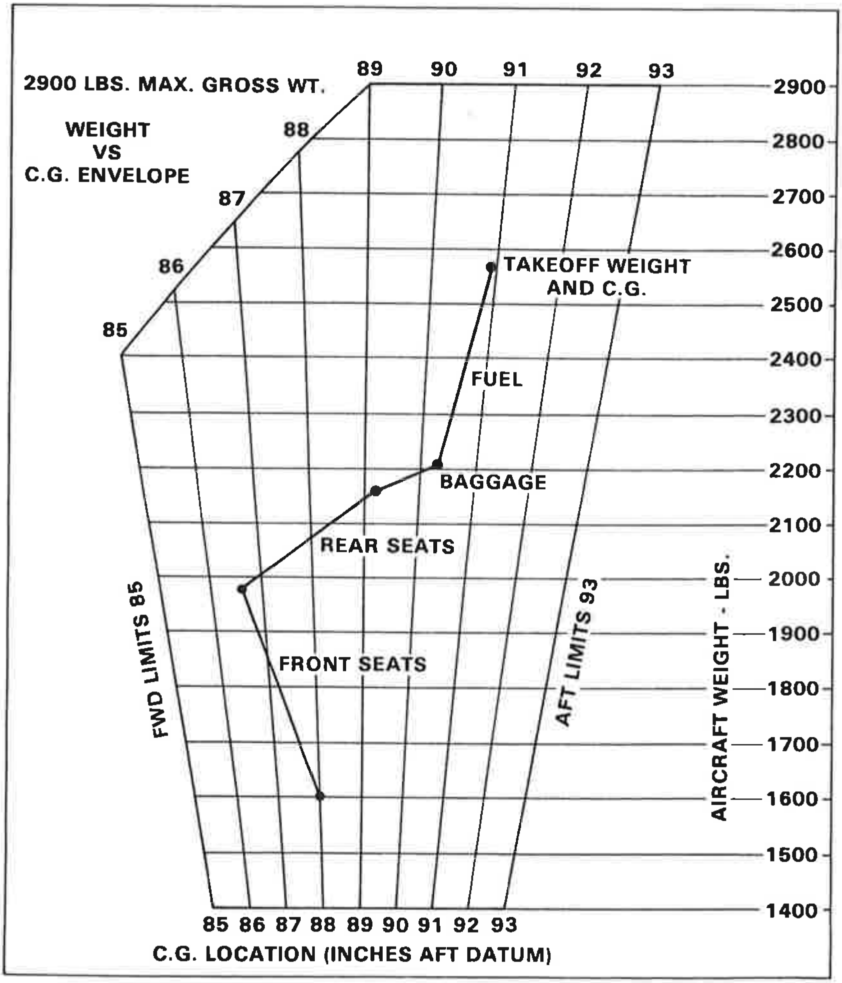
A sample problem will demonstrate the use of the weight and balance plotter.

Assume a basic weight and C.G. location of 1600 pounds at 88.00 inches respectively. We wish to carry a pilot and 3 passengers. Two men weighing 180 and 200 pounds will occupy the front seats, and two children weighing 80 and 100 pounds will ride in the rear. Two suitcases weighing 25 pounds and 20 pounds respectively, will be carried in the rear compartment. We wish to carry 60 gallons of fuel. Will we be within the safe envelope?

(a) Place a dot on the plotter grid at 1600 pounds and 88.00 inches to represent the basic airplane. (See illustration.)
(b) Slide the slotted plastic into position so that the dot is under the slot for the forward seats, at zero weight.
(c) Draw a line up the slot to the 380 pound position (180 + 200) and put a dot.
(d) Continue moving the plastic and plotting points to account for weight in the rear seats (80 + 100), baggage compartment (45), and fuel tanks (360).
(e) As can be seen from the illustration, the final dot shows the total weight to be 2565 pounds with the C.G. at 90.94. This is well within the envelope.
(f) There will be room for more fuel.

As fuel is burned off, the weight and C.G. will follow down the fuel line and stay within the envelope for landing.

## SAMPLE PROBLEM



# SECTION 7

# DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYTEMS

## 7.1 THE AIRPLANE

The Turbo Arrow IV is a single engine, retractable landing gear, all metal airplane featuring the tail surfaces in a "T" configuration. It has seating for up to four occupants, a 200 pound luggage compartment, and a turbocharged 200 HP engine.

## 7.3 AIRFRAME

With the exception of the steel engine mount, the landing gear, miscellaneous steel parts, the cowling, and the lightweight plastic extremities (tips of wings, tail fin, rudder and stabilator), the basic airframe is of aluminum alloy. Aerobatics are prohibited in this airplane since the structure is not designed for aerobatic loads.

The fuselage is a semi-monocoque structure. There is a front door on the right side. A cargo door is installed aft of the rear seat.

The wing is of a conventional design semi-tapered and employs a laminar flow NACA $65_2$-415 airfoil section. The main spar is located at approximately 40% of the chord aft of the leading edge. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the aft seats, provides in effect a continuous main spar. The wings are also attached fore and aft of the main spar by an auxiliary front spar and a rear spar. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. The four-position wing flaps are mechanically controlled by a handle located between the front seats. When fully retracted, the right flap locks into place to provide a step for cabin entry. Each wing contains one fuel tank.

A vertical stabilizer, an all-movable horizontal stabilator, and a rudder make up the empennage. The stabilator, which is mounted on top of the fin, incorporates an anti-servo tab which improves longitudinal stability and provides longitudinal trim. This tab moves in the same direction as the stabilator, but with increased travel.

## 7.5 ENGINE AND PROPELLER

The engine is a six cylinder, horizontally opposed, fuel injected, turbocharged engine, rated at 200 horsepower at 2575 RPM and 41 inches MAP from sea level to 12,000 feet density altitude. It is equipped with an oil cooler with a low temperature bypass system and engine mounted oil filter. A winterization plate is provided to restrict air during winter operation. (See Winterization in Handling and Servicing Section.) The turbocharger control system is a fixed, ground adjustable orifice ("fixed wastegate"), and is adjusted to provide 41 inches MAP at full throttle at 12,000 feet density altitude. Throttle position controls engine power and no separate turbocharger control system is utilized. An overboost valve prevents manifold pressure from exceeding 42 inches Hg. should the throttle inadvertently be opened too far below 12,000 feet density altitude. Should this occur, the amber "overboost" warning light in the annunciator panel will illuminate.

The engine induction system is provided with two independent air sources, an induction air filter box with filter, and interconnecting ducting. The primary air inlet is located above No. 1 cylinder (right rear) in the engine rear baffle. Induction air enters at this point and is ducted to the induction filter box, thru the filter and is further ducted to the turbocharger compressor inlet. The induction air filter box incorporates an alternate air valve. This valve may be manually operated (opened) with the alternate air control, allowing air to bypass the filter, supplying heated air directly to the compressor inlet. Should the primary air source become blocked, the alternate air valve will open automatically due to the sucking action of the turbocharger compressor. The heated air provided by the alternate air source will protect against induction system blockage caused by snow or freezing rain, or by the freezing of moisture accumulated in the induction air filter. The alternate air is unfiltered and therefore should not be used during ground operation when dust or other contaminates might enter the system. The primary (filtered air) induction source should always be used for takeoff.

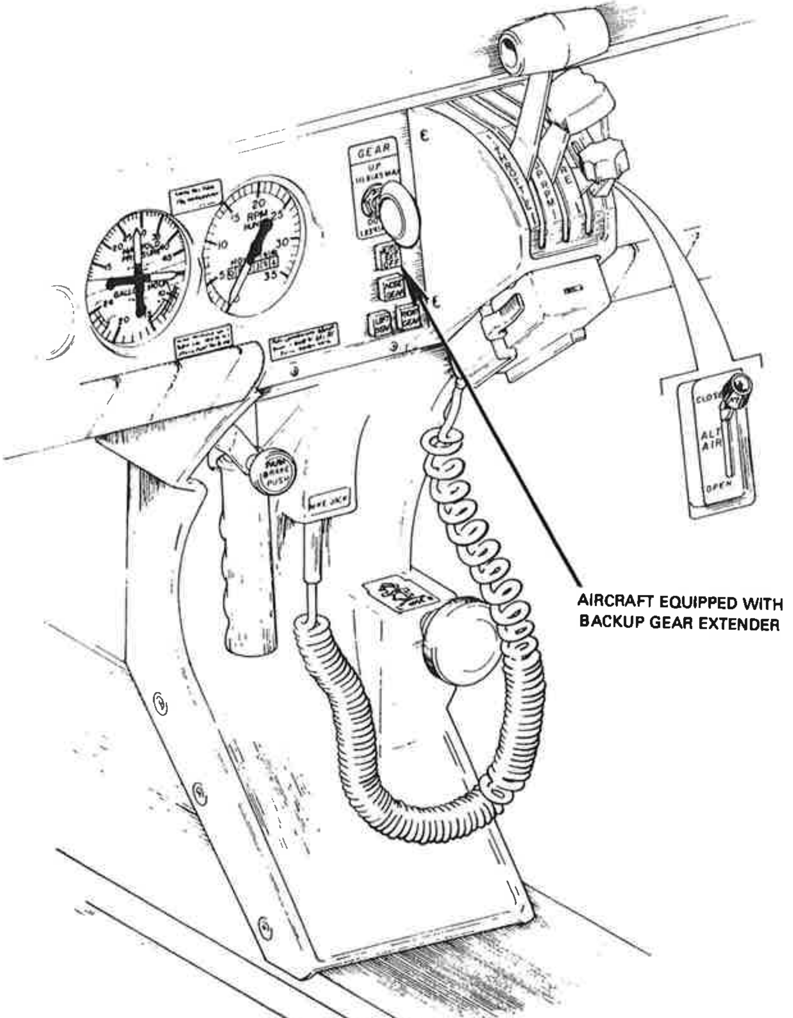
A RayJay turbocharger on the engine is operated by the engine exhaust gases. The exhaust gases drive a turbine wheel which is coaxial with a compressor wheel. Induction air entering the compressor wheel is compressed and delivered to the engine induction distribution system and hence to each cylinder. The amount of induction air compression is a function of engine power - low power, low compression; high power, higher compression. Any excessive pressure (and flow) is expelled by the overboost valve discussed previously.

The fuel injection system incorporates a metering system which measures the rate at which turbocharged air is being used by the engine and dispenses fuel to the cylinders proportionally. Fuel is supplied to the injector pump at a greater rate than the engine requires. The fuel injection system is a "continuous flow" type.

A combination fuel flow indicator and manifold pressure gauge is installed in the left side of the instrument panel. The fuel flow indicator is connected to the fuel flow divider and monitors fuel pressure. The instrument converts fuel pressure to an approximate indication of fuel flow in gallons per hour and percentage of cruise power.

To obtain maximum efficiency and time from the engine, follow the procedures recommended in the Teledyne Continental Operator's Manual provided with the airplane.

The Hartzell constant speed propeller is controlled by a governor mounted on the left forward side of the crankcase. The governor is controlled by a cable from the power control quadrant. A choice of a two bladed (standard) propeller or a three bladed (optional) propeller is offered.




**CONTROL QUADRANT AND CONSOLE**
Figure 7-1

## 7.7 ENGINE CONTROLS

Engine controls consist of a throttle control, a propeller control and a mixture control lever. These controls are located on the control quadrant on the lower center of the instrument panel (Figure 7-1) where they are accessible to both the pilot and the copilot. The controls utilize teflon-lined control cables to reduce friction and binding.

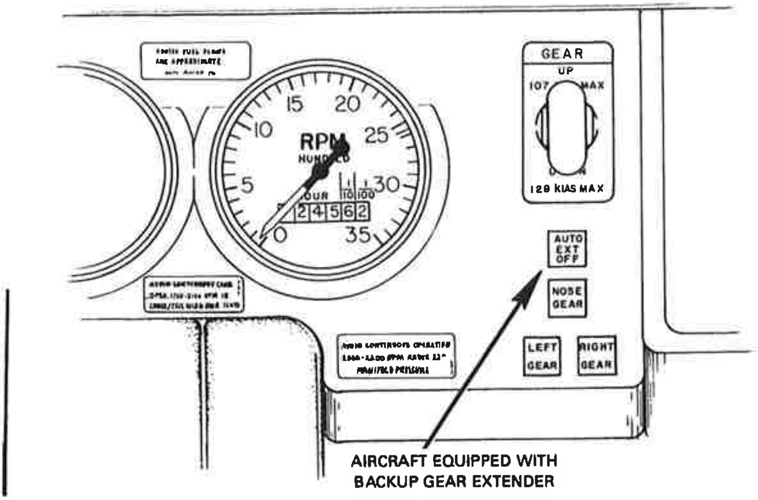
The throttle lever is used to adjust the manifold pressure. It incorporates a gear up warning horn switch which is activated during the last portion of travel of the throttle lever to the low power position. If the landing gear is not locked down, the horn will sound until the gear is down and locked or until the power setting is increased. This is a safety feature to warn of an inadvertent gear up landing.

The propeller control lever is used to adjust the propeller speed from high RPM to low RPM.

The mixture control lever is used to adjust the air to fuel ratio. The engine is shut down by the placing of the mixture control lever in the full lean position. In addition, the mixture control has a lock to prevent activation of the mixture control instead of the pitch control. For information on the leaning procedure, see the Continental Operator's Manual.

The friction adjustment lever on the right side of the control quadrant may be adjusted to increase or decrease the friction holding the throttle, propeller, and mixture controls in a selected position.

The alternate air control is located to the right of the control quadrant. When the alternate air lever is in the up, or closed, position the engine is operating on filtered air; when the lever is in the down, or open, position the engine is operating on unfiltered, heated air (refer to Figure 7-1).




**LANDING GEAR SELECTOR**
Figure 7-3

## 7.9 LANDING GEAR

The Turbo Arrow IV is equipped with a retractable tricycle landing gear, which is hydraulically actuated by an electrically powered reversible pump. The pump is controlled by a selector switch on the instrument panel to the left of the control quadrant (Figure 7-3). The landing gear is retracted or extended in about seven seconds.

Some aircraft also incorporate a pressure sensing device in the system which lowers the gear regardless of gear selector position, depending upon airspeed and engine power (propeller slipstream). Gear extension is designed to occur, even if the selector is in the up position, at airspeeds below approximately 103 KIAS with power off.The extension speeds will vary from approximately 78 KTS to approximately 103 KIAS depending on power settings and altitude. The device also prevents the gear from retracting at airspeeds below approximately 78 KTS with full power, though the selector switch may be in the up position. This speed increases with reduced power and/or increased altitude. Manual override of the device is provided by an emergency gear lever located between the front seats to the left of the flap handle (refer to Figure 7-9). The sensing device operation is controlled by differential air pressure across a flexible diaphragm which is mechanically linked to a hydraulic valve and an electrical switch which actuates the pump motor. A high pressure and static air source for actuating the diaphragm is provided in a mast mounted on the left side of the fuselage above the wing. Any obstruction of the holes in this mast will cause the gear to extend. An optional heated mast is available to alleviate obstruction in icing conditions. The optional heated mast is turned on whenever the "PITOT HEAT" is turned on.

***WARNING***

Avoid ejecting objects out of the pilot storm window which could possibly enter or obstruct the holes in the mast.

The emergency gear lever, when placed in the raised position, can be used to override the system, and gear position is then controlled by the selector switch regardless of airspeed/power combinations. The emergency gear lever is provided with a locking device which may be used to lock the override lever in the up position. The lock is located on the left side panel of the console below the level of the manual override lever. To lock the override lever in the up position, raise the override lever to the full up position and push the pin in. A yellow warning light located below the gear selector switch (Figure 7-3) flashes to warn the pilot that the automatic gear lowering system is disabled. The lock is spring-loaded to the off position to aid disengagement. To disengage the lock raise the override lever and release. The lever will return to its normal position and the yellow flashing light will extinguish. The lever must also be locked in the raised (up) position when gear-up stalls are practiced.

The emergency gear lever, when used for emergency extension of the gear, manually releases hydraulic pressure to permit the gear to free-fall with spring assistance on the nose gear. The lever must be held in the downward position for emergency extension.

Gear down and locked positions are indicated by three green lights located below the selector, and a red "Warning Gear Unsafe" light is located at the top of the panel. An all lights out condition indicates the gear is up. The landing gear should not be retracted above a speed of 111 KIAS and should not be extended above a speed of 133 KIAS.

The main landing gear uses 6.00 x 6 wheels. The main gear incorporate brake drums and Cleveland single disc hydraulic brake assemblies. The nose wheel carries a 5.00 x 5 four ply tire and the main gear use 6.00 x 6 six ply tires. All three tires are tube type.

A micro-switch in the throttle quadrant activates a warning horn and red "Warning Gear Unsafe" light under the following conditions:

(a) Gear up and power reduced below approximately 14 inches of manifold pressure.
(b) On aircraft equipped with the backup gear extender, if the system has extended the landing gear and the gear selector is UP, with the reduced below approximately 14 inches of manifold pressure.
(c) Gear selector switch "UP" while on the ground and throttle in retarded position.

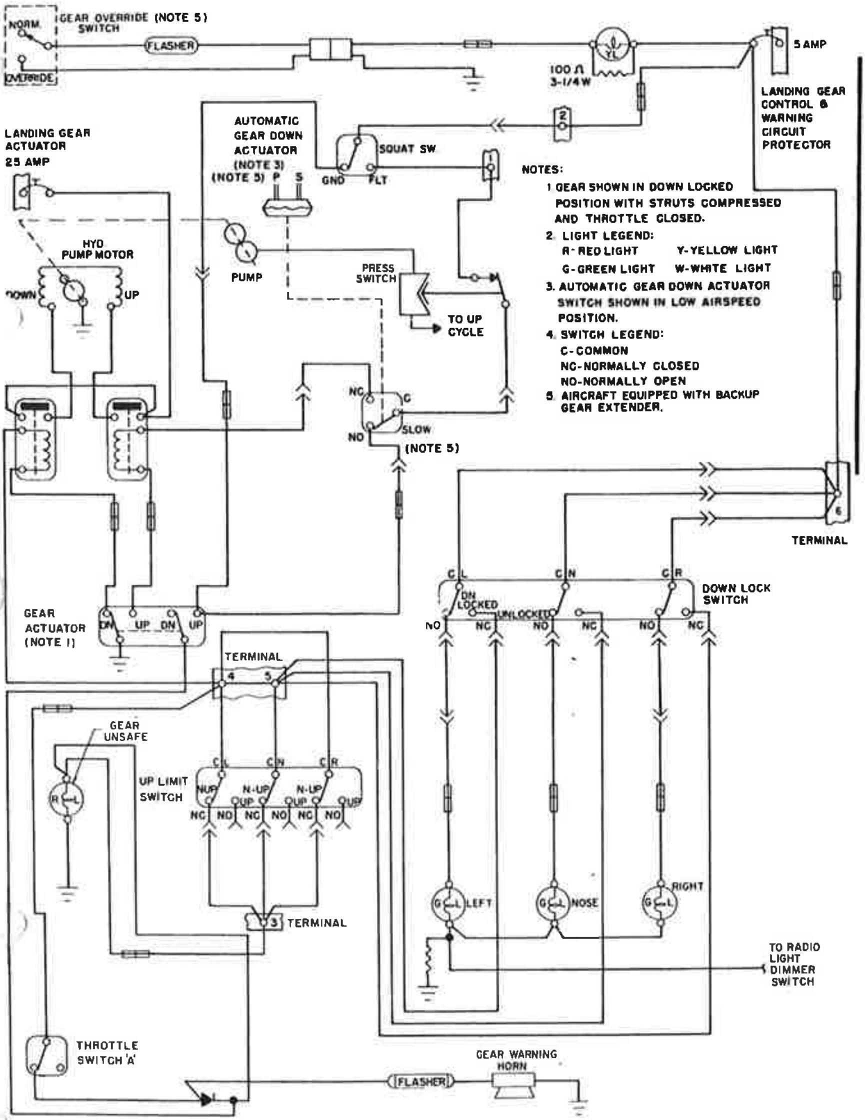
On aircraft which are NOT equipped with the backup gear extender an additional switch is installed which activates the warning horn and light whenever the flaps are extended beyond the approach position (10°) and the landing gear are not down and locked.

The gear warning horn emits a 90 cycle per minute beeping sound in contrast to the stall warning horn which emits a continuous sound.

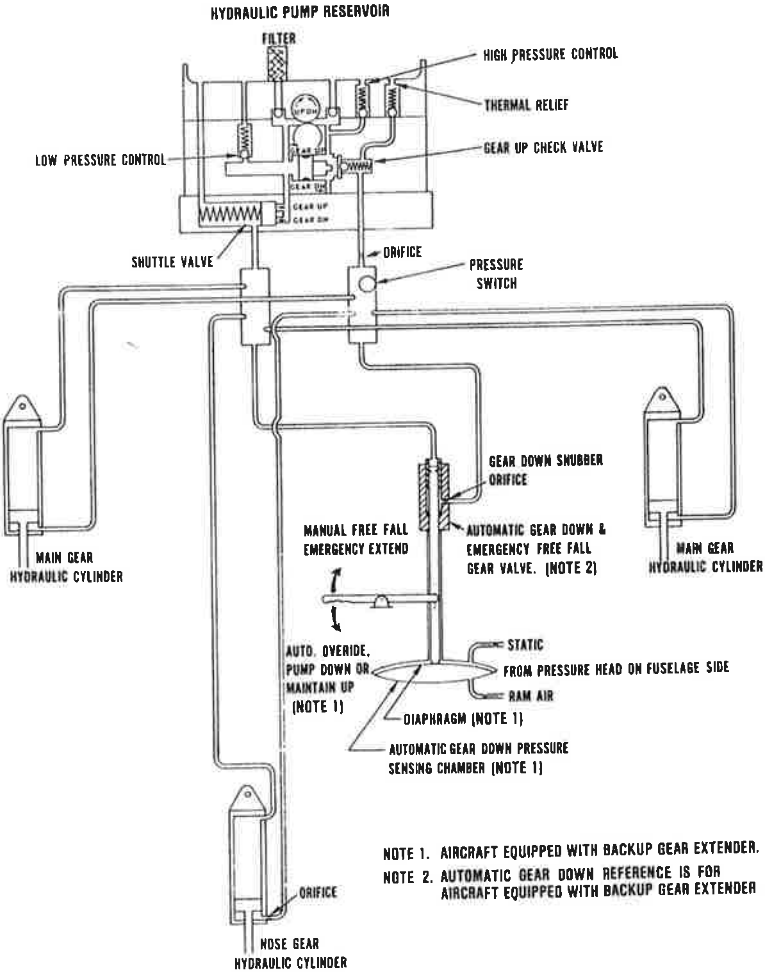
The nose gear is steerable through a 30 degree arc each side of center through the use of the rudder pedals. As the nose wheel retracts, the steering linkage disengages to reduce rudder pedal loads in flight. The nose wheel is equipped with a hydraulic shimmy dampener to reduce nose wheel shimmy. A bungee assembly is also included to reduce ground steering effort and to dampen shocks and bumps during taxiing.

The oleo struts are of the air-oil type, with normal extension being 2.75 ± .25 inches for the nose gear and 2.5 ± .25 inches for the main gear under normal static load (empty weight of airplane plus full fuel and oil).

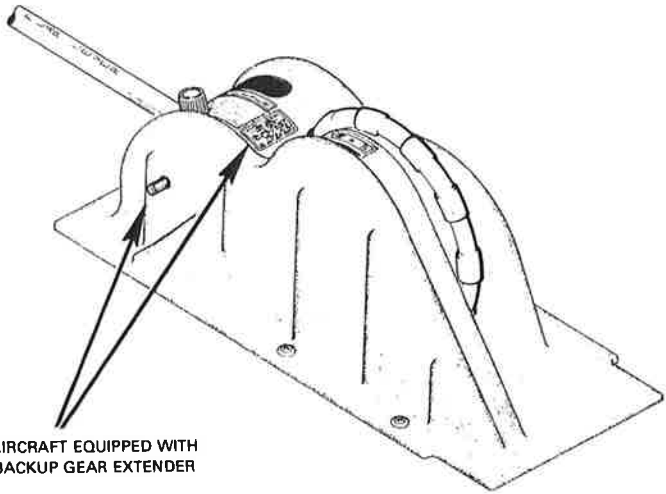
The standard brake system includes toe brakes on the left and right set of rudder pedals and a hand brake located below and near the center of the instrument panel. The toe brakes and the hand brake have individual brake cylinders, but all cylinders use a common reservoir. The parking brake is incorporated in the lever brake and is operated by pulling back on the lever and depressing the knob attached to the top of the handle. To release the parking brake, pull back on the brake lever; then allow the handle to swing forward.




**LANDING GEAR ELECTRICAL SCHEMATIC**
Figure 7-5




**LANDING GEAR HYDRAULIC SCHEMATIC**
Figure 7-7




**FLIGHT CONTROL CONSOLE**
Figure 7-9

## 7.11 FLIGHT CONTROLS

Dual flight controls are provided as standard equipment. A cable system provides actuation of the control surfaces when the flight controls are moved in their respective directions.

The horizontal surface (stabilator) is mounted atop the fin in a "T" configuration and features a trim tab/servo mounted on the trailing edge. This tab serves the dual function of providing trim control and pitch control forces. The trim function is controlled by a trim control wheel located on the control console between the two front seats (Figure 7-9). Rotating the wheel forward gives nose down trim and rotation aft gives nose up trim.

The rudder is conventional in design and incorporates a rudder trim. The trim mechanism is a spring-loaded recentering device. The trim control is located on the right side of the pedestal below the throttle quadrant. Turning the trim control clockwise gives nose right trim and counterclockwise rotation gives nose left trim.

Manually controlled flaps are provided. They are extended by a control cable and are spring-loaded to the retracted (up) position. The control is located between the two front seats on the control console. To extend the flaps pull the handle up to the desired flap setting of 10, 25 or 40 degrees. To retract, depress the button on the end of the handle and lower the control.

When extending or retracting flaps, there is a pitch change in the aircraft. This pitch change can be corrected either by stabilator trim or increased control wheel force. When the flaps are in the retracted position the right flap, provided with a over-center lock mechanism, acts as a step.

NOTE

The right flap will support a load only in the fully retracted (up) position. When loading and unloading passengers make sure the flaps are in the retracted (up) position.

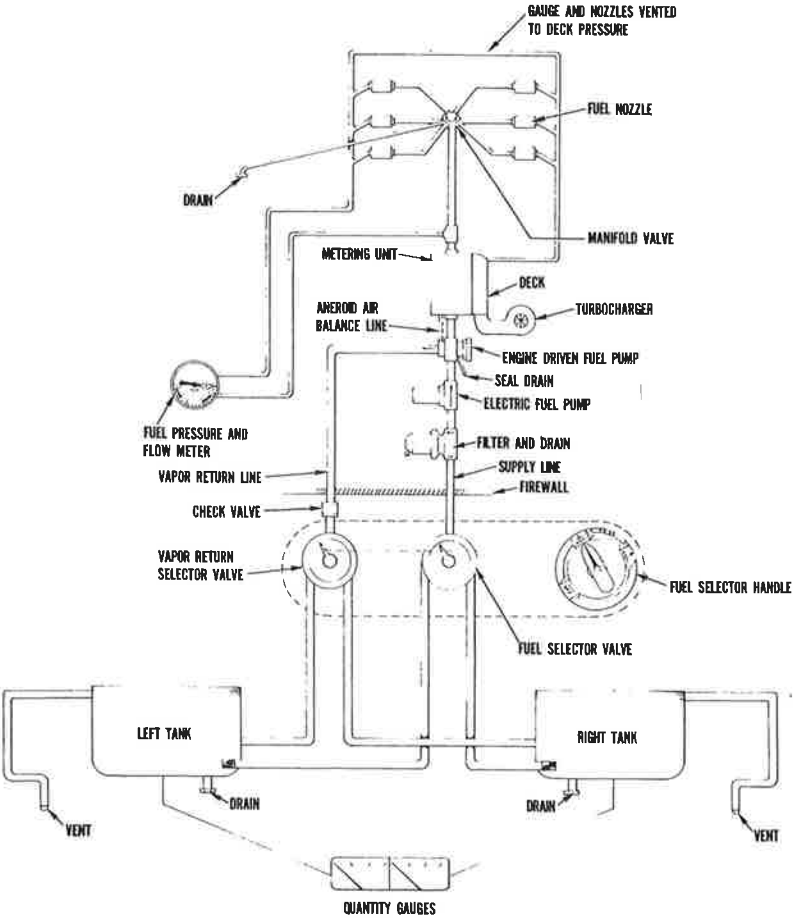
## 7.13 FUEL SYSTEM

The fuel system was designed with simplicity in mind. It incorporates two fuel tanks, one in each wing containing 38.5 U.S. Gallons, giving a total capacity of 77 gallons, of which 72 gallons are usable. Each tank is equipped with a filler neck indicator tab to aid in determining fuel remaining when the tanks are not full. Usable capacity to the bottom of the indicator tab is 25 gallons. The minimum fuel grade is 100 or 100LL Aviation Grade. The tanks are attached to the leading edge of the wing with screws and are an integral part of the wing structure. This allows removal for service. The tanks are vented individually by a vent tube which protrudes below the bottom of the wing at the rear inboard corner of each tank. The vents should be checked periodically to ascertain that the vent is not obstructed and will allow free passage of air.

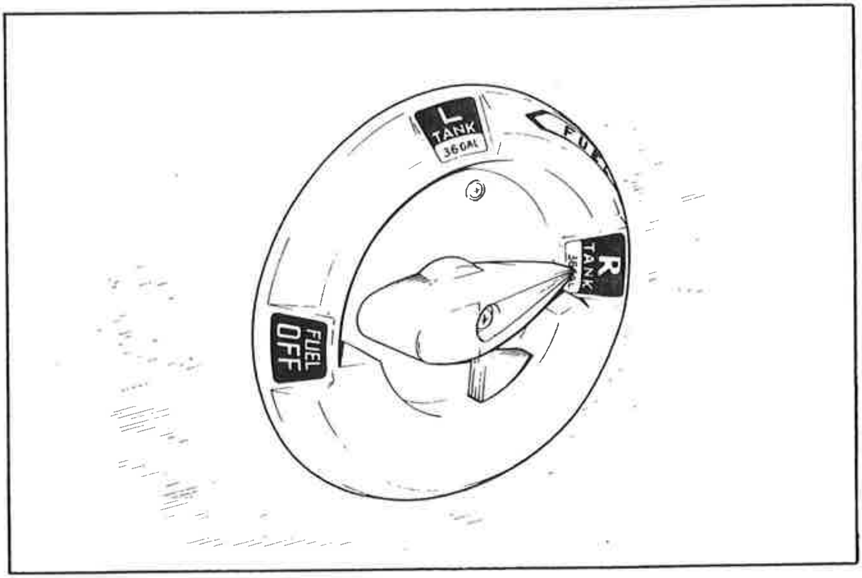
Each fuel tank has an individual quick drain located at the bottom inboard rear corner. The fuel strainer also incorporates a quick drain, which is located on the left lower portion of the firewall. The quick drain protrudes thru the cowling to allow easy draining of the fuel strainer. To avoid the accumulation of water and sediment, the fuel tank sumps and strainer should be drained daily prior to first flight and after refueling.

*CAUTION*

When draining fuel, care should be taken to ensure that no fire hazard exists before starting the engine.




**FUEL SYSTEM SCHEMATIC**
Figure 7-11




**FUEL SELECTOR**
Figure 7-13

A fuel tank selector allows the pilot to control the flow of fuel to the engine, and is located on the left side wall below the instrument panel. It has three positions: OFF, LEFT TANK and RIGHT TANK. The arrow on the handle of the selector points to the tank which is supplying fuel to the engine. The vapor return from the engine is also routed back to the tank selected. When the selector valve is in the OFF position, vapor return is routed back to the right fuel tank. The valve also incorporates a safety latch which prevents inadvertently selecting the "OFF" position.

The engine fuel injection system is a "continuous flow" type, which utilizes a vapor return line leading back to the fuel tanks. This line provides a route back to the tanks for vapor laden fuel that has been separated in the injector pump swirl chamber. The engine has an engine driven fuel pump that is a part of the fuel injection system. An auxiliary fuel pump is also provided. The purpose of the electrically powered auxiliary fuel pump is to supply fuel to the engine in case of engine driven fuel pump shaft failure or malfunction, for ground and inflight engine starting, and for vapor suppression. The auxiliary fuel pump switch is located on the instrument panel above the engine control quadrant, and is a three position rocker switch; LO, HI and OFF. The LO auxiliary fuel pressure is selected by pushing the

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In case of a failed engine driven fuel pump, the auxiliary electric fuel pump should be set on HI. Adequate pressure and fuel flow will be supplied for up to approximately 75% power. Manual leaning to the correct fuel flow will be required at altitudes above 15,000 feet and for engine speeds less than 2300 RPM. An absolute pressure switch automatically selects a lower fuel pressure when the throttle is reduced below 21" Hg manifold pressure and the HI auxiliary fuel pump is on.

NOTE

> Excessive fuel pressure and very rich fuel/air mixtures will occur if the HI position is energized when the engine fuel injection system is functioning normally.

Low auxiliary fuel pressure is available and may be used during normal engine operation both on the ground and inflight for vapor suppression should it be necessary as evidenced by unstable engine operation or fluctuating fuel flow indications during idle or at high altitudes.

A spring loaded OFF primer button switch is located on the instrument panel and is used to select HI auxiliary fuel pump operation for priming, irrespective of other switch positions. The primer button may be used for both hot or cold engine starts.

On airplanes equipped with an optional engine primer system (identified by Placard below primer button shown in Figure 7-21), the primer switch location and actuation is the same as the basic airplane. However, this system does provide a separate primer system as an integral part of the engine fuel system. An electrically operated diverter valve is located in the metered fuel supply line between the air throttle valve and the manifold valve. Other components are two primer nozzles, located in the intake manifold on each side of the engine, the interconnecting fuel lines, and fine wire spark plugs. Actuation of the engine primer switch operates the auxiliary electric fuel pump on HI and energizes the diverter valve which supplies fuel to each primer nozzle. The diverter valve does not shut off all fuel flow to the manifold valve, therefore some quantity of fuel is also supplied to each cylinder nozzle during priming. Operation of the auxiliary fuel pump on HI and LO is unchanged.

## 7.15 ELECTRICAL SYSTEM

All switches are grouped in a switch panel above the power quadrant. On the lower right side of the instrument panel is the circuit breaker panel, with each breaker clearly marked to show what circuit it protects. Also, circuit provisions are made to handle the addition of communications and navigational equipment.

Standard electrical accessories include alternator, starter, electric fuel pump, stall warning indicator, ammeter, and annunciator panel.

The annunciator panel includes alternator and low oil pressure indicator lights. When the optional gyro system is installed, the annunciator panel also includes a low vacuum indicator light. The annunciator panel lights are provided only as a warning to the pilot that a system may not be operating properly, and that he should check and monitor the applicable system gauge to determine when or if any necessary action is required.

Optional electrical accessories includes navigation, ground recognition, anti-collision, landing, instrument and cabin dome lights. Navigation and radio lights are controlled by a rheostat switch on the left side of the switch panel. The instrument panel lights are controlled by a rheostat switch on the right side of the panel.

An optional light, mounted in the overhead panel, provides instrument and cockpit lighting for night flying. The light is controlled by a rheostat switch located adjacent to the light. A map light window in the lens is actuated by an adjacent switch.

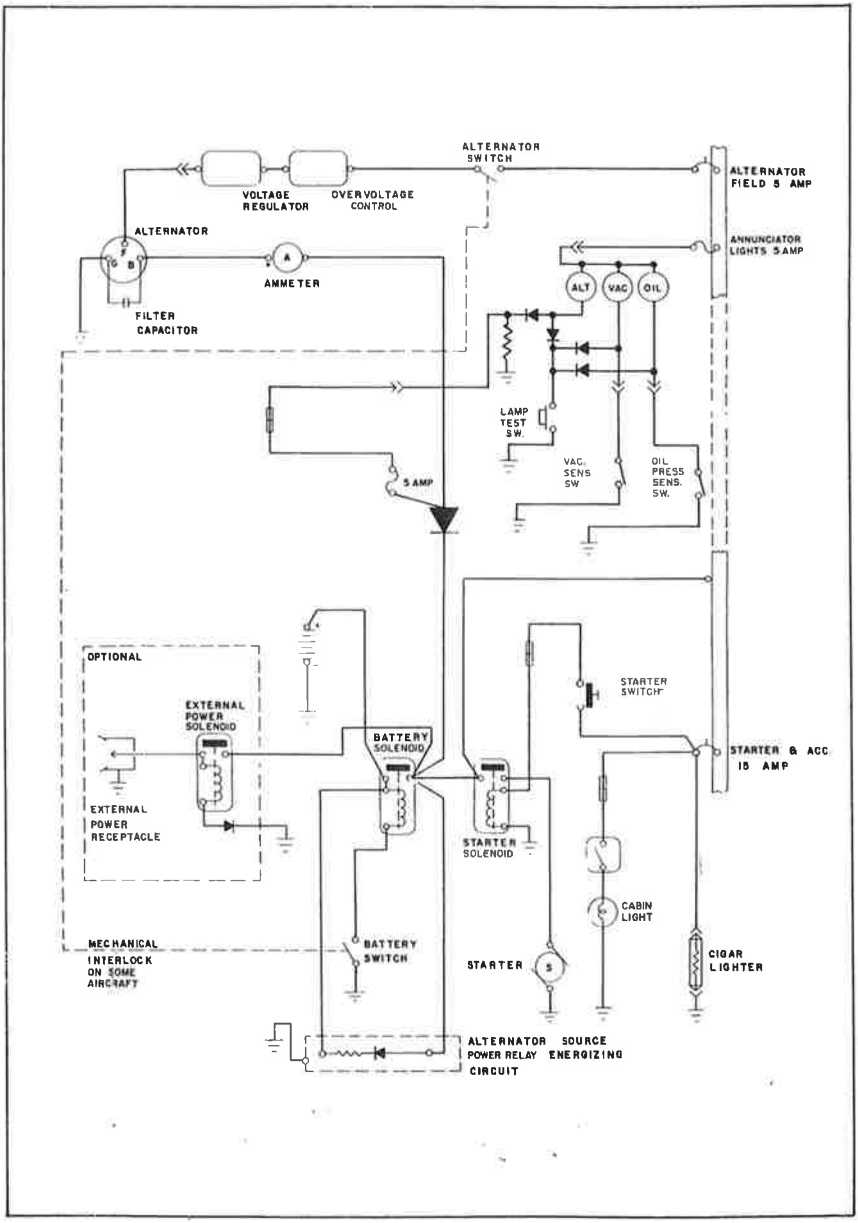
An optional wing tip/recognition light system consists of 2 lights (one in each wing tip) and is operated by a split landing light/recognition light rocker type switch mounted on the switch panel.

*WARNING*

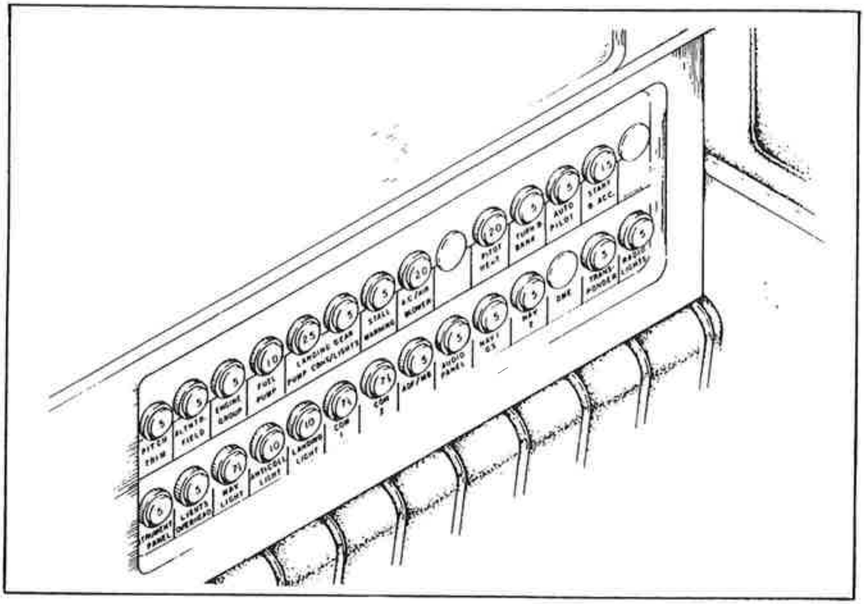
When optional panel lights are installed, rheostat switch must be off to obtain gear lights full intensity during daytime flying. When aircraft is operated at night and panel light rheostat switch is turned on, gear lights and over boost light will automatically dim.

*CAUTION*

Do not use cigar lighter receptacles as power sources for any devices other than the cigar lighters supplied with the airplane. Any other device plugged into these receptacles may be damaged.




**ALTERNATOR AND STARTER SCHEMATIC**
Figure 7-15




**CIRCUIT BREAKER PANEL**
Figure 7-17

The anti-collision and landing lights are controlled by rocker switches on the switch panel.

***WARNING***

Strobe lights should not be operating when flying through overcast and clouds since reflected light can produce spacial disorientation. Do not operate strobe lights in close proximity to ground, such as during takeoff and landing.

NOTE

On airplanes with interlocked BAT and ALT switches, the ALT switch is mechanically interlocked with the BAT switch. When ALT switch is turned ON, the BAT switch will also be turned ON. On airplanes with separate BAT and ALT switch operations, the switches may be positioned independently as desired.

The primary electrical power source is a 14-volt, 65-amp alternator, which is protected by a voltage regulator and an overvoltage relay. The alternator provides full electrical power output even at low engine RPM. This provides improved radio and electrical equipment operation and increases battery life by reducing battery load.

Secondary power is provided by a 12-volt, 25-ampere hour battery.

The ammeter as installed does not show battery discharge; rather it shows the electrical load placed on the system. With all the electrical equipment off, and the master switch on, the ammeter will indicate the charging rate of the battery. As each electrical unit is switched on, the ammeter will indicate the total ampere draw of all the units including the battery. For example, the average continuous load for night flying with radios on is about 30 amperes. The 30 ampere value plus 2 amperes for charging the battery will then show on the ammeter, indicating the alternator is functioning properly.

Solenoids, provided in the battery and starter circuits, are used to control high current drain functions remotely from the cabin.

## 7.17 VACUUM SYSTEM

The vacuum system is designed to operate the air driven gyro instruments. This includes the directional and attitude gyros when installed. The system consists of an engine vacuum pump, a vacuum regulator, a filter and the necessary plumbing.

The vacuum pump is a dry type pump which eliminates the need for an air/oil separator and its plumbing. A shear drive protects the engine from damage. If the drive shears the gyros will become inoperative.

**The vacuum gauge, mounted on the right instrument panel to the right of the radios, (refer to Figure 7-21) provides valuable information to the pilot about the operation of the vacuum system. A decrease in pressure in a system that has remained constant over an extended period, may indicate a dirty filter, dirty screens, possibly a sticking vacuum regulator or leak in system (a low vacuum indicator light is provided in the annunciator panel). Zero pressure would indicate a sheared pump drive, defective pump, possibly a defective gauge or collapsed line. In the event of any gauge variation from the norm, the pilot should have a mechanic check the system to prevent possible damage to the system components or eventual failure of the system.**

A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads 4.8 to 5.1 inches of mercury, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM. Higher settings will damage the gyros and with a low setting the gyros will be unreliable. The regulator is located behind the instrument panel.

## 7.19 PITOT-STATIC SYSTEM

The system supplies both pitot and static pressure for the airspeed indicator, altimeter and vertical speed indicator (when installed).

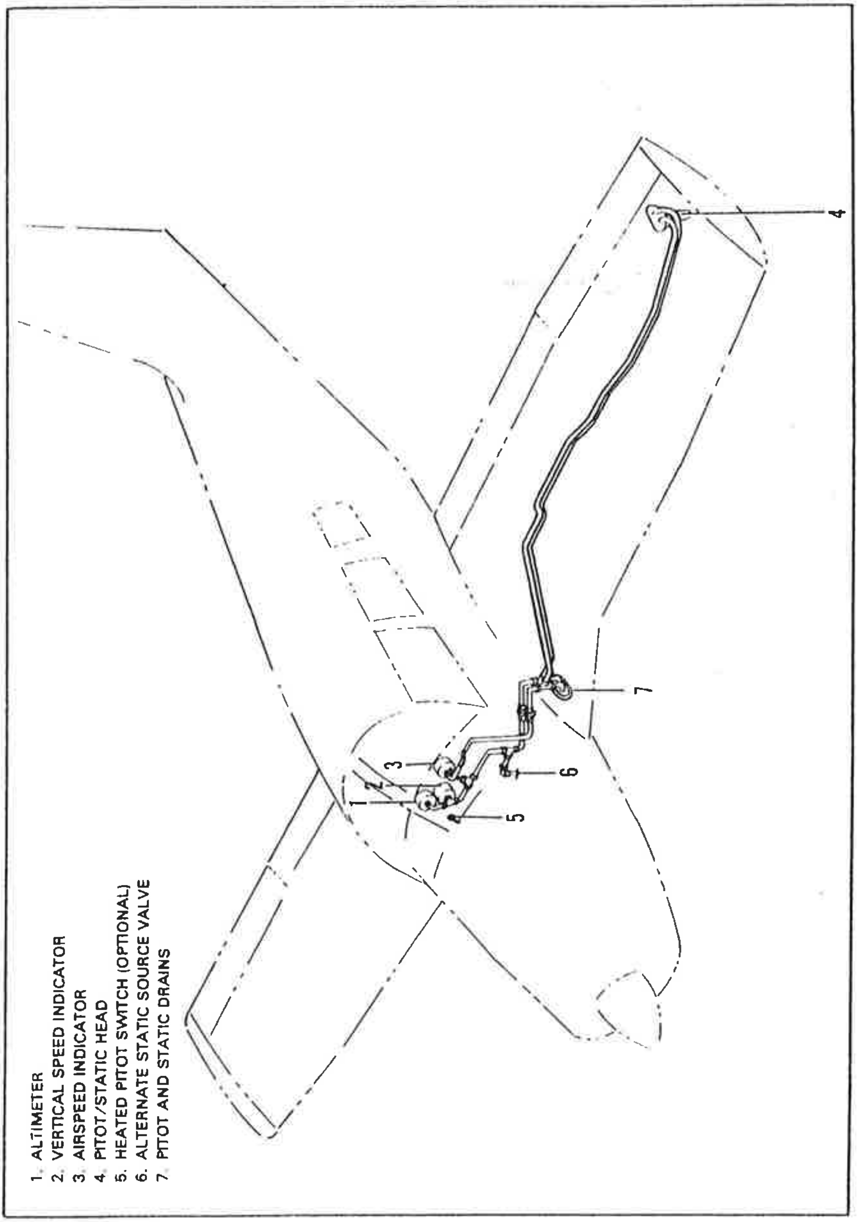
Pitot and static pressure is picked up by the pitot head on the bottom of the left wing. An optional heated pitot head, which alleviates problems with icing or heavy rain, is available. The switch for pitot heat is located on the switch panel. Push-button type pitot and static drains are located on the lower left sidewall of the cockpit.

An alternate static source is available as optional equipment. The control valve is located below the left side of the instrument panel. When the valve is set in the alternate position, the altimeter, vertical speed indicator and airspeed indicator will be using cabin air for static pressure. The storm window and cabin vents must be closed and the cabin heater and defroster must be on during alternate static source operation. The altimeter error is less than 50 feet unless otherwise placarded.

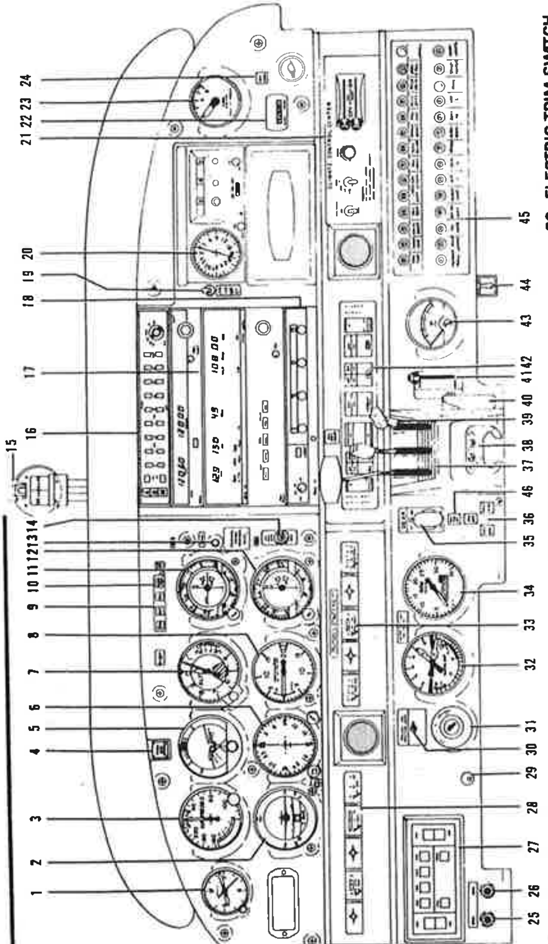
To prevent bugs and water from entering the pitot pressure holes when the airplane is parked, a cover should be placed over the pitot head. A partially or completely blocked pitot head will give erratic or zero readings on the instruments.

NOTE

During preflight, check to make sure the pitot cover is removed.




**PITOT-STATIC SYSTEM**
Figure 7-19



1. CLOCK
2. TURN COORDINATOR
3. AIRSPEED INDICATOR
4. WARNING - GEAR UNSAFE LIGHT
5. ATTITUDE GYRO
6. DIRECTIONAL GYRO
7. ALTIMETER
8. VERTICAL SPEED INDICATOR
9. ANNUNCIATOR DISPLAY
10. OVER BOOST LIGHT
11. OMNI AND GLIDE SLOPE INDICATOR
12. OMNI INDICATOR
13. PRIMER BUTTON
14. AIR CONDITIONER DOOR LIGHT
15. COMPASS
16. AUDIO CONTROL PANEL
17. COMMUNICATIONS TRANSCEIVER/RNAV
18. TRANSPONDER
19. RADIO MASTER SWITCH
20. ADF
21. CLIMATE CONTROL CENTER
22. HOUR METER
23. GYRO SUCTION GAUGE
24. GROUND CLEARANCE SWITCH
25. MIKE JACK
26. PHONE JACK
27. AUTOPILOT
28. CLUSTER GAUGES
29. NAV 1, NAV 2 SWITCH
30. ELECTRIC TRIM SWITCH
31. IGNITION SWITCH
32. MANIFOLD PRESSURE/ FUEL FLOW GAUGE
33. CLUSTER GAUGE
34. TACHOMETER
35. GEAR SELECTOR SWITCH
36. GEAR INDICATOR LIGHTS
37. CONTROL QUADRANT
38. MIKE ATTACHMENT
39. MIXTURE CONTROL LOCK
40. FRICTION LOCK
41. ALTERNATE AIR
42. CONTROL SWITCHES
43. EGT
44. EMERGENCY BUS SWITCH
45. CIRCUIT BREAKER PANEL
46. AUTO-EXT OFF LIGHT*

* AIRCRAFT EQUIPPED WITH BACKUP GEAR EXTENDER

**INSTRUMENT PANEL**
Figure 7-21

## 7.21 INSTRUMENT PANEL

The instrument panel is designed to accommodate the customary advanced flight instruments and the normally required power plant instruments. The artificial horizon and directional gyro are vacuum operated and are located in the center of the left hand instrument panel. The vacuum gauge is located on the right hand instrument panel. The turn indicator, on the left side, is electrically operated.

The radios are located in the center section of the panel, and the circuit breakers are in the lower right corner of the panel. An optional radio master switch is located near the top of the instrument panel between the radio stacks. It controls the power to all radios through the aircraft master switch. An emergency bus switch is also provided to provide auxiliary power to the avionics bus in event of a radio master switch circuit failure. The emergency bus switch is located behind the lower right shin guard left of the circuit breaker panel.

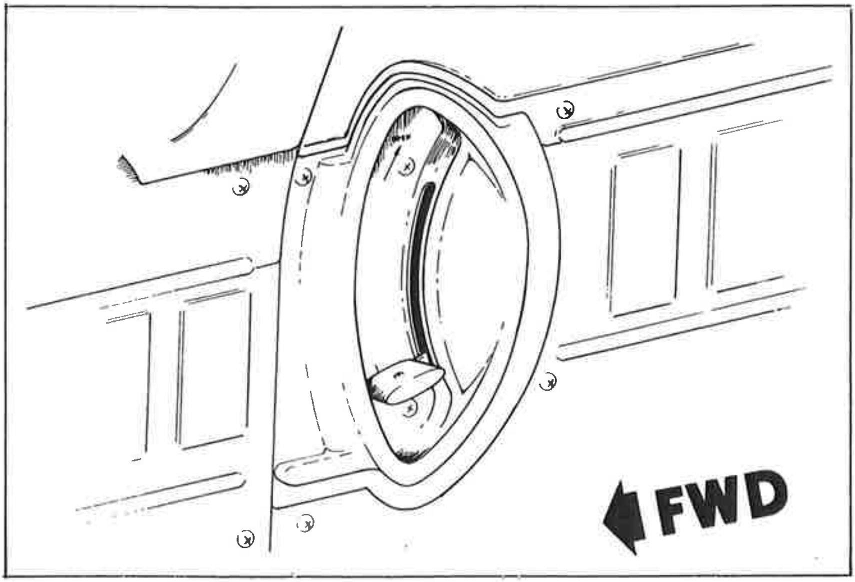
An annunciator panel is mounted in the upper instrument panel to warn the pilot of a possible malfunction in the alternator, oil pressure, and vacuum systems. The overboost light is located beside the annunciator panel.

A ground clearance energy saver system is available to provide direct power to Comm #1 without turning on the master switch. An internally lit pushbutton switch, located on the instrument panel, provides annunciation for engagement of the system. When the button is engaged direct aircraft battery power is applied to Comm #1 audio amplifier (speaker) and radio accessories. The switch must be turned OFF or depletion of the battery could result.

The manifold pressure line has a drain valve located behind and below the manifold pressure gauge. This allows any moisture which may have collected from condensation to be pulled into the engine. This is accomplished by depressing the valve for 5 seconds while operating the engine at 1000 RPM.

NOTE

Do not depress the valve when manifold pressure exceeds 25 inches Hg.




**CABIN DOOR LATCH**
Figure 7-23

## 7.23 CABIN FEATURES

All seat backs have three position: normal, intermediate and recline. The adjustment lever is located at the base of the seat back on the outboard side of the seat. The front seats adjust fore and aft for ease of entry and occupant comfort. An armrest is located on the side panels adjacent to the front seat. The rear seats are easily removed to provide room for bulky items. Rear seat installations incorporate leg retainers with latching mechanisms which must be released before the rear seats can be removed. Releasing the retainers is accomplished by depressing the plunger behind each rear leg. Optional headrests are available.

Shoulder harnesses with inertia reels are provided for each front seat occupant. On aircraft serial numbers 28R-7931001 through 28R-8431032, shoulder harnesses with inertia reels were provided as optional equipment for the occupants of the rear seats. On aircraft serial numbers 28R-8531001 and up, shoulder harnesses with inertia reels are provided as standard equipment for the occupants of the rear seats. A check of the inertia reel mechanism can be made by pulling sharply on the strap and checking that the reel will lock in place under sudden stress. This locking feature prevents the strap from extending and holds the occupant in place. Under normal movement, the strap will extend and retract as required. On earlier aircraft provided with a single strap adjustable shoulder harness located above the side window for each front seat, the shoulder strap is routed over the shoulder adjacent to the window and attached to the lap belt in the general area of the occupant's hip. Adjust this fixed strap so that all controls are accessible while maintaining adequate restraint for the occupant. Shoulder harnesses should be routinely worn during takeoff, landing, and whenever an inflight emergency situation occurs.

Additional features include pilot storm window, two sun visors, ash trays for each occupant, map pockets located on the side panels below the instrument panel, miscellaneous pockets on the rear of the front seat backs, armrests for the front occupants, cabin or baggage door locks and ignition lock.

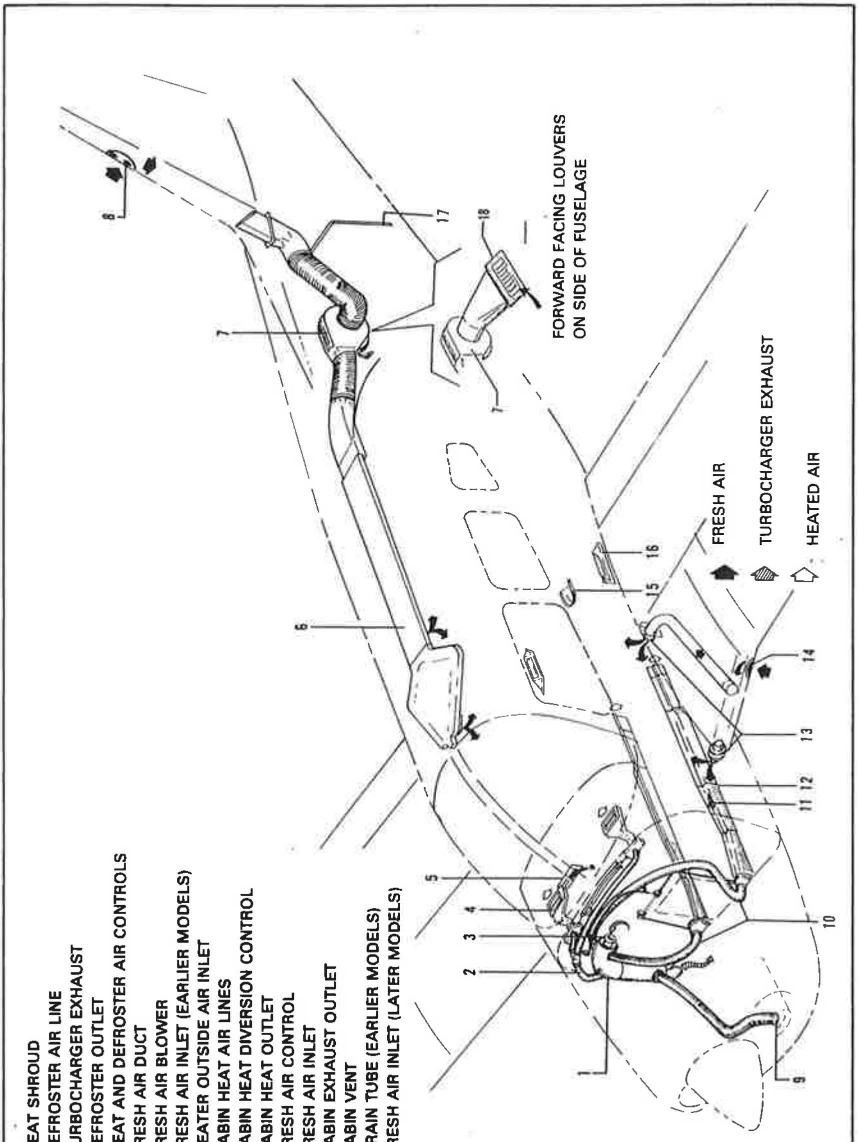
The cabin door is double latched. To close the cabin door, hold the door closed with the arm set while moving the side door latch to the "LATCHED" position. Then engage the top latch. Both latches must be secured before flight.

## 7.25 BAGGAGE AREA

A large baggage area, located behind the rear seats, is accessible either from the cabin or through a large outside baggage door on the right side of the aircraft. Maximum capacity is 200 lbs. Tie-down straps are provided and should be used at all times.

NOTE

It is the pilot's responsibility to be sure when the baggage is loaded that the aircraft C.G. falls within the allowable C.G. Range. (See Weight and Balance Section.)




**HEATING, VENTILATING AND DEFROSTING SYSTEM**
Figure 7-25

## 7.27 HEATING, VENTILATING AND DEFROSTING SYSTEM

The heating system is designed to provide maximum comfort for the occupants during winter and cool weather flights. The system includes a heat shroud, heat ducts, defroster outlets, heat and defroster controls.

*CAUTION*

When cabin heat is operated, heat duct surface becomes hot. This could result in burns if arms or legs are placed too close to heat duct outlets or surface.

An opening in the front of the lower cowl admits ram air to the heater shroud and then the air is ducted to the heater shut-offs on the right and left side of the fire wall. When the shut-off's are opened the heated air then enters the heat ducts located along each side of the center console. Outlets in the heat duct are located at each seat location. Airflow to the rear seats can be regulated by controls in the heat ducts located between the front seats. The temperature of the cabin is regulated by the heater control located on the right side of the instrument panel.

Defrosting is accomplished by heat outlets located on the right and left side of the cowl cover. Heated air is ducted directly to defroster shut-off valves at the fire wall, then to the defroster outlets. The airflow is regulated by a defroster control located below the heat control.

To aid air distribution, the cabin air is exhausted overboard by an outlet located on the bottom of the fuselage. Cabin exhaust outlets are located below and outboard of the rear seats. The above features are removed when air conditioning is installed.

An optional overhead ventilating system with outlets over each seat is also available. An additional option to aid in fresh air circulation on models without air conditioning is a cabin air blower to force air through the overhead vent system. This blower is operated by a fan switch with three positions - "OFF," "LOW," and "HIGH." The switch is located on the right side of the instrument panel with the heater and defroster controls.

## 7.29 STALL WARNING

An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall. Stall speeds are shown on graphs in the Performance Section. The stall warning horn emits a continuous sound. The landing gear warning horn is different in that it emits a 90 cycle per minute beeping sound. The stall warning horn is activated by a lift detector installed on the leading edge of the left wing. During preflight, the stall warning system should be checked by turning the master switch "ON," lifting the detector and checking to determine if the horn is actuated.

## 7.31 FINISH

All exterior surfaces are primed with etching primer and finished with acrylic lacquer. An optional polyurethane finish is available.

## 7.33 AIR CONDITIONING*

The air conditioning system is a recirculating air system. The major components include an evaporator, a condenser, a compressor, a blower, switches and temperature controls.

The evaporator is located behind the rear baggage compartment. This cools the air used for the air conditioning system.

The condenser is mounted on a retractable scoop located on the bottom of the fuselage and to the rear of the baggage compartment area. The scoop extends when the air conditioner is ON and retracts to a flush position when the system is OFF.

The compressor is mounted on the rear left side of the engine. It has an electric clutch which automatically engages or disengages the compressor to the belt drive system of the compressor.

*Optional equipment

Air from the baggage area is drawn through the evaporator by the blower and distributed through an overhead duct to individual outlets located adjacent to each occupant.

The switches and temperature control are located on the lower right side of the instrument panel in the climate control center panel. The temperature control regulates the temperature of the cabin. Turning the control clockwise increases cooling; counterclockwise decreases cooling.

The fan speed switch and the air conditioning ON-OFF switch are inboard of the temperature control. The fan can be operated independently of the air conditioning; however, the fan must be on for air conditioner operation. Turning either switch off will disengage the compressor clutch and retract the condenser door. Cooling air should be felt within one minute after the air conditioner is turned on.

NOTE

If the system is not operating in 5 minutes, turn the system OFF until the fault is corrected.

The fan switch allows operation of the fan with the air conditioner turned OFF to aid in cabin air circulation. "LOW" or "HIGH" can be selected to direct a flow of air through the air conditioner outlets in the overhead duct. These outlets can be adjusted or turned off individually.

The condenser door light is located to the right of the engine instrument cluster in front of the pilot. The door light illuminates when the door is open and is off when the door is closed.

A circuit breaker on the circuit breaker panel protects the air conditioning electrical system.

Whenever 38 inches Hg or more manifold pressure is used a manifold pressure switch disengages the compressor and retracts the scoop. This allows maximum power and maximum rate of climb. The fan continues to operate and the air will remain cool for about one minute. When the throttle is retarded so that less then 38 inches Hg manifold pressure is used, the clutch will engage, the scoop will extend, and the system will again supply cool, dry air.

## 7.35 PIPER EXTERNAL POWER*

An optional starting installation known as Piper External Power (PEP) is accessible through a receptacle located on the right side of the fuselage aft of the wing. An external battery can be connected to the socket, thus allowing the operator to crank the engine without having to gain access to the airplane's battery.

## 7.37 EMERGENCY LOCATOR TRANSMITTER*

The Emergency Locator Transmitter (ELT) meets the requirements of FAR 91.52. It operates on self-contained batteries and is located in the aft fuselage section. It is accessible through a rectangular cover on the right hand side. A number 2 Phillips screwdriver is required to remove the cover.

A battery replacement date is marked on the transmitter. To comply with FAA regulations, the battery must be replaced on or before this date. The battery must also be replaced if the transmitter has been used in an emergency situation or if the accumulated test time exceeds one hour, or if the unit has been inadvertently activated for an undetermined time period.

NOTE

If for any reason a test transmission is necessary, the test transmission should be conducted only in the first five minutes of any hour and limited to three audio sweeps. If tests must be made at any other time, the tests should be coordinated with the nearest FAA tower or flight service station.

### NARCO ELT 10 OPERATION

On the ELT unit itself is a three position switch placarded "ON," "OFF" and "ARM." The ARM position sets the ELT so that it will transmit after impact and will continue to transmit until its battery is drained. The ARM position is selected when the ELT is installed in the airplane and it should remain in that position.

*Optional equipment

To use the ELT as a portable unit in an emergency, remove the cover and unlatch the unit from its mounting base. The antenna cable is disconnected by a left quarter-turn of the knurled nut and a pull. A sharp tug on the two small wires will break them loose. Deploy the self-contained antenna by pulling the plastic tab marked "PULL FULLY TO EXTEND ANTENNA." Move the switch to ON to activate the transmitter.

In the event the transmitter is activated by an impact, it can only be turned off by moving the switch on the ELT unit to OFF. Normal operation can then be restored by pressing the small clear plastic reset button located on the top of the front face of the ELT and then moving the switch to ARM.

A pilot's remote switch located on the left side panel is provided to allow the transmitter to be turned on from inside the cabin. The pilot's remote switch is placarded "ON" and "ARMED." The switch is normally in the ARMED position. Moving the switch to ON will activate the transmitter. Moving the switch back to the ARMED position will turn off the transmitter only if the impact switch has not been activated.

The ELT should be checked to make certain the unit has not been activated during the ground check. Check by selecting 121.50 MHz on an operating receiver. If there is an oscillating chirping sound, the ELT may have been activated and should be turned off immediately. This requires removal of the access cover and moving the switch to OFF, then press the reset button and return the switch to ARM. Recheck with the receiver to ascertain the transmitter is silent.

CCC CIR 11-2 OPERATION

On the unit itself is a three position selector switch placarded "OFF," "ARM" and "ON." The ARM position is provided to set the unit to the automatic position so that it will transmit only after impact and will continue to transmit until the battery is drained to depletion or until the switch is manually moved to the OFF position. The ARM position is selected when the transmitter is installed at the factory and the switch should remain in that position whenever the unit is installed in the airplane. The ON position is provided so the unit can be used as a portable transmitter or in the event the automatic feature was not triggered by impact or to periodically test the function of the transmitter.

Select the OFF position when changing the battery, when rearming the unit if it has been activated for any reason, or to discontinue transmission.

NOTE

If the switch has been placed in the ON position for any reason, the OFF position has to be selected before selecting ARM. If ARM is selected directly from the ON position, the unit will continue to transmit in the ARM position.

A pilot's remote switch, located on the left side panel, is provided to allow the transmitter to be controlled from inside the cabin. The pilot's remote switch is placarded "ON," "AUTO/ARM" and "OFF/RESET." The switch is normally left in the AUTO/ARM position. To turn the transmitter off, move the switch momentarily to the OFF/RESET position. The aircraft master switch must be ON to turn the transmitter OFF. To actuate the transmitter for tests or other reasons, move the switch upward to the ON position and leave it in that position as long as transmission is desired.

The unit is equipped with a portable antenna to allow the locator to be removed from the aircraft in case of an emergency and used as a portable signal transmitter.

The locator should be checked during the ground check to make certain the unit has not been accidentally activated. Check by tuning a radio receiver to 121.50 MHz. If there is an oscillating sound, the locator may have been activated and should be turned off immediately. Reset to the ARM position and check again to insure against outside interference.