ARROW IV

PILOT'S OPERATING HANDBOOK

AND

FAA APPROVED AIRPLANE FLIGHT MANUAL

AIRPLANE SERIAL NO. 28R-7918161

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FAA APPROVED IN NORMAL CATEGORY BASED ON CAR 3. THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR 3 AND CONSTITUTES THE APPROVED AIRPLANE FLIGHT MANUAL AND MUST BE CARRIED IN THE AIRPLANE AT ALL TIMES.

PIPER

HANDBOOK PART NO. 761 600

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THIS BOOK I

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GENERAL

SECTION 1

GENERAL

1.1 INTRODUCTION

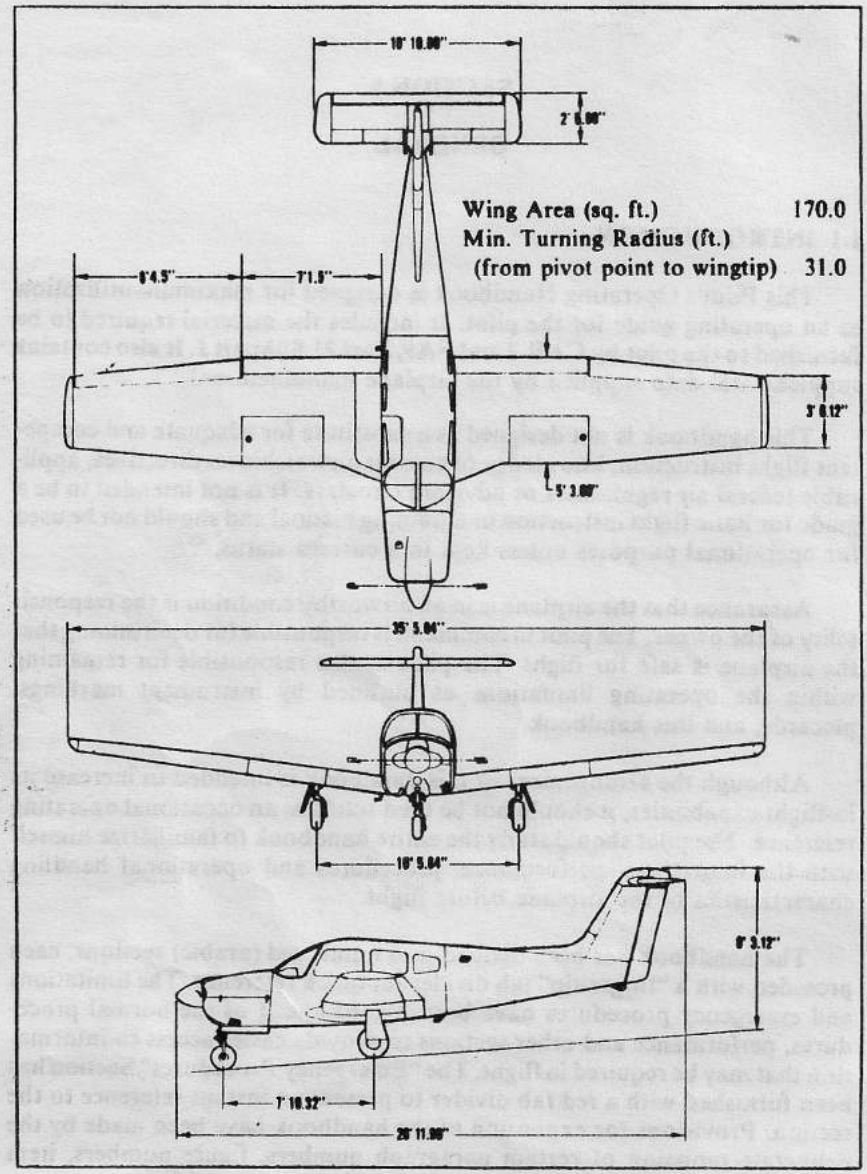
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by CAR 3 and FAR Part 21 Subpart J. It also contains supplemental data supplied by the airplane manufacturer.

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	Lycoming
(c) Engine Model Number	IO-360-C1C6
(d) Rated Horsepower	200
(e) Rated Speed (rpm)	2700
(f) Bore (in.)	5.125
(g) Stroke (in.)	4.375
(h) Displacement (cu. in.)	361
(i) Compression Ratio	8.5:1
(j) Engine Type	Four Cylinder, Direct Drive, Horizontally Opposed, Air Cooled and Fuel Injected

1.5 PROPELLERS

McCAULEY

(a) Number of Propellers	1
(b) Propeller Manufacturer	McCauley
(c) Blade Model	90DHA-16
(d) Number of Blades	2
(e) Hub Model	B2D34C213
(f) Propeller Diameter (in.)	
(1) Maximum	74
(2) Minimum	73
(g) Propeller Type	Constant Speed, Hydraulically Actuated

HARTZELL

(a) Number of Propellers	1
(b) Propeller Manufacturer	Hartzell
(c) Blade Model	F7666A-2R
(d) Number of Blades	2
(e) Hub Model	HC-C2YK-1( )F
(f) Propeller Diameter (in.)	
(1) Maximum	74
(2) Minimum	72
(g) Propeller Type	Constant Speed, Hydraulically Actuated

1.7 FUEL

TABS (25 EACH)

(a) Fuel Capacity (U.S. gal.) (total)	50
(b) Usable Fuel (U.S. gal.) (total)	77
(c) Fuel Grade, Aviation	72
(1) Minimum Octane	100/130 - Green
(2) Specified Octane	100 - Green, 100 LL - Blue or 100/130 - Green
(3) Alternate Fuels	Refer to latest revision of Lycoming Service Instruction 1070

1.9 OIL

(a) Oil Capacity (U.S. qts.)	8
(b) Oil Specification	Refer to latest issue of Lycoming Service Instruction 1014
(c) Oil Viscosity	Refer to Section 8 - paragraph 8.19

1.11 MAXIMUM WEIGHTS

(a) Maximum Takeoff Weight (lbs.)	2750
(b) Maximum Landing Weight (lbs.)	2750
(c) Maximum Weights in Baggage Compartment	200

1.13 STANDARD AIRPLANE WEIGHTS*

(a) Standard Empty Weight (lbs.): Weight of a standard airplane including unusable fuel, full operating fluids and full oil.	1627
(b) Maximum Useful Load (lbs.): The difference between the Maximum Takeoff Weight and the Standard Empty Weight.	1123

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.)	16.18
(b) Power Loading (lbs. per hp)	13.75

*These values are approximate and vary from one aircraft to another. Refer to Figure 6-5 for the Standard Empty Weight value and the Useful Load value to be used for C.G. calculations for the aircraft specified.

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LIMITATIONS

SECTION 2

LIMITATIONS

2.1 GENERAL

This section provides the "FAA Approved" operating limitations, instrument markings, color coding and basic placards necessary for the safe 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.	190	186
Maximum Structural Cruising Speed (VNO) - Do not exceed this speed except in smooth air and then only with caution.	149	148
Design Maneuvering Speed (VA) - Do not make full or abrupt control movements above this speed.		
At 2750 lbs. G.W.	121	121
At 1863 lbs. G.W.	96	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.	130	130
Maximum Landing Gear Retraction Speed - Do not exceed this speed when retracting the landing gear.	109	109
Maximum Landing Gear Extended Speed (VLE) - Do not exceed this speed with the landing gear extended.	130	130

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	IAS
Red Radial Line (Never Exceed)	190 KTS
Yellow Arc (Caution Range - Smooth Air Only)	149 KTS to 190 KTS
Green Arc (Normal Operating Range)	58 KTS to 149 KTS
White Arc (Flap Down)	53 KTS to 108 KTS

2.7 POWER PLANT LIMITATIONS

(a) Number of Engines	1
(b) Engine Manufacturer	Lycoming
(c) Engine Model No.	IO-360-C1C6
(d) Engine Operating Limits	
(1) Maximum Horsepower	200
(2) Maximum Rotation Speed (RPM)	2700
(3) Maximum Oil Temperature	245°F
(e) Oil Pressure	
Minimum (red line)	25 PSI
Maximum (red line)	100 PSI
(f) Fuel Pressure	
Minimum (red line)	14 PSI
Maximum (red line)	45 PSI
(g) Fuel Grade (minimum octane)	100/130 - Green
(h) Number of Propellers	1
(i) Propeller Manufacturer	McCauley or Hartzell
(j) Propeller Hub and Blade Model	
(1) McCauley	B2D34C213/90DHA-16
(2) Hartzell	HC-C2YK-1( )F F7666A-2R
(k) Propeller Diameter	
(1) McCauley	
Minimum	73
Maximum	74
(2) Hartzell	
Minimum	72
Maximum	74
(l) Blade Angle Limits	
(1) McCauley	
Low Pitch Stop	12.5 ± 0.2°
High Pitch Stop	27.5 ± 0.5°
(2) Hartzell	
Low Pitch Stop	14.0 ± 0.2°
High Pitch Stop	29.0 ± 2.0°

(m) RPM Restrictions (McCauley Propeller Only)	Avoid Continuous Operation Between 1500 and 1950 RPM Below 15 Inches Map.

2.9 POWER PLANT INSTRUMENT MARKINGS

(a) Tachometer	
Green Arc (Normal Operating Range)	500 to 2700 RPM
Red Line (Maximum Continuous Power)	2700 RPM
(b) Oil Temperature	
Green Arc (Normal Operating Range)	75° to 245°F
Red Line (Maximum)	245°F
(c) Oil Pressure	
Green Arc (Normal Operating Range)	60 PSI to 90 PSI
Yellow Arc (Caution Range) (Idle)	25 PSI to 60 PSI
Red Line (Minimum)	25 PSI
Red Line (Maximum)	100 PSI
(d) Fuel Pressure	
Green Arc (Normal Operating Range)	14 PSI to 45 PSI
Red Line (Minimum)	14 PSI
Red Line (Maximum)	45 PSI

2.11 WEIGHT LIMITS

(a) Maximum Weight	2750 LBS.
(b) 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
2750	90.0	93.0
2400	85.5	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 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 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 NOISE LEVEL

The noise level of this aircraft is 75.5 d B(A).

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.

2.25 PLACARDS

In full view of the piiot:

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

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 and Landing Check Lists will be installed:

TAKEOFF CHECK LIST

Fuel on Proper Tank
Electric Fuel Pump - On
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
Electric Fuel Pump - On
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 121 KIAS
AT 2750 LBS. (SEE A.F.M.)

On the instrument panel in full view of the pilot:

DEMONSTRATED CROSSWIND COMPONENT 17 KTS

On the instrument panel in full view of the pilot:

NO ACROBATIC MANEUVERS,
INCLUDING SPINS, APPROVED

On the instrument panel in full view of the pilot:

GEAR DOWN	130 KIAS (MAX.)
GEAR UP	109 KIAS (MAX.)
EXTENDED	130 KIAS (MAX.)

Near emergency gear lever:

EMERGENCY DOWN

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	109 KIAS MAX.
DOWN	130 KIAS MAX.

Adjacent to upper door latch:

ENGAGE LATCH BEFORE FLIGHT

On the instrument panel 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.

Adjacent to fuel tank filler caps:

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

USABLE CAPACITY TO BOTTOM OF FILLER NECK INDICATOR 25 GAL.

Above fuel quantity gauges:

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 McCauley propeller installations only:

AVOID CONTINUOUS OPERATION BETWEEN 1500 AND 1950 RPM BELOW 15" MANIFOLD PRESSURE.

On the aft baggage closeout:

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

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EMERGENCY PROCEDURES

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 the safe 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 by 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 the best course of action for coping with the particular condition described, but are not a substitute for sound judgment and common sense. Since emergencies rarely happen in modern aircraft, their occurrence is usually unexpected and the best corrective action may not always be obvious. 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
Electric fuel pump ..... 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 ..... 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
Electric fuel pump ..... check ON
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
Electric fuel pump ..... ON
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
Electric fuel pump ..... OFF
If power is not restored prepare for power off landing.
Trim for 79 KIAS.

POWER OFF LANDING

Trim for 79 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 72 KIAS for shortest landing.

GEAR DOWN EMERGENCY LANDING

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

When committed to landing:
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:
Lock emergency gear lever in "Override Engaged" position before airspeed drops to 105 KIAS to prevent landing gear from inadvertently free falling.
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.

HIGH OIL TEMPERATURE

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

ALTERNATOR FAILURE

Verify failure.
Reduce electrical load as much as possible.
Alternator circuit breakers ..... check
Alt switch ..... OFF (for 1 second), then on
If no output:
Alt switch ..... OFF

Reduce electrical load and land as soon as practical.

If battery is fully discharged, the gear will have to be lowered using the emergency gear extension procedure. Position lights will not illuminate.

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 2700 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 87 KIAS
Landing gear selector switch ..... gear DOWN position
If gear has failed to lock down, 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 ..... "Override Engage" position
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

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 and 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 electric fuel pump to ON. Check that the mixture is RICH. The alternate air should be OPEN. Use the emergency gear lever as required.

The landing gear will extend automatically when engine power fails at speeds below approximately 95 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 lever in the OVER-RIDE 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 79 KIAS should be maintained.

If altitude permits, switch the fuel selector to another tank containing fuel and turn the electric fuel pump to ON. 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 electric fuel pump.

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

If time permits, turn the ignition switch to "L" then to "R" then back to "BOTH." 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, trim the aircraft for best gliding angle (79 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 72 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.

Don't forget that at airspeeds below approximately 95 KIAS the gear will free fall, 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 105 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, 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.

Always remember that the automatic gear mechanism will extend the gear below approximately 95 KIAS with power off. Be prepared to lock the emergency gear lever in the OVERRIDE ENGAGED position before the airspeed drops to 105 KIAS to prevent the landing gear from inadvertently free falling, unless gear extension is desired.

NOTE

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

(b) Gear Up Emergency Landing

In the event a gear up landing is required lock the emergency gear lever in OVERRIDE ENGAGED position before the airspeed drops to 105 KIAS to 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.

Don't forget that at airspeeds below approximately 95 KIAS the gear will free fall, 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 105 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, 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.

Always remember that the automatic gear mechanism will extend the gear below approximately 95 KIAS with power off. Be prepared to lock the emergency gear lever in the OVERRIDE ENGAGED position before the airspeed drops to 105 KIAS to prevent the landing gear from inadvertently free falling, unless gear extension is desired.

NOTE

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

(b) Gear Up Emergency Landing

In the event a gear up landing is required lock the emergency gear lever in OVERRIDE ENGAGED position before the airspeed drops to 105 KIAS to 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 electric 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 and turn ON the electric fuel pump.

If the problem is not an empty tank, land as soon as practical and have the engine driven fuel pump and fuel system checked.

3.21 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.

3.23 ALTERNATOR FAILURE

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 breaker for a popped circuit breaker.

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 O 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 and can be depleted rapidly.

3.25 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 2700 RPM.

3.27 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.

If the landing gear does not check down and locked, reduce the airspeed below 87 KIAS. Move the landing gear selector switch to the DOWN position. If the gear has failed to lock down, 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 ENGAGED position. 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.

3.29 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.

3.31 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.

3.33 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 and then turn "ON" the electric fuel pump.

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.

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SECTION 4

NORMAL PROCEDURES

SECTION 4

NORMAL PROCEDURES

4.1 GENERAL

This section clearly describes the recommended procedures for the conduct of normal operations for the Arrow IV. All of the required (FAA regulations) procedures and those necessary for the safe 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 by 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.

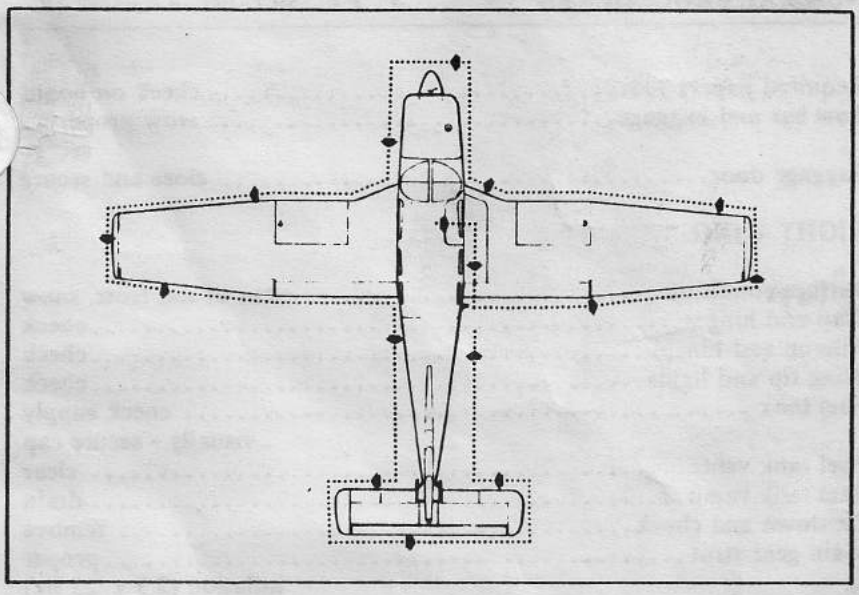
The remainder of the section is devoted to amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an in-flight reference due to the lengthly explanations. The short form check list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

4.3 AIRSPEEDS FOR SAFE OPERATIONS

The following airspeeds are those which are significant to the safe 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	87 KIAS
gear down, flaps up	76 KIAS
(b) Best Angle of Climb Speed	
gear up, flaps up	77 KIAS
gear down, flaps up	70 KIAS
(c) Turbulent Air Operating Speed (See Subsection 2.3)	121 KIAS
(d) Maximum Flap Speed	108 KIAS
(e) Landing Final Approach Speed (Flaps 40°)	74 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
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
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
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 - check inertia reel

BEFORE STARTING ENGINE

Brakes ..... set
Propeller ..... full INCREASE rpm
Fuel selector ..... desired tank
Alternate air ..... OFF

STARTING ENGINE WHEN COLD

Throttle	1/2" open
Master switch	ON
Electric fuel pump	ON
Mixture	prime - then idle cut-off
Starter	engage
Mixture	full RICH
Throttle	adjust
Oil pressure	check

STARTING ENGINE WHEN HOT

Throttle	1/2" open
Master switch	ON
Electric fuel pump	ON
Mixture	idle cut-off
Starter	engage
Mixture	advance
Throttle	adjust
Oil pressure	check

STARTING ENGINE WHEN FLOODED

Throttle	open full
Master switch	ON
Electric fuel pump	OFF
Mixture	idle cut-off
Starter	engage
Mixture	advance
Throttle	retard
Oil pressure	check

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 ..... 1400 to 1500 RPM

TAXIING

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

GROUND CHECK

Propeller ..... full INCREASE
Throttle ..... 2000 RPM
Magnetos ..... max. drop 175 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 throttle can be opened without engine faltering.
Electric fuel pump ..... OFF
Fuel pressure ..... check
Throttle ..... retard

BEFORE TAKEOFF

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

TAKEOFF

NORMAL

Flaps..... set
Tab ..... set
Accelerate to 65 to 75 KIAS.
Control wheel ..... back pressure to rotate to climb attitude

SHORT FIELD, OBSTACLE CLEARANCE

Flaps ..... 25° (second notch)
Accelerate to 50 to 60 KIAS depending on aircraft weight.
Control wheel ..... back pressure to rotate to climb attitude
After breaking ground, accelerate to 55 to 65 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 - 77 KIAS, slowly retract the flaps and climb past the obstacle.
Accelerate to best flaps up rate of climb speed - 87 KIAS.

SOFT FIELD

Flaps ..... 25° (second notch)
Accelerate to 50 to 60 KIAS depending on aircraft weight.
Control wheel ..... back pressure to rotate to climb attitude
After breaking ground, accelerate to 55 to 65 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 87 KIAS.
Flaps ..... retract slowly

CLIMB

Best rate (2750 lb.) (gear up)
(flaps up) ..... 87 KIAS
Best rate (2750 lb.) (gear down)
(flaps up) ..... 76 KIAS
Best angle (2750 lb.) (gear up)
(flaps up) ..... 77 KIAS
Best angle (2750 lb.) (gear down) (flaps up) ..... 70 KIAS
En route ..... 104 KIAS
Electric fuel pump ..... OFF at desired altitude

CRUISING

Reference performance charts, Avco-Lycoming Operator's Manual and power setting table.

Normal max power	75%
Power	set per power table
Mixture	adjust

APPROACH AND LANDING

Fuel selector	proper tank
Seat backs	erect
Belts/harness	fasten
Electric fuel pump	ON
Mixture	set
Propeller	set
Gear	down - 130 KIAS max
Flaps	set - 108 KIAS max
Air conditioner	OFF

Trim to 75 KIAS

STOPPING ENGINE

Flaps	retract
Electric fuel pump	OFF
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 belt
Flaps	full
Wheel chocks	in place
Tie downs	secure

Open the fuel cap and visually check the fuel color and 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.

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 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.

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 color. 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. Drain enough fuel 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.

4.11 BEFORE STARTING ENGINE

Before starting the engine the brakes should be set ON 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

(a) Starting Engine When Cold

Open the throttle lever approximately 1/2 inch. Turn ON the master switch and the electric fuel pump. Move the mixture control to full RICH until an indication is noted on the fuel flow meter. The engine is now primed.

Move the mixture control to idle cut-off and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch, advance the mixture control to full RICH and move the throttle to the desired setting.

If the engine does not fire within five to ten seconds, disengage the starter and reprime.

(b) Starting Engine When Hot

Open the throttle approximately 1/2 inch. Turn ON the master switch and the electric fuel pump. Move the mixture control lever to idle cut-off and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch, advance the mixture and move the throttle to the desired setting.

(c) Starting Engine When Flooded

The throttle lever should be full OPEN. Turn ON the master switch and turn OFF the emergency fuel pump. Move the mixture control lever to idle cut-off and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch, advance the mixture and retard the throttle.

(d) Starting Engine 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.

When the engine is firing evenly, advance the throttle to 800 RPM. If oil pressure is not indicated within thirty seconds, stop the engine and determine

the trouble. In cold weather it will take a few seconds longer to get an oil pressure indication. If the engine has failed to start, refer to the Lycoming Operating Handbook, Engine Troubles and Their Remedies.

Starter manufactures recommend that cranking periods be limited to thirty seconds with a two minute rest between cranking periods. Longer cranking periods will shorten the life of the starter.

4.15 WARM-UP

Warm-up the engine at 1400 to 1500 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 throttle may be opened 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.

4.17 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.

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.

4.19 GROUND CHECK

The magnetos should be checked at 2000 RPM with the propeller set at high RPM. Drop off on either magneto should not exceed 175 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 500 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.

The electric fuel pump should be turned "OFF" after starting or during warm-up to make sure that the engine driven pump is operating. Prior to takeoff the electric pump should be turned ON again to prevent loss of power during takeoff should the engine driven pump fail. Check both oil temperature and oil pressure. The temperature may be low for some time if the engine is being run for the first time of the day. The engine is warm enough for takeoff when the throttle can be opened without the engine faltering.

4.21 BEFORE TAKEOFF

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

After takeoff, if the gear selector switch is placed in the gear up position before reaching the airspeed at which the back up gear extender 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 "OVER-

*Approximately 75 KIAS at sea level to approximately 88 KIAS at 10,000 ft. with a straight line variation between.

RIDE 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.

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). Turn "ON" the electric fuel pump. Check the engine gauges. The alternate air should be in the "CLOSED" position.

All seat backs should be erect.

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.

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

4.23 TAKEOFF

The normal takeoff technique is conventional for the 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 65 to 75 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 50 to 60 KIAS depending on the aircraft weight and rotate the aircraft to climb attitude. After breaking ground, accelerate to 55 to 65 KIAS, depending on aircraft weight and select gear up*. Continue to climb while accelerating to the flaps-up rate of climb speed, 87 KIAS if no obstacle is present or 77 KIAS if obstacle clearance is a consideration. Slowly retract the flaps while climbing out.

4.25 CLIMB

On climb-out after takeoff, it is recommended that the best angle of climb speed (77 KIAS) be maintained only if obstacle clearance is a consideration. The best rate of climb speed (87 KIAS) should be maintained with full power on the engines until adequate terrain clearance is obtained. At lighter than gross weight these speeds are reduced somewhat**. An en route climb speed of 104 KIAS or higher is also recommended. This increased climb speed provides better engine cooling, less engine wear, reduced fuel consumption, lower cabin noise level, and better forward visibility.

When reaching the desired altitude, the electric fuel pump may be turned OFF.

NOTE

For climbs at best angle of climb speed at any altitude and best rate of climb speed above approximately 9000 ft. 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.

*If desired, the override up 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.

**To obtain the performance presented in the Performance Section of this handbook, full power (full throttle and 2700 RPM) must be used.

4.27 CRUISING

The cruising speed of the Arrow IV is determined by many factors, including power setting, altitude, temperature, loading and equipment installed in the airplane.

The normal maximum cruising power is 75% of the rated horsepower of the engine. When selecting cruising RPM below 2400, limiting manifold pressure for continuous operation, as specified by the appropriate "Avco-Lycoming Operator's Manual," should be observed.

To obtain the desired power, set the manifold pressure and RPM according to the power setting table in this manual.

Use of the mixture control in cruising flight reduces fuel consumption significantly, especially at higher altitudes. The mixture should be leaned during cruising operation when 75% power or less is being used. If any doubt exists as to the amount of power being used, the mixture should be in the full "RICH" position for all operations.

To lean the mixture, disengage the lock and pull the mixture control until the engine becomes rough, indicating that the lean mixture limit has been reached in the leaner cylinders. Then enrich the mixture by pushing the control towards the instrument panel until engine operation becomes smooth. The fuel flow meter will give a close approximation of the fuel being consumed. The low side of the power setting, as shown on the fuel flow meter, indicates best economy for that percent of power while the high side indicates best power.

If the airplane is equipped with the optional exhaust gas temperature (EGT) gauge, a more accurate means of leaning is available to the pilot. For this procedure, refer to the "Avco-Lycoming Operator's Manual."

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.

Always remember that the electric fuel pump should be turned "ON" before switching tanks, and should be left on for a short period thereafter. To preclude making a hasty selection, and to provide continuity of flow, the selector should be changed to another tank before fuel is exhausted from the tank in use. The electric fuel pump should be normally "OFF" so that any malfunction of the engine driven fuel pump is immediately apparent. If signs of fuel starvation should occur at any time during flight, fuel exhaustion should be suspected, at which time the fuel selector should be immediately positioned to a full tank and the electric fuel pump switched to the "ON" position.

4.29 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.

Turn "ON" the electric fuel pump. 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 130 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. Turn "OFF" the air conditioner.

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, and the electric fuel pump "ON." 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.

4.31 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 electric fuel pump, 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."

4.33 PARKING

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.

4.35 STALLS

The stall characteristics of the 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 Arrow IV with power off and full flaps is 53 KIAS. With the flaps up this speed is increased 6 KTS. Loss of altitude during stalls can be as great as 400 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.

4.37 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.

4.39 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.

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 back-up extender 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.

*Approximately 95 KIAS at any altitude, power off.

WARNING

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

On aircraft equipped with the backup bear 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.

3.6
7.6

When the Emergency Landing Gear Extension Procedure (Paragraph 3.27) is performed for training purposes, the following changes must be made to the procedure 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 to allow normal gear system operation.

4.41 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

SECTION 5

PERFORMANCE

5.1 GENERAL

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

Performance information associated with those optional systems and equipment which require handbook supplements is provided by 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.

5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

The first step in planning our 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 delivered from 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 we have found the following weights for consideration in our 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	1890 lbs.
(2)	Occupants (2 x 170 lbs.)	340 lbs.
(3)	Baggage and Cargo	70 lbs.
(4)	Fuel (6 lb./gal. x 50)	300 lbs.
(5)	Takeoff Weight	2600 lbs.
(6)	Landing Weight (a)(5) minus (g)(1), (2600 lbs. minus 62 lbs.)	2538 lbs.

Our takeoff weight is below the maximum of 2750 lbs., and our weight and balance calculations have determined our C.G. position within the approved limits.

(b) Takeoff and Landing

Now that we have determined our aircraft loading, we must consider all aspects of our takeoff and landing.

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

	Departure Airport	Destination Airport
(1) Pressure Altitude	1900 ft.	1900 ft.
(2) Temperature	20°C	20°C
(3) Wind Component (Headwind)	4 KTS	2 KTS
(4) Runway Length Available	3000 ft.	4600 ft.
(5) Runway Required	2250 ft.*	1490 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 our 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 our flight planning example.

(1) Cruise Pressure Altitude	6000 ft.
(2) Cruise OAT	3°C
(3) Time to Climb (9.2 min. minus 2.8 min.)	6.4 min.*
(4) Distance to Climb (15 naut. miles minus 4 naut. miles)	11 naut. miles*
(5) Fuel to Climb (2 gal. minus 0.5 gal.)	1.5 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 we 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 our example are shown below.

(1) Time to Descend
(6 min. minus 2 min.) — 4 min.*

(2) Distance to Descend
(15.7 naut. miles minus
4.8 naut. miles) — 10.9 naut. miles*

(3) Fuel to Descend
(1.5 gal. minus 0.5 gal.) — 1.0 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 5-21 or 5-23).

Calculate the cruise fuel flow for the cruise power setting (65% Power Best Economy for this example) from the information provided by the Best Economy Range 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 our flight planning example are as follows:

(1) Total Distance — 130 naut. miles

(2) Cruise Distance
(e)(1) minus (c)(4) minus (d)(2),
(130 naut. miles minus 11 naut.
miles minus 10.9 naut. miles) — 108.1 naut. miles

*reference Figure 5-31

(3) Cruise Power (Best Economy)	65% rated power
(4) Cruise Speed	126 KTS TAS*
(5) Cruise Fuel Consumption	9.2 GPH*
(6) Cruise Time	
(e)(2) divided by (e)(4), (108 naut. miles divided by 126 KTS)	.86 hrs. (52 min.)
(7) Cruise Fuel	
(e)(5) multiplied by (e)(6), (9.2 GPH mulitiplied by .86 hrs.)	7.9 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 our flight planning example.

(1) Total Flight Time	
(c)(3) plus (d)(1) plus (e)(6),	
(.11 hrs. plus .07 hrs. plus .86 hrs.)	
(6.4 min. plus 4 min. plus 52 min.)	1.04 hrs. 62.4 min.

(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.

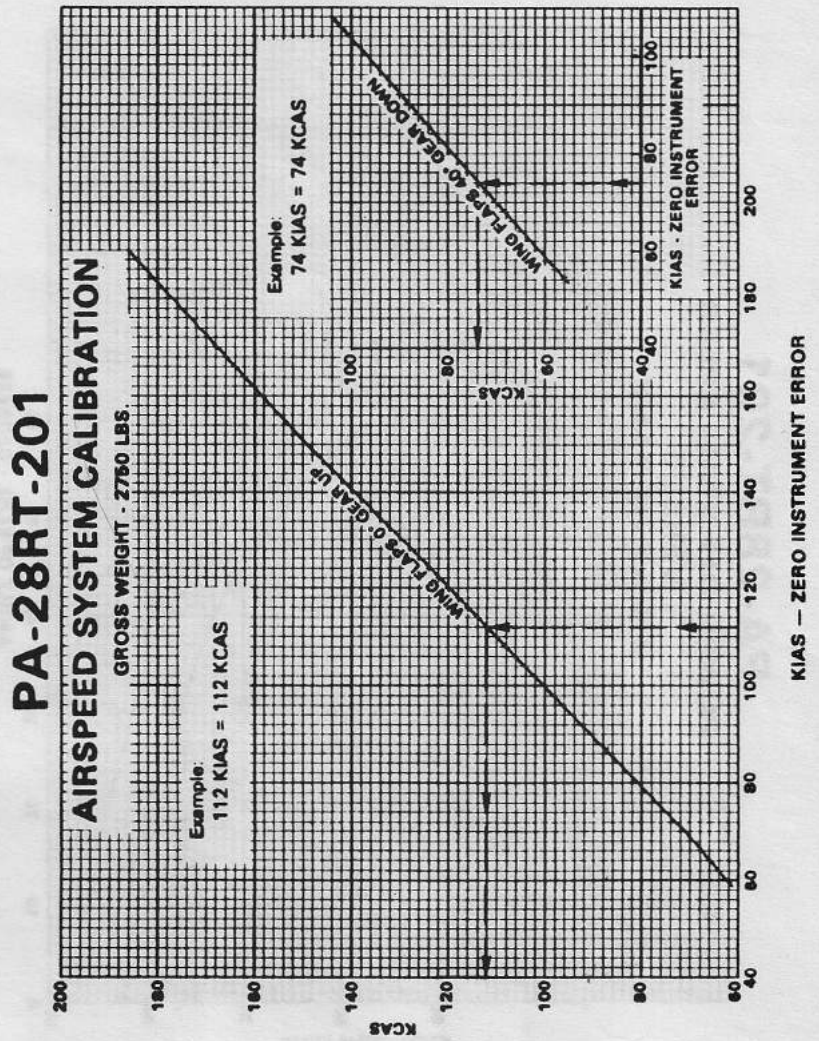
The total fuel calculations for our example flight plan are shown below.

(1) Total Fuel Required	
(c)(5) plus (d)(3) plus (e)(7),	
(1.5 gal. plus 1.0 gal. plus 7.9 gal.)	10.4 gal.
(10.4 gal. multiplied by 6 lb./gal.)	62 lbs.

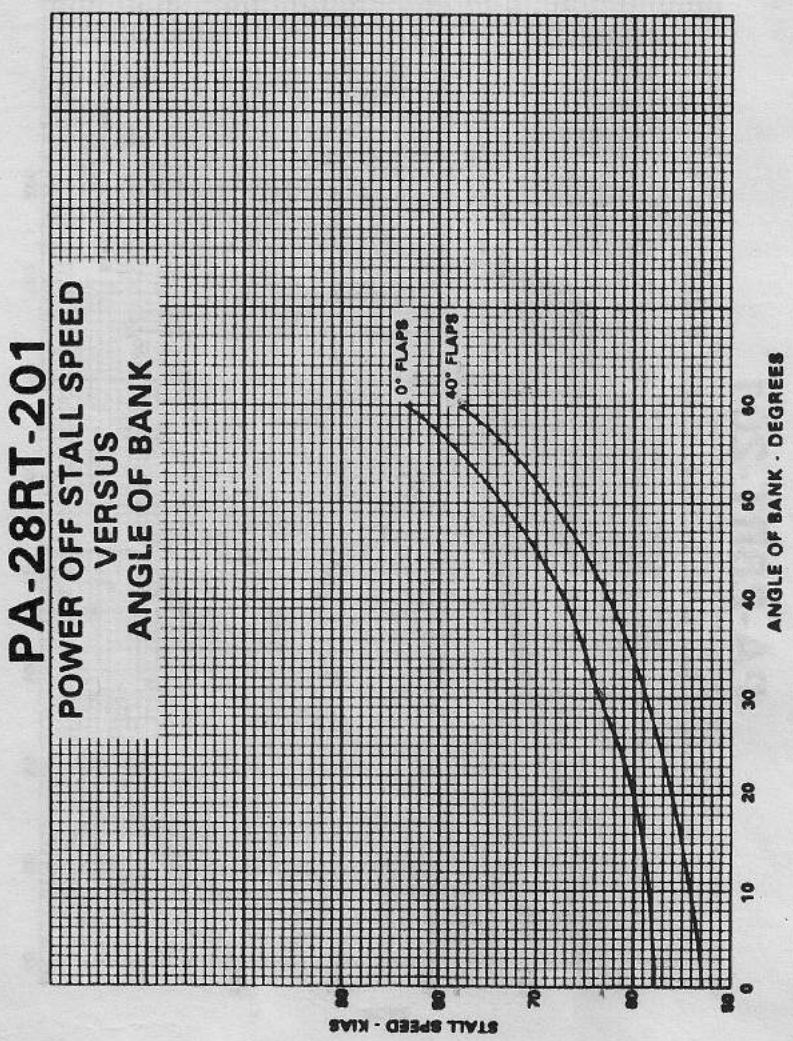
*reference Figure 5-23

5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

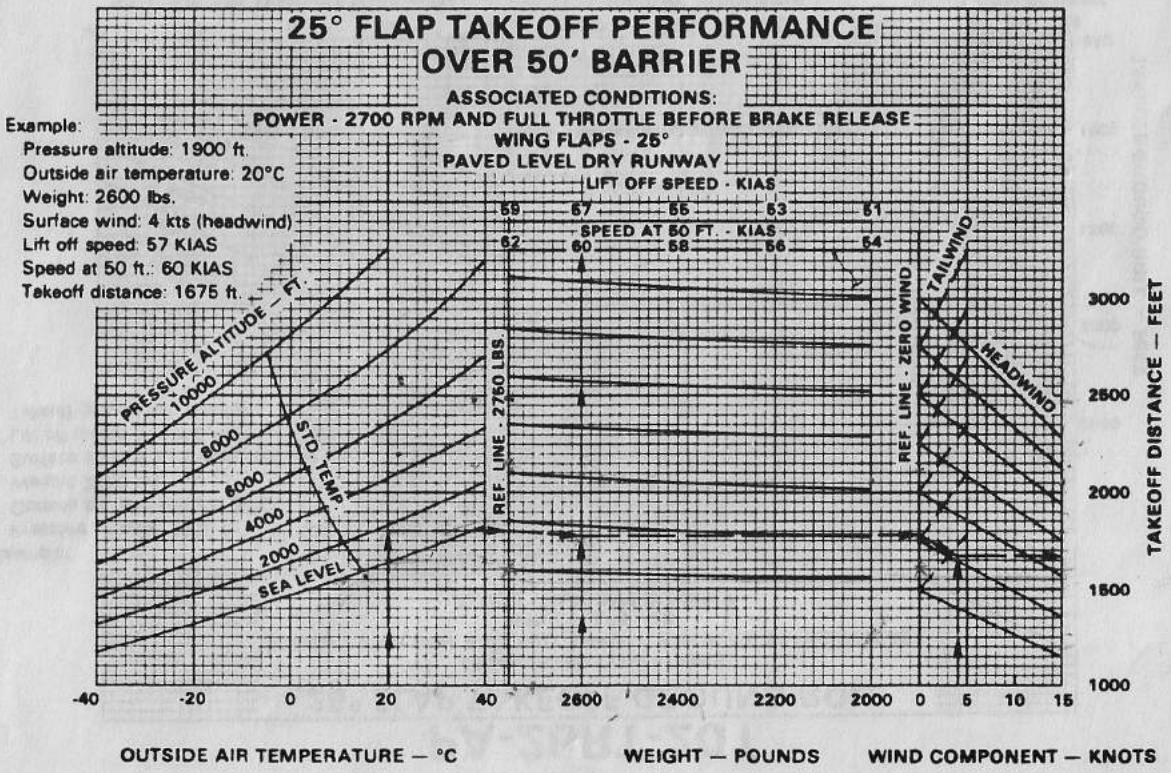


AIRSPEED SYSTEM CALIBRATION
Figure 5-1

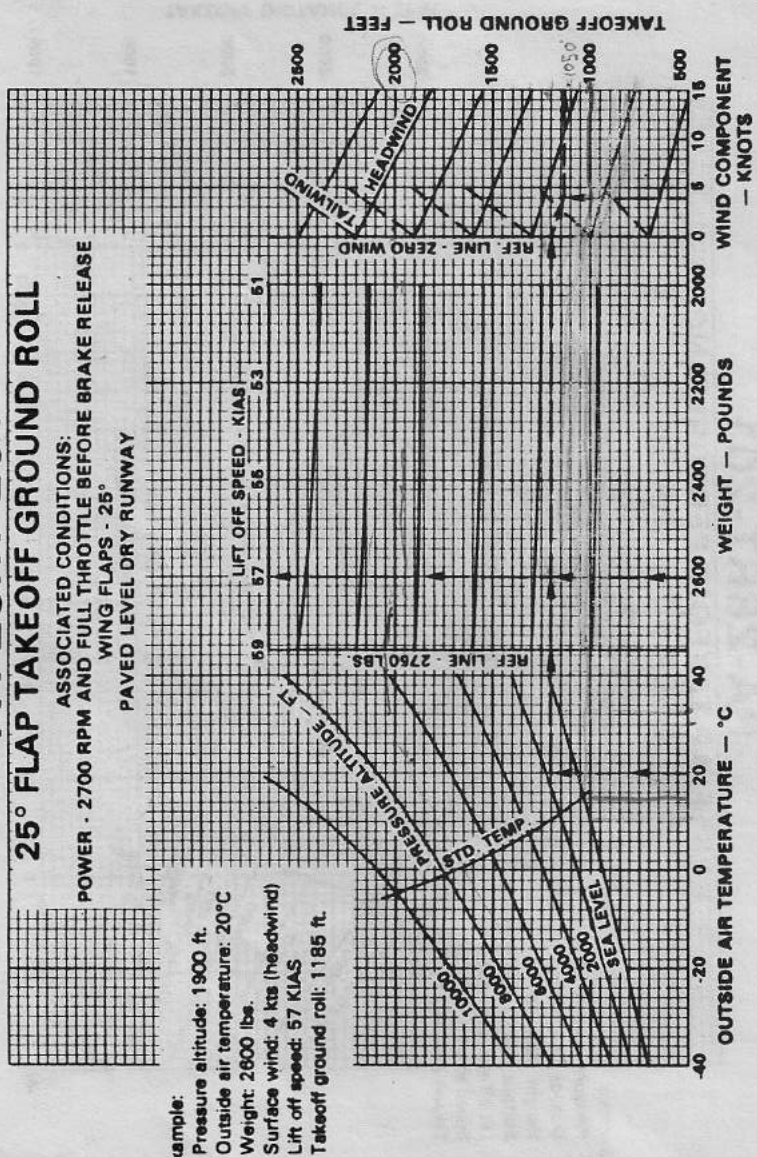


POWER OFF STALL SPEED VS. ANGLE OF BANK
Figure 5-3

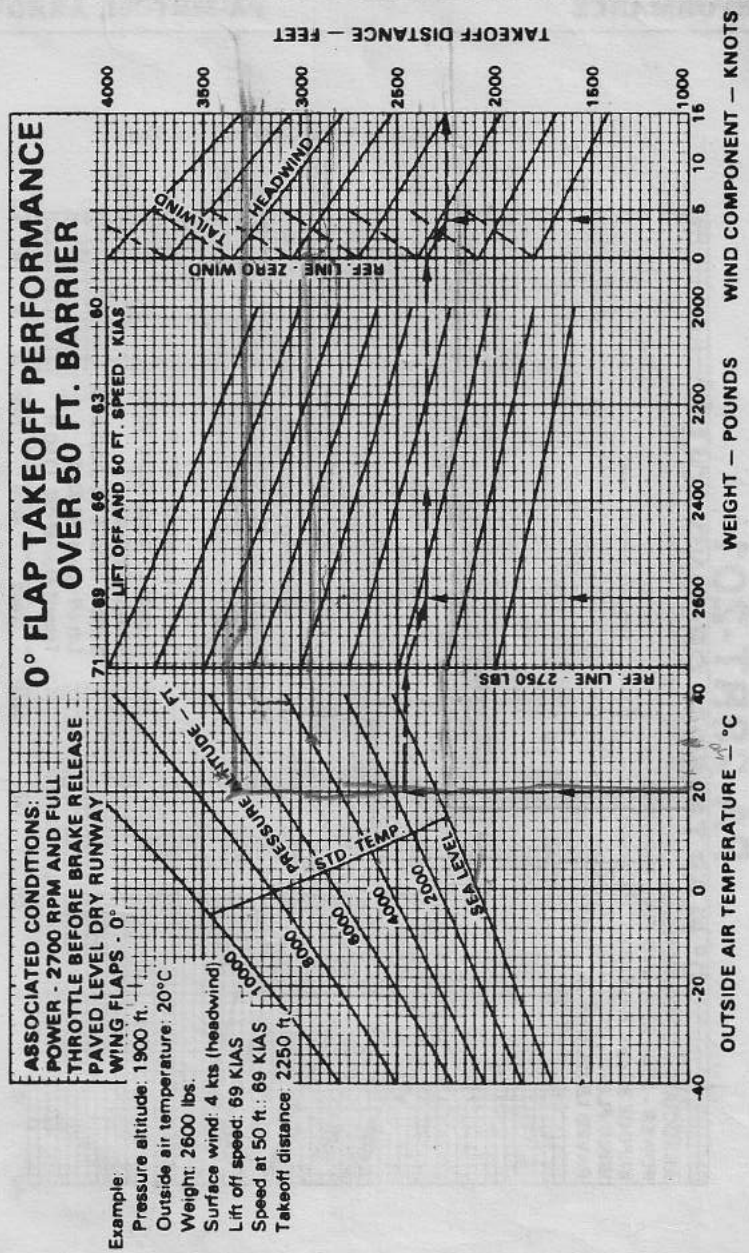
PA-28RT-201



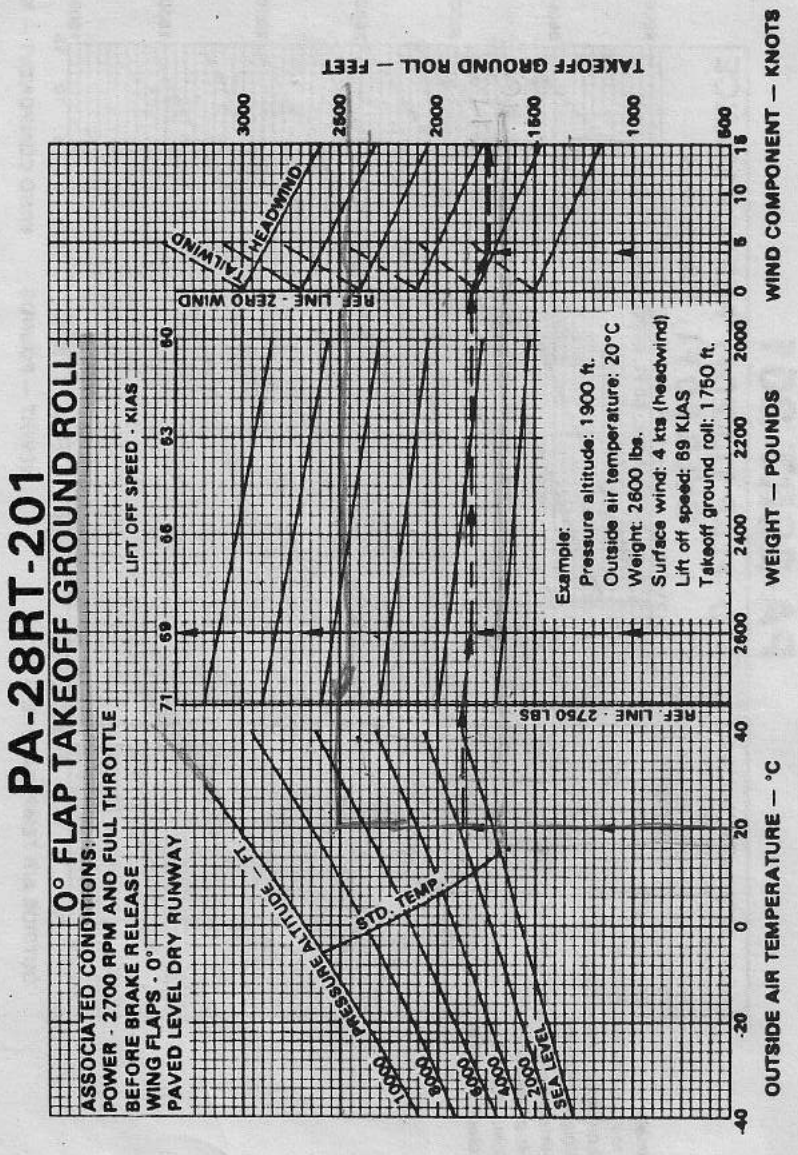
25° FLAP TAKEOFF PERFORMANCE
Figure 5-5



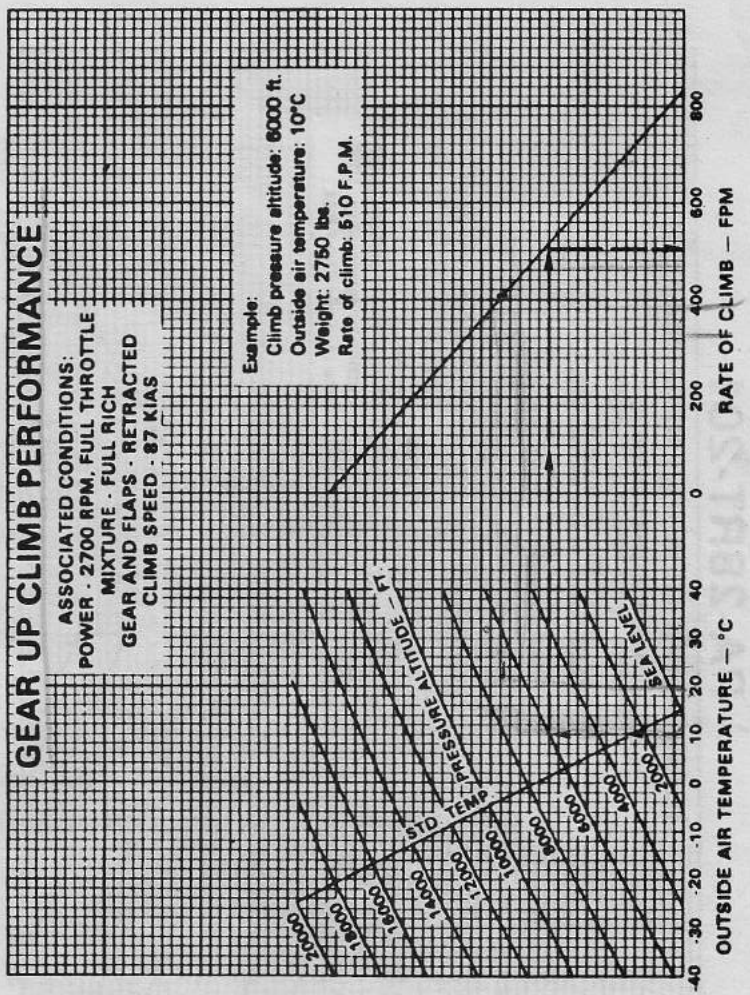
25° FLAP TAKEOFF GROUND ROLL
Figure 5-7



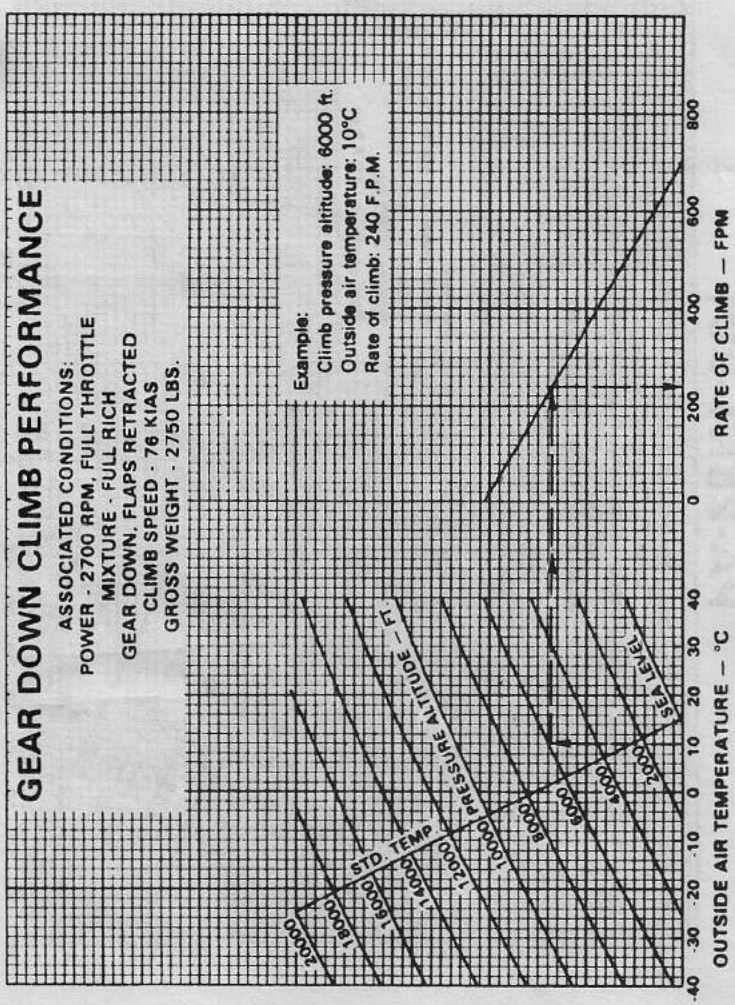
0° FLAP TAKEOFF PERFORMANCE
Figure 5-9



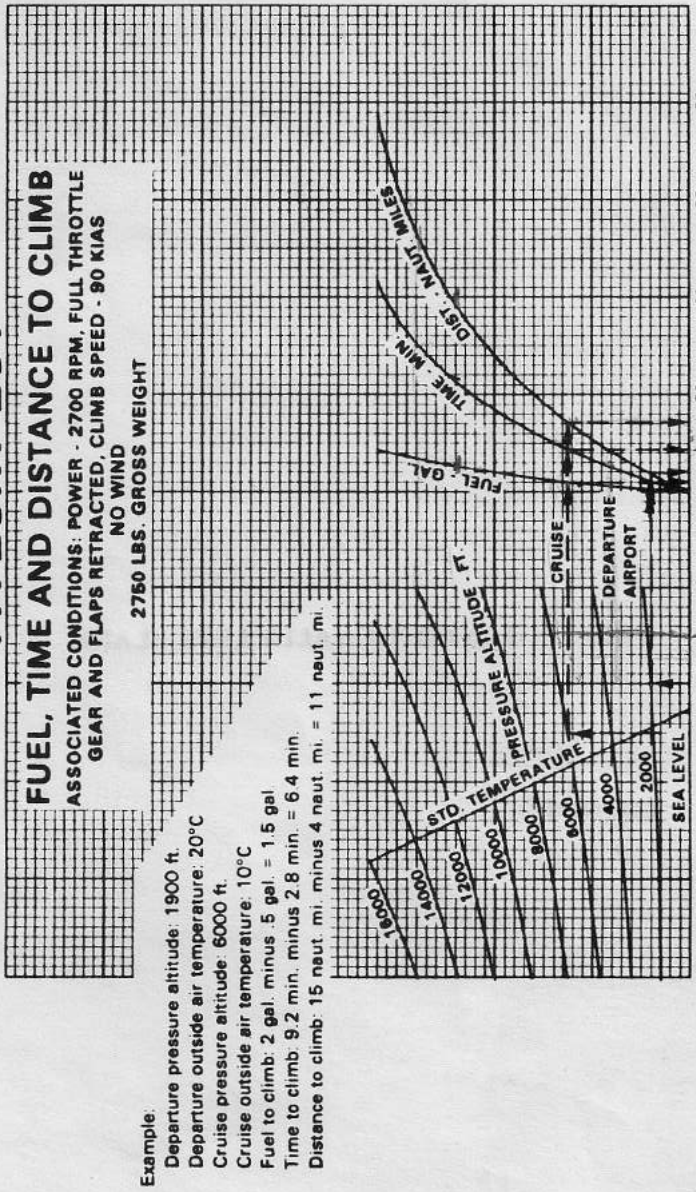
0° FLAP TAKEOFF GROUND ROLL
Figure 5-11



GEAR UP CLIMB PERFORMANCE
Figure 5-13



GEAR DOWN CLIMB PERFORMANCE
Figure 5-15



FUEL, TIME AND DISTANCE TO CLIMB
Figure 5-17

2235 24.85

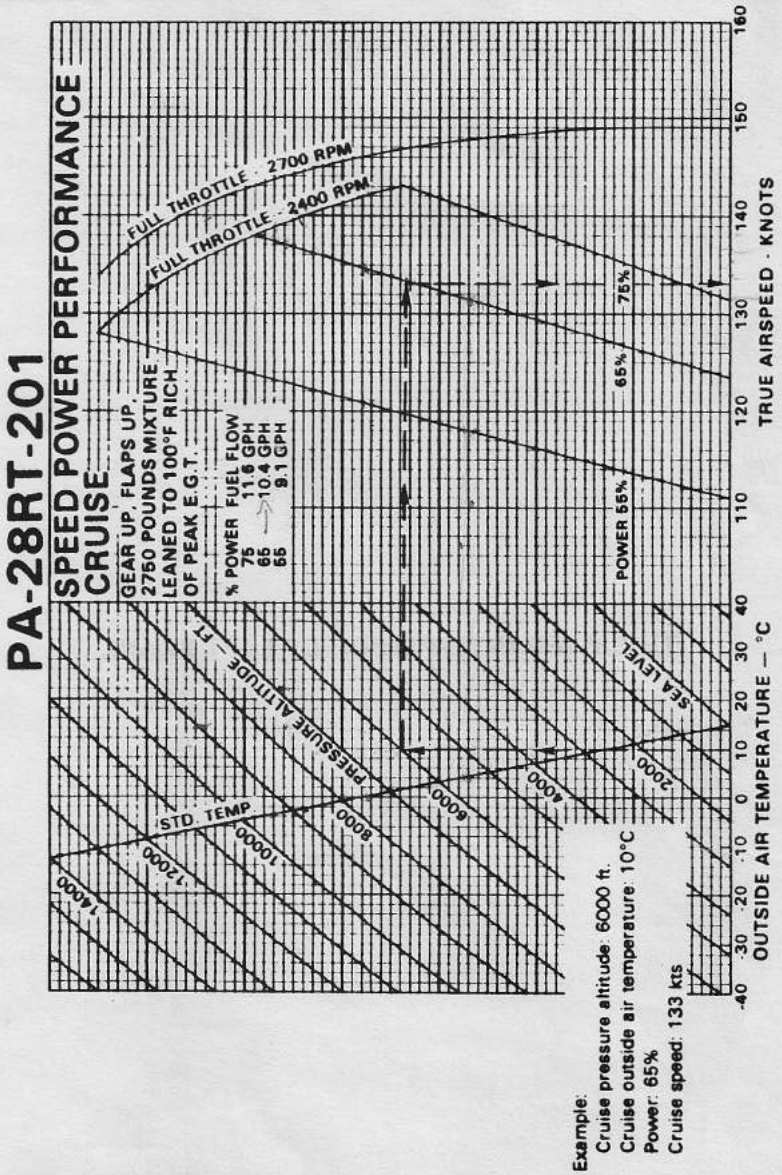
Power Setting Table - Lycoming Model IO-360-C Series, 200 HP Engine

Press. Alt. Feet	Std. Alt. Temp. °F	110 HP - 55% Rated RPM AND MAN. PRESS. 2100	2400	130HP - 65% Rated RPM AND MAN. PRESS. 210	2400	150 HP - 75% Rated RPM AND MAN. PRESS. 2400	Press. Alt. Feet
S.L.	59	22.9	20.4	25.	22.9	25.5	S.L.
1000	55	22.7	20.2	25.	22.7	25.2	1000
2000	52	22.4	20.0	25.	22.5	25.0	2000
3000	48	22.2	19.8	25.	22.2	24.7	3000
4000	45	21.9	19.5	24.	22.0	24.4	4000
5000	41	21.7	19.3	FT	21.7	FT	5000
6000	38	21.4	19.1	- -	21.5	- -	6000
7000	34	21.2	18.9	- -	21.3	- -	7000
8000	31	21.0	18.7	- -	21.0		8000
9000	27	FT	18.5	- -	FT		9000
10000	23	- -	18.3				10000
11000	19	- -	18.1				11000
12000	16	- -	17.8				12000
13000	12	- -	17.6				13000
14000	9	- -	FT				14000

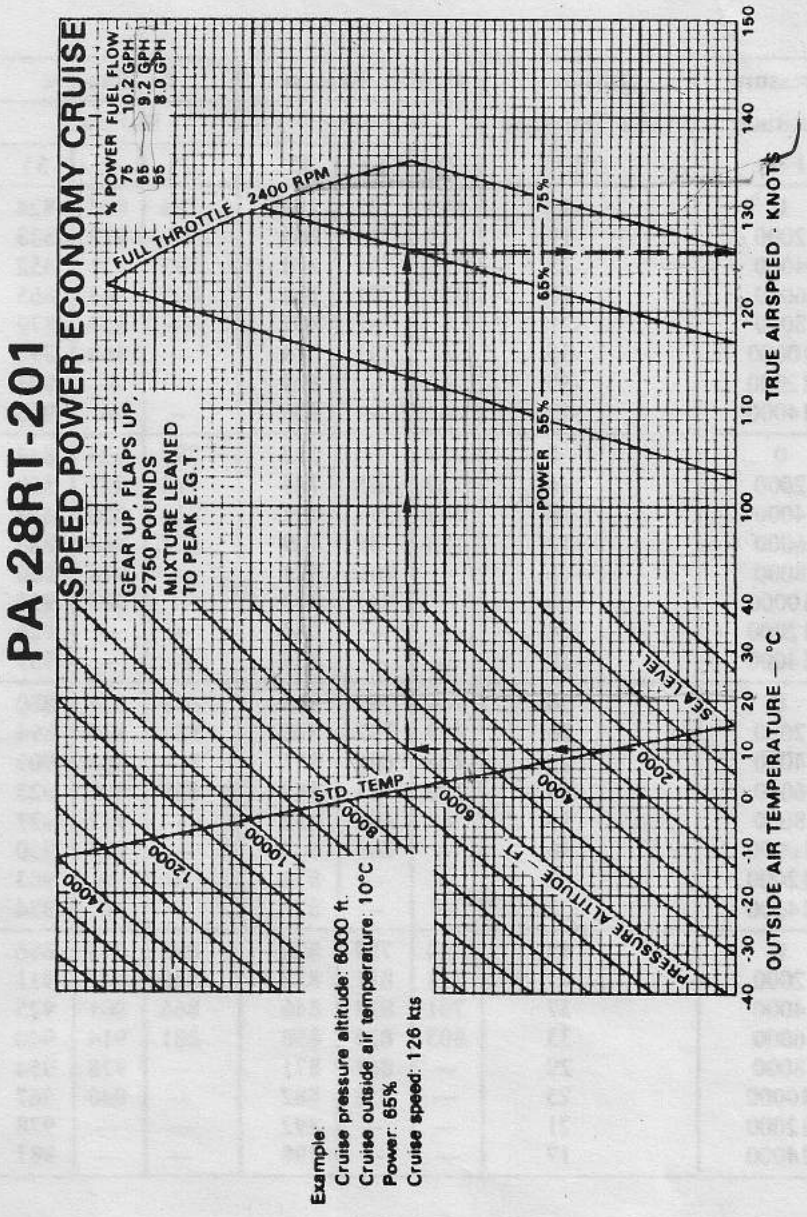
To maintain constant power, correct manifold pressure approximately 0.16" Hg for each 10°F variation in inlet air temperature from standard altitude temperature. Add manifold pressure for air temperatures above standard; subtract for temperatures below standard.

Full throttle manifold pressure values may not be obtainable when atmospheric conditions are non-standard.

POWER SETTING TABLE
Figure 5-19



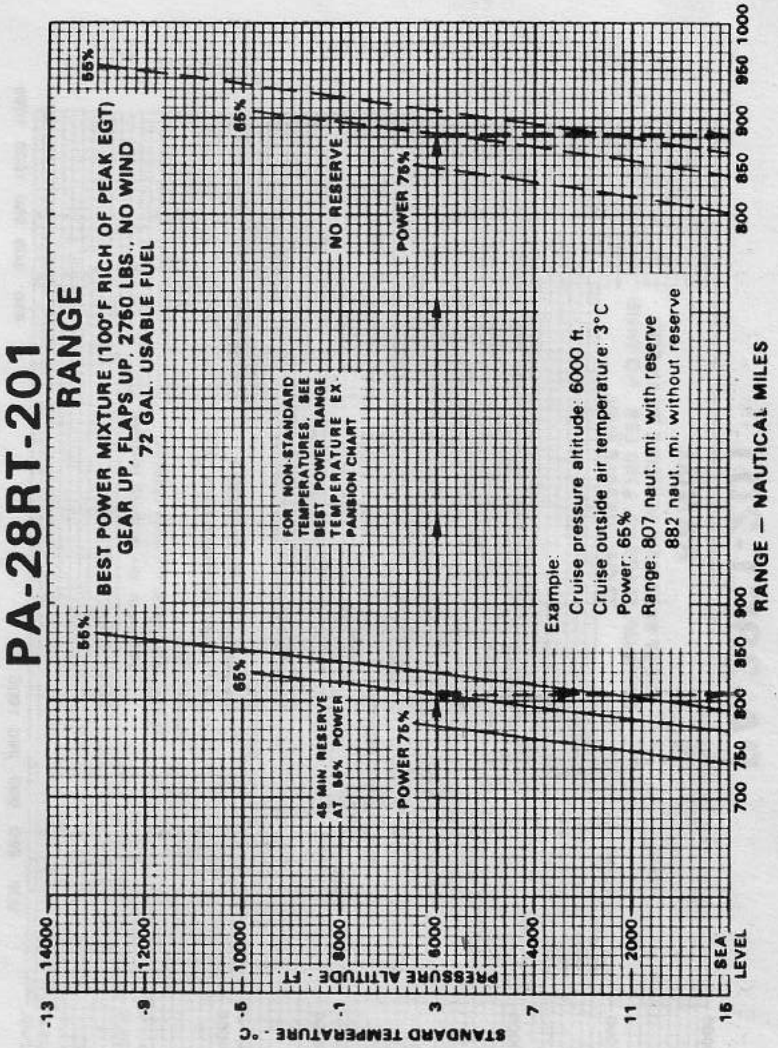
SPEED POWER - PERFORMANCE CRUISE
Figure 5-21



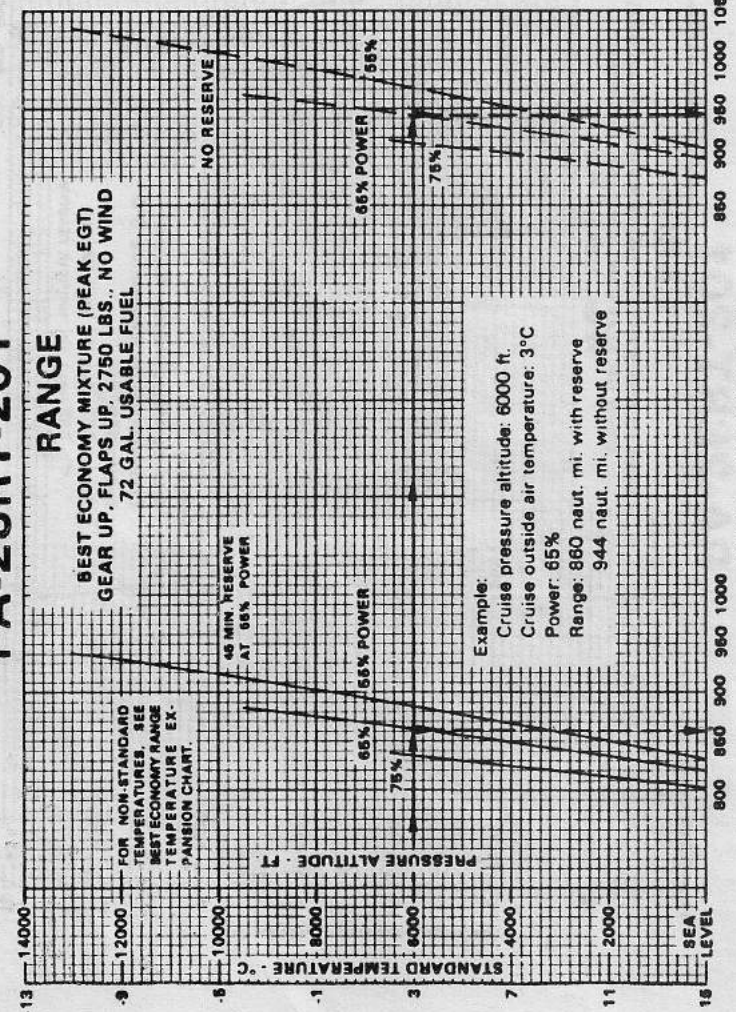
SPEED POWER - ECONOMY CRUISE
Figure 5-23

Pressure Altitude Feet	Outside Air Temp. °C	45 Min. Reserve % Power			No Reserve % Power		
		75	65	55	75	65	55
0	-15	699	737	754	764	805	824
2000	-19	712	748	766	778	818	838
4000	-23	725	759	778	793	831	852
6000	-27	737	771	790	807	844	865
8000	-31	—	782	802	—	857	879
10000	-35	—	793	814	—	869	892
12000	-39	—	—	825	—	—	905
14000	-43	—	—	836	—	—	918
0	0	717	754	772	783	824	844
2000	-4	730	765	785	798	837	858
4000	-8	743	777	797	813	850	872
6000	-12	756	789	809	827	863	886
8000	-16	—	800	821	—	876	900
10000	-20	—	811	833	—	889	913
12000	-24	—	—	844	—	—	926
14000	-28	—	—	855	—	—	939
0	30	749	785	805	819	858	880
2000	26	763	797	818	834	871	894
4000	22	776	809	831	849	885	909
6000	18	790	821	843	864	898	923
8000	14	—	832	855	—	912	937
10000	10	—	844	867	—	925	950
12000	6	—	—	878	—	—	963
14000	2	—	—	887	—	—	974
0	45	764	799	820	835	873	896
2000	41	778	811	833	850	887	911
4000	37	791	823	846	866	901	925
6000	33	805	835	858	881	914	940
8000	29	—	847	871	—	928	954
10000	25	—	858	882	—	940	967
12000	21	—	—	892	—	—	978
14000	17	—	—	898	—	—	987

BEST POWER RANGE
TEMPERATURE EXPANSION CHART
Figure 5-24



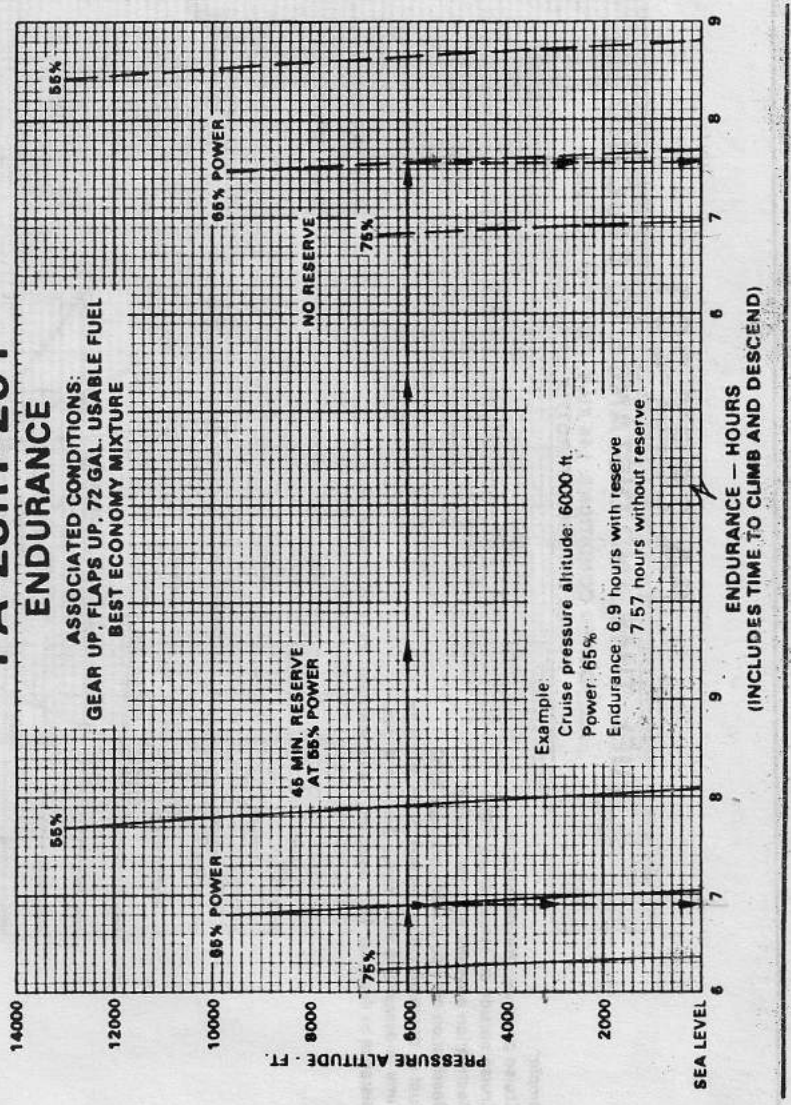
RANGE - BEST POWER MIXTURE
Figure 5-25



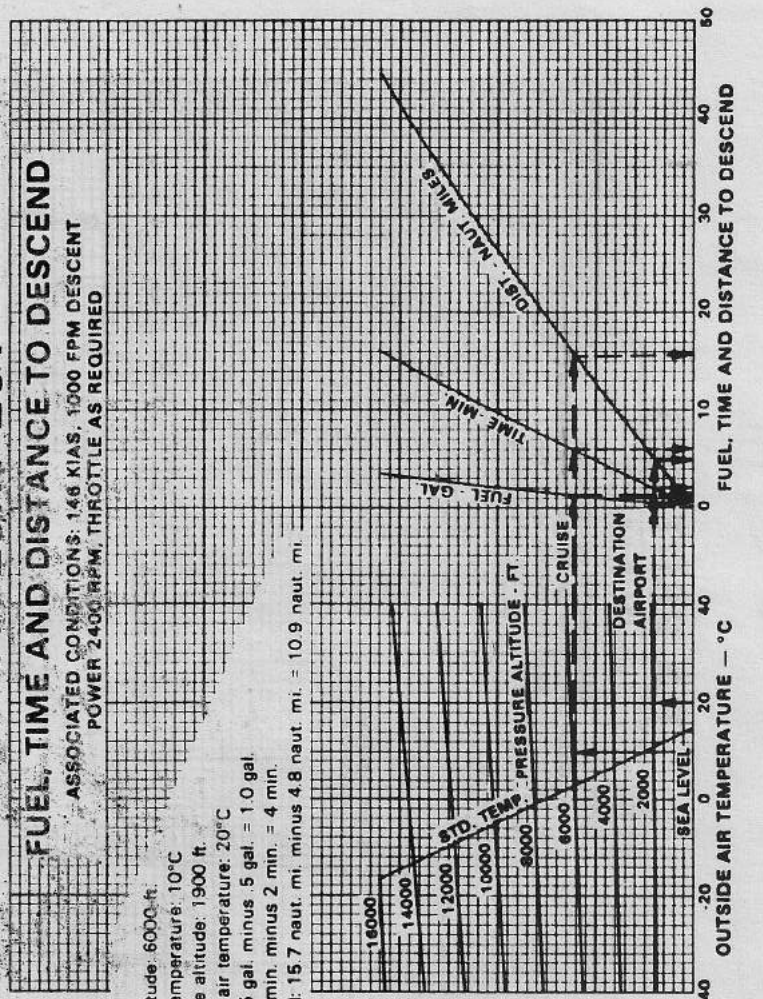
RANGE - BEST ECONOMY MIXTURE
Figure 5-27

Pressure Altitude Feet	Outside Air Temp. °C	45 Min. Reserve % Power			No Reserve % Power		
		75	65	55	75	65	55
0	-15	770	784	784	841	857	857
2000	-19	780	797	802	853	871	877
4000	-23	791	809	819	865	886	897
6000	-27	801	822	837	877	900	916
8000	-31	—	834	854	—	914	935
10000	-35	—	846	870	—	928	954
12000	-39	—	—	886	—	—	972
14000	-43	—	—	901	—	—	990
0	0	787	803	808	860	878	883
2000	-4	797	816	827	872	893	904
4000	-8	808	829	844	884	907	924
6000	-12	818	842	862	896	922	943
8000	-16	—	854	878	—	936	963
10000	-20	—	866	895	—	950	981
12000	-24	—	—	911	—	—	999
14000	-28	—	—	925	—	—	1017
0	30	817	838	853	893	916	932
2000	26	828	852	871	905	931	953
4000	22	839	865	889	918	946	973
6000	18	850	877	906	930	961	992
8000	14	—	890	923	—	975	1011
10000	10	—	902	939	—	988	1029
12000	6	—	—	953	—	—	1046
14000	2	—	—	965	—	—	1060
0	45	831	854	873	908	933	954
2000	41	842	868	891	920	949	975
4000	37	853	881	909	933	963	995
6000	33	864	893	926	946	978	1014
8000	29	—	906	943	—	992	1033
10000	25	—	917	958	—	1005	1050
12000	21	—	—	970	—	—	1065
14000	17	—	—	977	—	—	1074

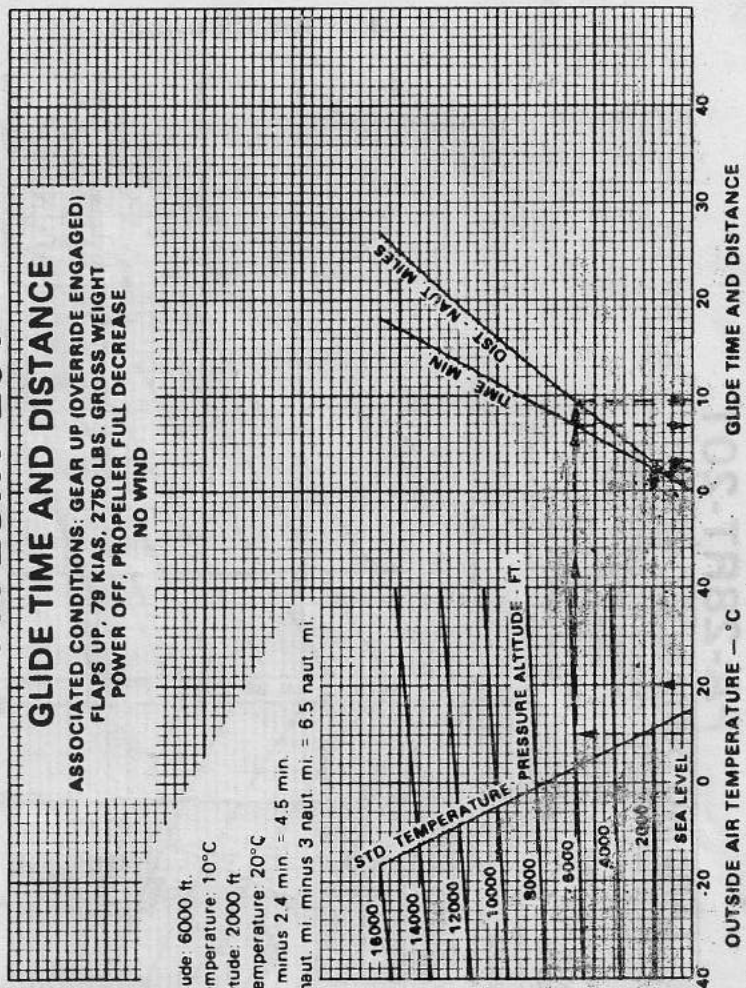
BEST ECONOMY RANGE
TEMPERATURE EXPANSION CHART
Figure 5-28



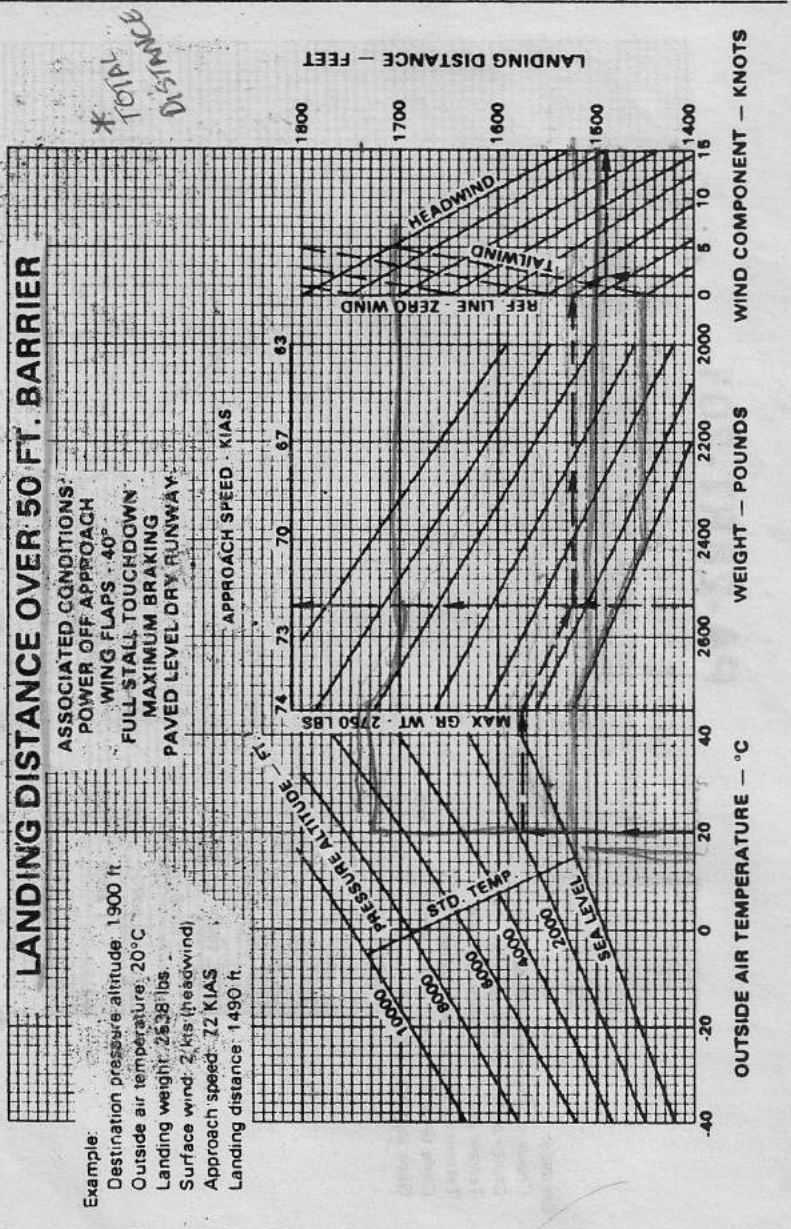
ENDURANCE
Figure 5-29



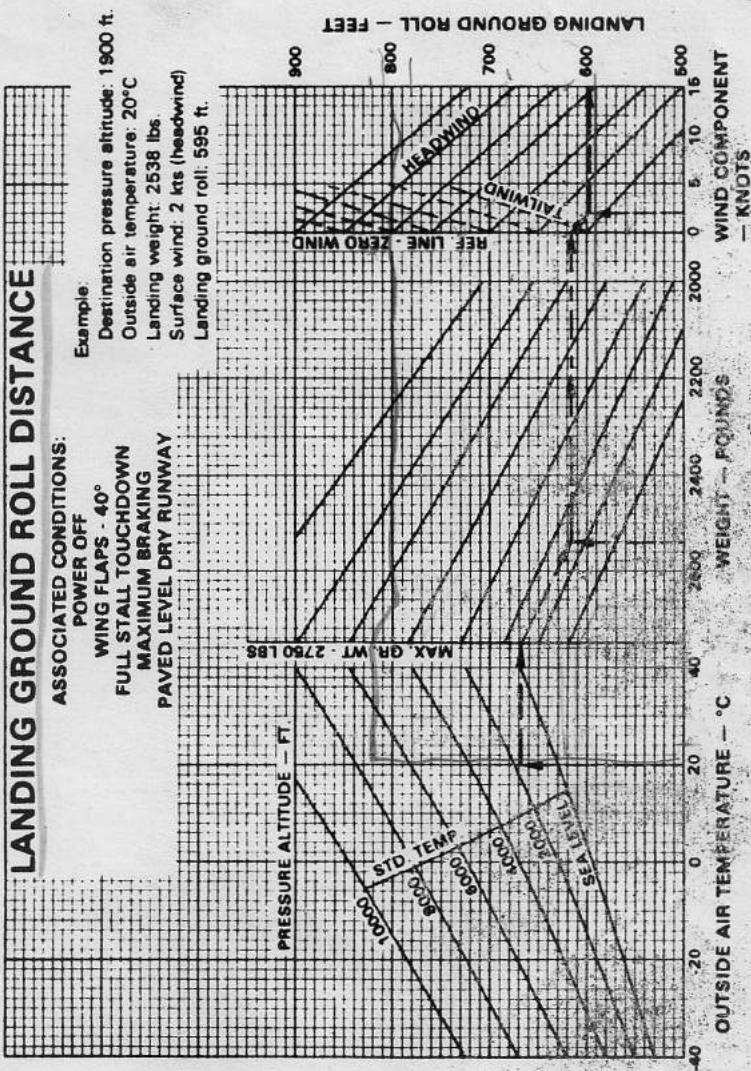
FUEL, TIME AND DISTANCE TO DESCEND
Figure 5-31



GLIDE TIME AND DISTANCE
Figure 5-33



LANDING DISTANCE OVER 50 FT.
Figure 5-35



LANDING GROUND ROLL DISTANCE
Figure 5-37

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SECTION 6

WEIGHT AND BALANCE

SECTION 6

WEIGHT AND BALANCE

6.1 GENERAL

In order to achieve the performance and good 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 tremendous 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 delivered, 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 easily 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 delivery, 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 engines 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

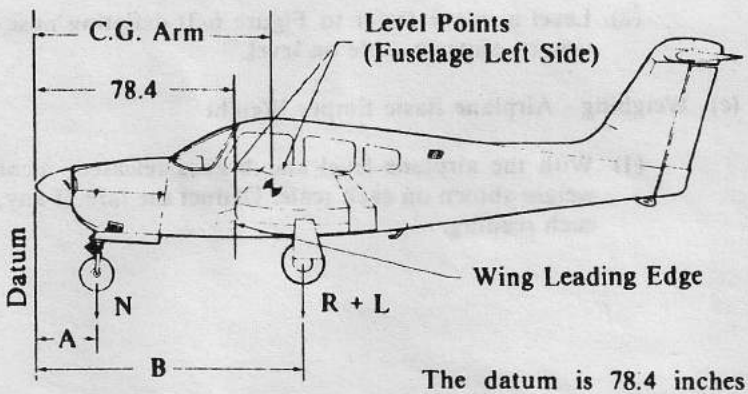
(1) With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

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-201 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 Useful Load listed in Figure 6-5 are for the airplane as delivered from the factory. These figures apply only to the specific airplane serial number and registration number shown.

The basic empty weight of the airplane as delivered from 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.

MODEL PA-28RT-201 ARROW IV

Airplane Serial Number _____

Registration Number _____

Date _____

AIRPLANE BASIC EMPTY WEIGHT

Item		Weight (Lbs)	x C.G. Arm (Inches Aft of Datum)	= Moment (In-Lbs)
Standard Empty Weight*	Actual / Computed			
Optional Equipment				
Basic Empty Weight				

*The standard empty weight includes full oil capacity and 5.0 gallons of unusable fuel.

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

(Gross Weight) - (Basic Empty Weight) = Useful Load

(2750 lbs.) - (lbs.) = lbs.

THIS BASIC EMPTY WEIGHT, C.G. AND USEFUL LOAD ARE FOR THE AIRPLANE AS DELIVERED FROM THE FACTORY. REFER TO APPROPRIATE AIRCRAFT RECORD WHEN ALTERATIONS HAVE BEEN MADE.

WEIGHT AND BALANCE DATA FORM
Figure 6-5

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			
Pilot and Front Passenger	340.0	80.5	27370
Passengers (Rear Seats)	340.0	118.1	40154
Fuel (72 Gallons Maximum)		95.0	
Baggage (200 Lbs. Maximum)		142.8	
Moment due to Retraction of Landing Gear			819
Total Loaded Airplane			

The center of gravity (C.G.) of this sample loading problem is at inches aft of the datum line. Locate this point ( ) 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.

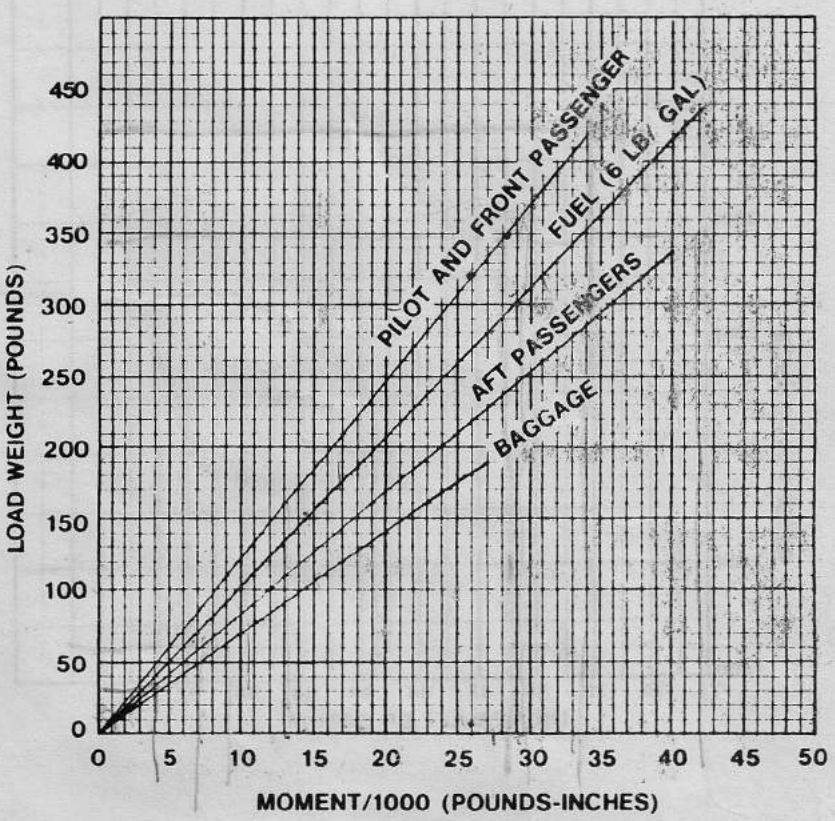
IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO INSURE THAT THE AIRPLANE IS LOADED PROPERLY.

SAMPLE LOADING PROBLEM (NORMAL CATEGORY)
Figure 6-9

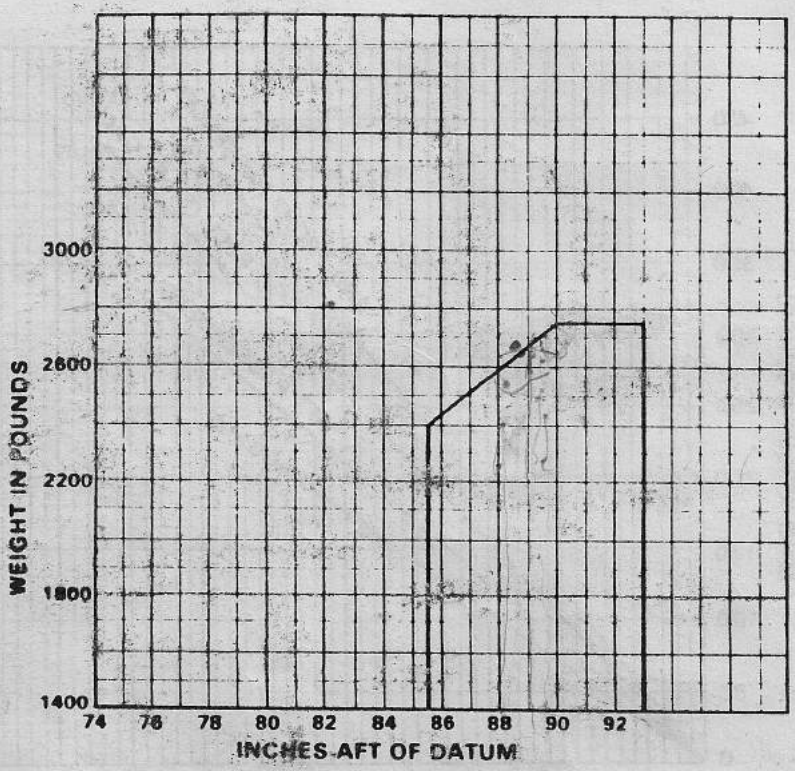
	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger		80.5	
Passengers (Rear Seats)		118.1	
Fuel (72 Gallons Maximum)		95.0	
Baggage (200 Lbs. Maximum)		142.8	
Moment due to Retraction of Landing Gear			819
Total Loaded Airplane			

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



Moment due to retracting landing gear = +819 in.-lbs.

C.G. RANGE AND WEIGHT
Figure 6-15

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DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYTEMS

7.1 THE AIRPLANE

The 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 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 652-415 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 Arrow IV incorporates a Lycoming IO-360-C1C6 four-cylinder, direct drive, horizontally opposed fuel injected engine rated at 200 horsepower at 2700 RPM. It is furnished with a starter, 60 ampere 14-volt alternator, shielded ignition, vacuum pump drive, fuel pump, propeller governor and a dry automotive type induction air filter. A recommended overhaul period of 1600 hours is based on Lycoming service experience. Operation beyond the recommended time is the decision of the operator. Since Lycoming from time to time revises the recommended overhaul period, the owner should check the latest Lycoming Service Instruction at his Piper dealer for the latest recommended overhaul period and for any additional information.

The aircraft is equipped with a constant speed, controllable pitch propeller. The propeller control is located on the power quadrant between the throttle and mixture controls. A mixture control lock is provided to prevent activation of the mixture control instead of the pitch control.

The exhaust system is a crossover type, which reduces back pressure and improves performance. It is constructed entirely of stainless steel and is equipped with dual mufflers. Cabin heat and windshield defrosting are provided by a heater shroud around the muffler.

An oil cooler is located on the forward lower right side of the fire wall, with the air inlet for the cooler located on the right side of the bottom cowling. A winterization plate is provided to restrict air during winter operation. **(See Winterization in Handling and Servicing.)**

7.7 INDUCTION SYSTEM

The induction system incorporates a Bendix RSA-5AD1 type fuel injector. The injector is based on the principle of differential pressure, which balances air pressure against fuel pressure. The regulated fuel pressure established by the servo valve when applied across a fuel control (jetting system) makes the fuel flow proportional to airflow. Fuel pressure regulation by the servo valve causes a minimal drop in fuel pressure throughout the metering system. Metering pressure is maintained above most vapor forming conditions while fuel inlet pressure is low enough to allow use of a diaphragm pump. The servo system feature also checks vapor lock and associated starting problems.

The servo regulation meters fuel flow proportionally with airflow and maintains the mixture as manually set for all engine speeds. The fuel flow divider receives metered fuel and distributes fuel to each cylinder fuel nozzle.

The fuel flow portion of the manifold pressure/fuel flow gauge is connected to the flow divider and monitors fuel pressure. This instrument converts fuel pressure to an indication of fuel flow in gallons per hour and percentage of rated horsepower.

The alternate air source of the induction system contains a door that functions automatically or manually. If the primary source is obstructed, the door will open automatically. It may be opened manually by moving the selector on the right side of the quadrant. The primary source should always be used for takeoff.

The pilot should read and follow the procedures recommended in the Lycoming Operator's Manual for this engine, in order to obtain maximum engine efficiency and time between engine overhauls.

7.9 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.

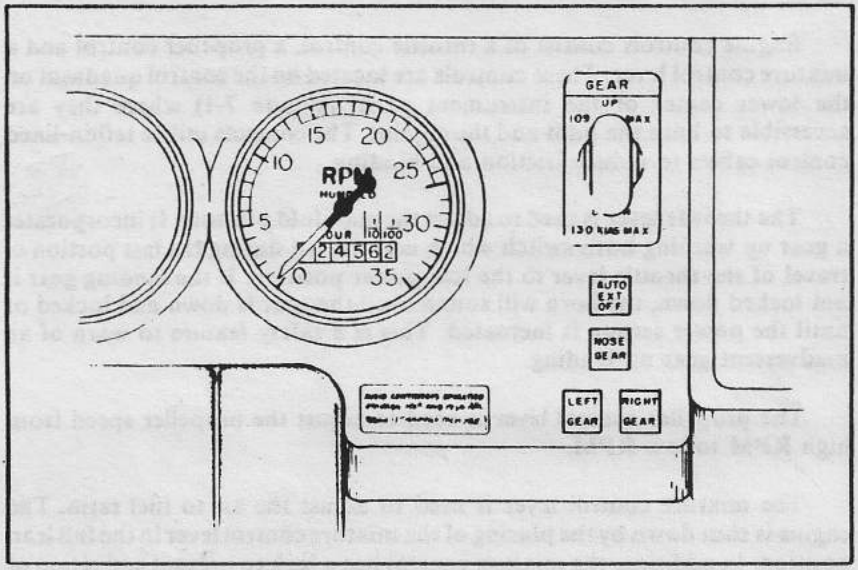
The throttle lever is used to adjust the manifold pressure. It incorporates a gear up warning horn switch which is activated during the last portion of travel of the throttle lever to the low power position. If the landing gear is not locked down, the horn will sound until the gear is down and locked 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 Avco-Lycoming 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.



LANDING GEAR SELECTOR
Figure 7-3

7.11 LANDING GEAR

The 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.

Also incorporated in the system is a pressure sensing device 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 95 KIAS with power off.

The extension speeds will vary from approximately 75 KTS to approximately 95 KIAS depending on power settings and altitude. The device also prevents the gear from retracting at airspeeds below approximately 75 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, 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. This same 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.

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 109 KIAS and should not be extended above a speed of 130 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:

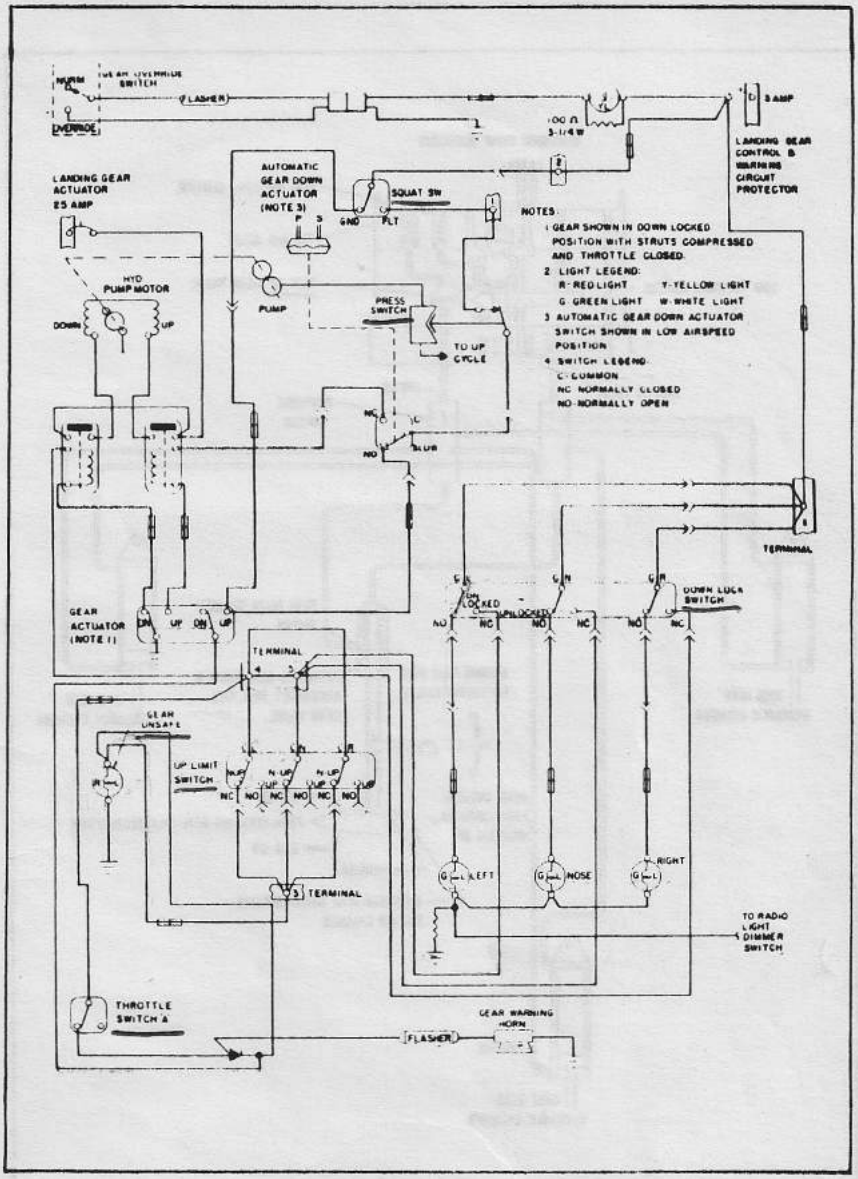
(a) Gear up and power reduced below approximately 14 inches of manifold pressure.
(b) Gear extended by back-up gear extender system but gear selector switch "UP," power reduced below approximately 14 inches of manifold pressure.
(c) Gear selector switch "UP" while on the ground and throttle in retarded position.

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

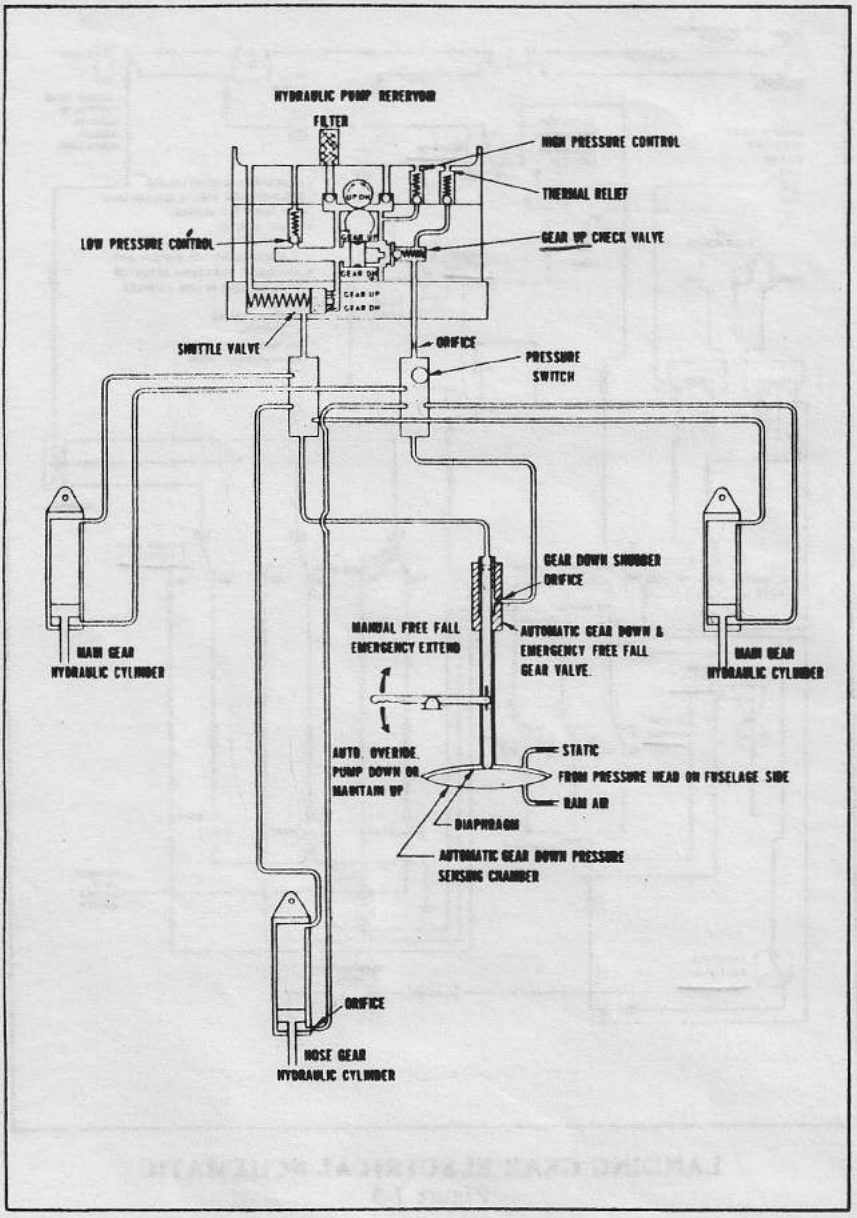
The nose gear is steerable through a 30 degree arc each side of center through the use of the rudder pedals. As the nose wheel retracts, the steering linkage disengages to reduce rudder pedal loads in flight. The nose wheel is equipped with a hydraulic shimmy dampener to reduce nose wheel shimmy. A bungee 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).

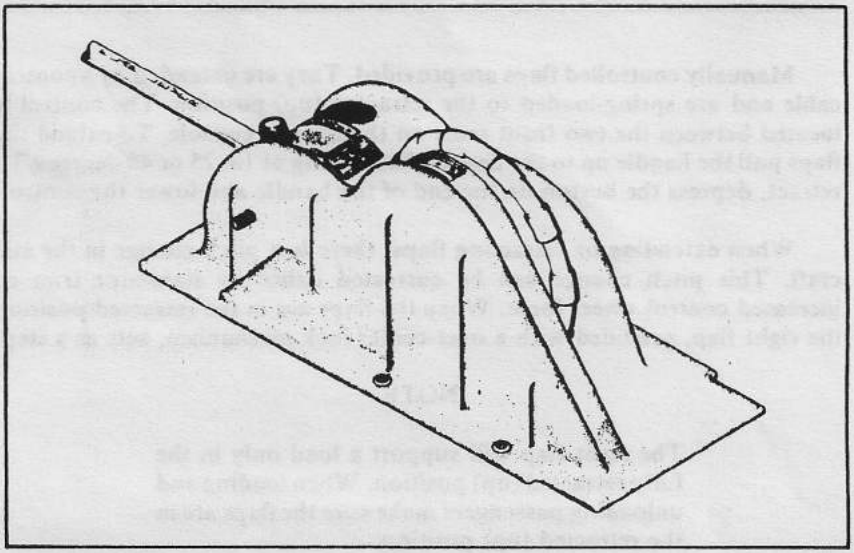
The standard brake system includes toe brakes on the left and right set of rudder pedals and a hand brake located below and near the center of the instrument panel. The toe brakes and the hand brake have individual brake cylinders, but all cylinders use a common reservoir. The parking brake is incorporated 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

7.13 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.

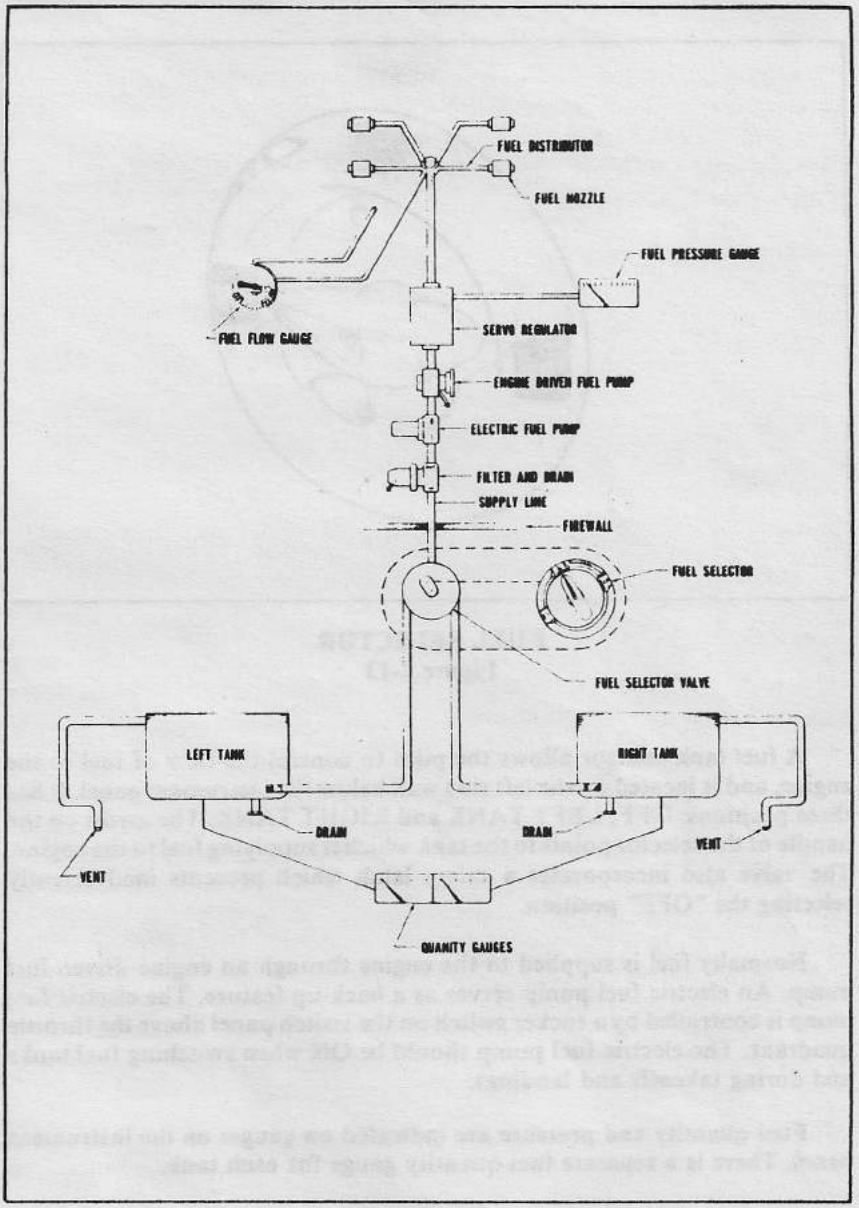
7.15 FUEL SYSTEM

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. The minimum fuel grade is 100/130 octane (green) or 100LL (blue). 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.

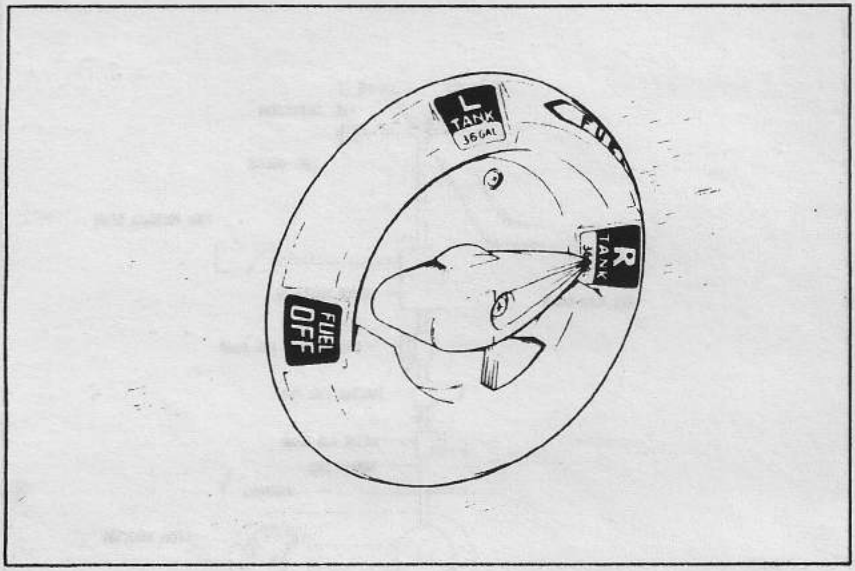
Each fuel tank has an individual quick drain located at the bottom inboard rear corner. The fuel strainer also incorporates a quick drain, which is located on the left lower portion of the firewall. The quick drain protrudes thru the cowling to allow easy draining of the fuel strainer. To avoid the accumulation 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 valve also incorporates a safety latch which prevents inadvertently selecting the "OFF" position.

Normally fuel is supplied to the engine through an engine-driven fuel pump. An electric fuel pump serves as a back-up feature. The electric fuel pump is controlled by a rocker switch on the switch panel above the throttle quadrant. The electric fuel pump should be ON when switching fuel tanks and during takeoffs and landings.

Fuel quantity and pressure are indicated on gauges on the instrument panel. There is a separate fuel quantity gauge for each tank.

7.17 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.

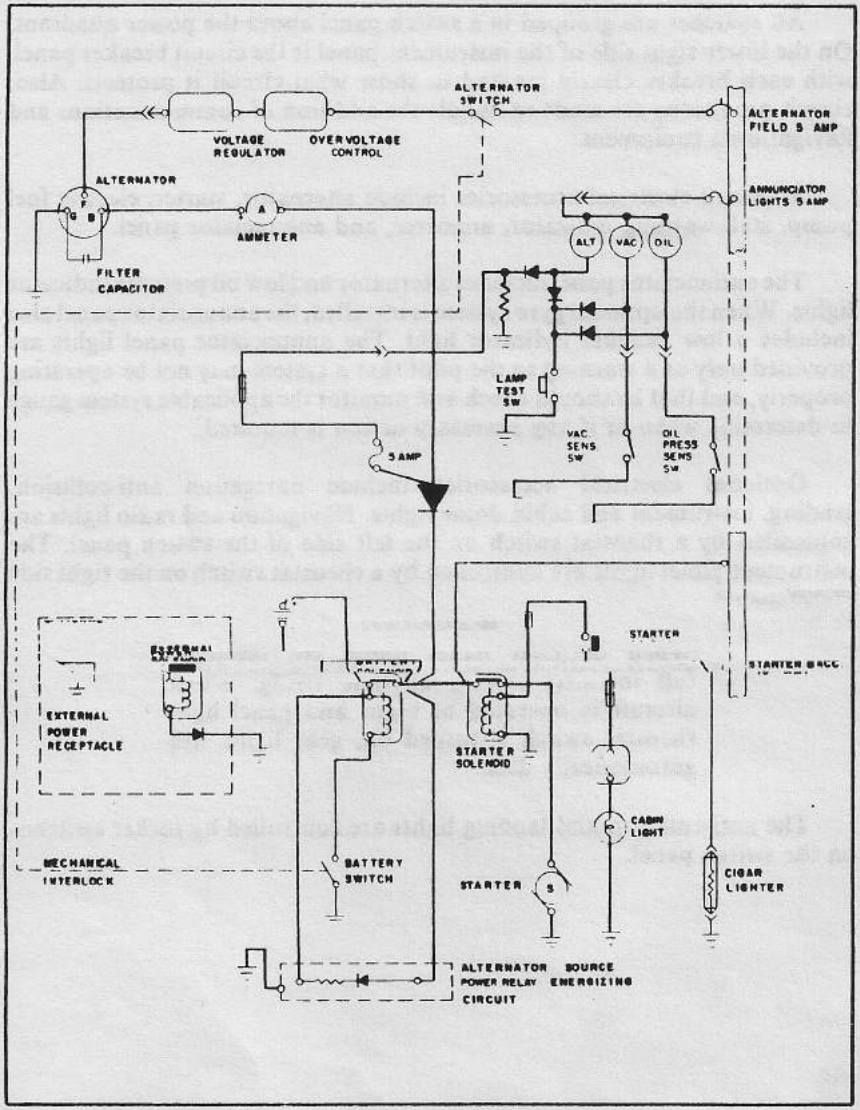
The annunciator panel includes alternator and low oil pressure indicator lights. When the optional gyro system is installed, the annunciator panel also includes a low vacuum indicator light. The annunciator panel lights are provided only as a warning to the pilot that a system may not be operating properly,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

Optional electrical accessories include navigation 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.

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 will automatically dim.

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



ALTERNATOR AND STARTER SCHEMATIC
Figure 7-15

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.

7.21 PITOT-STATIC SYSTEM

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

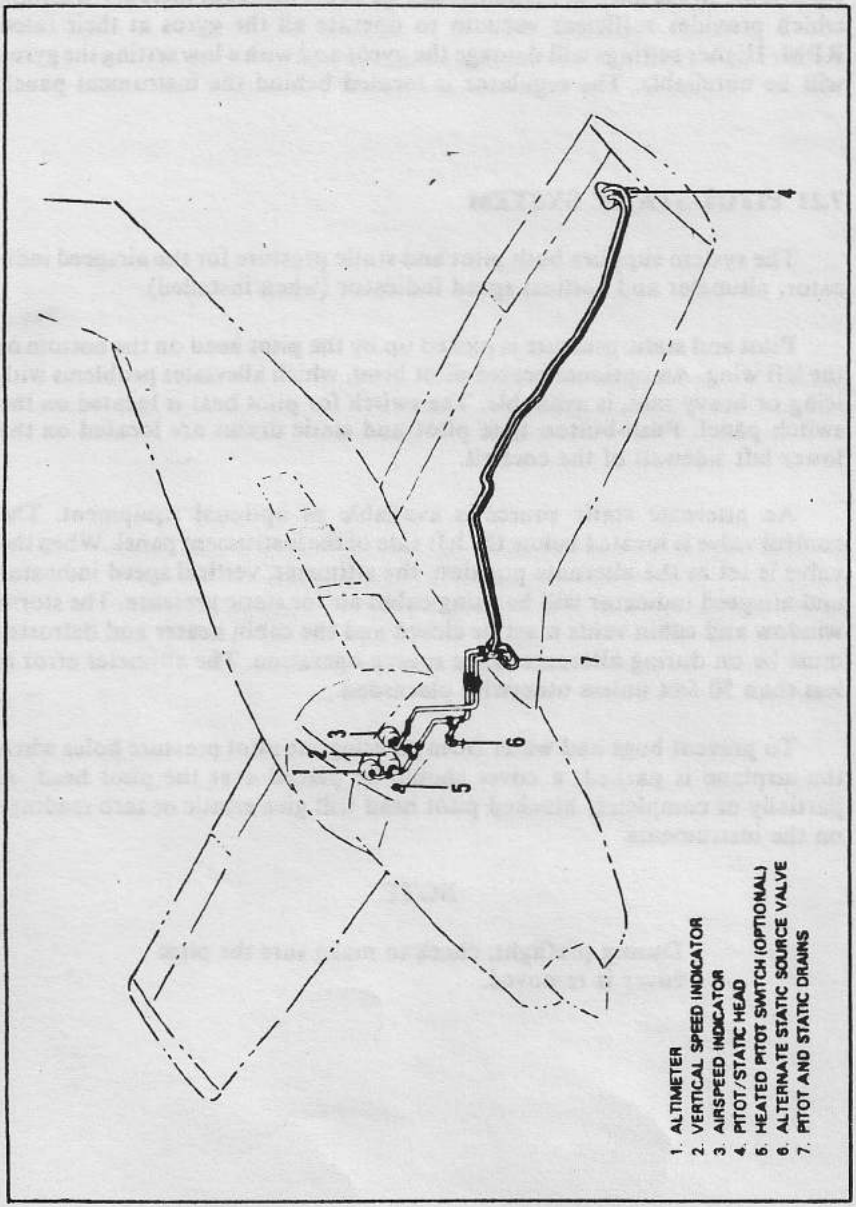
Pitot and static pressure is picked up by the pitot head on the bottom of the left wing. An optional heated pitot head, which alleviates problems with icing or heavy rain, is available. The switch for pitot heat is located on the switch panel. Push-button type pitot and static drains are located on the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

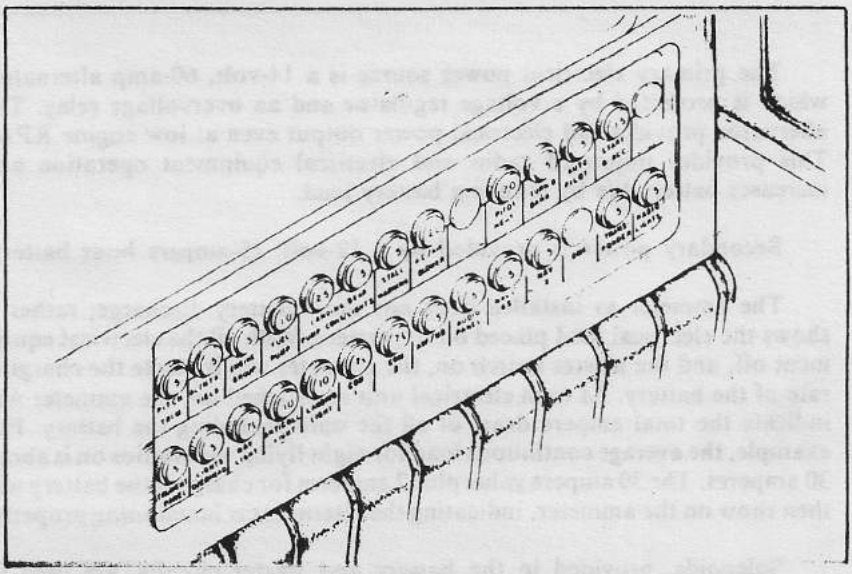
To prevent bugs and water from entering the pitot pressure holes when the airplane is parked, a cover should be placed over the pitot head. A partially or completely blocked pitot head will give erratic or zero readings on the instruments.

NOTE

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



PITOT-STATIC SYSTEM
Figure 7-19



CIRCUIT BREAKER PANEL.
Figure 7-17

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, during takeoff and landing.

The master switch also located in the switch panel, is a split rocker switch. One side of the switch is the battery side ("BAT") and the other is the alternator side ("ALT"). Henceforth, "master switch" used in this manual, shall mean both "BAT" and "ALT" switches. The "ALT" switch is provided for an emergency and its function is covered under "Alternator Failure" in the Emergency section of the handbook.

The primary electrical power source is a 14-volt, 60-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.

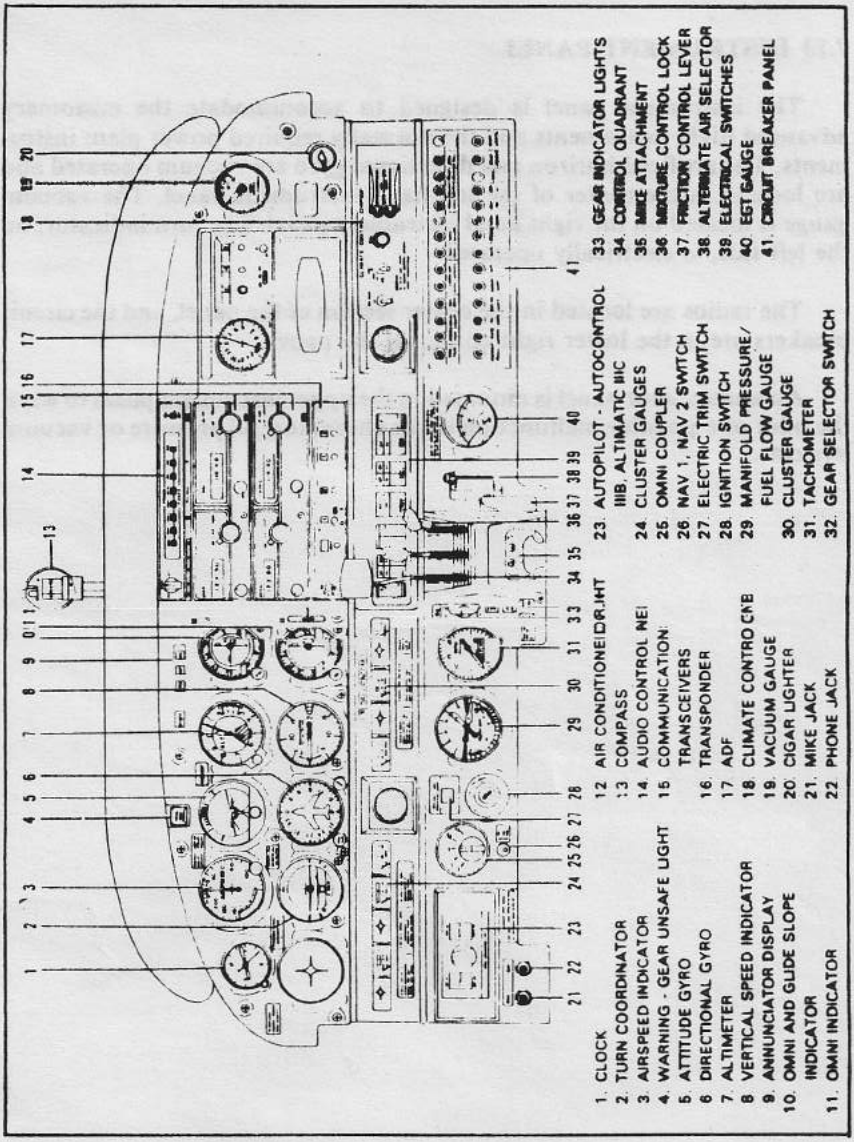
Solenoids, provided in the battery and starter circuits, are used to control high current drain functions remotely from the cabin.

7.19 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.



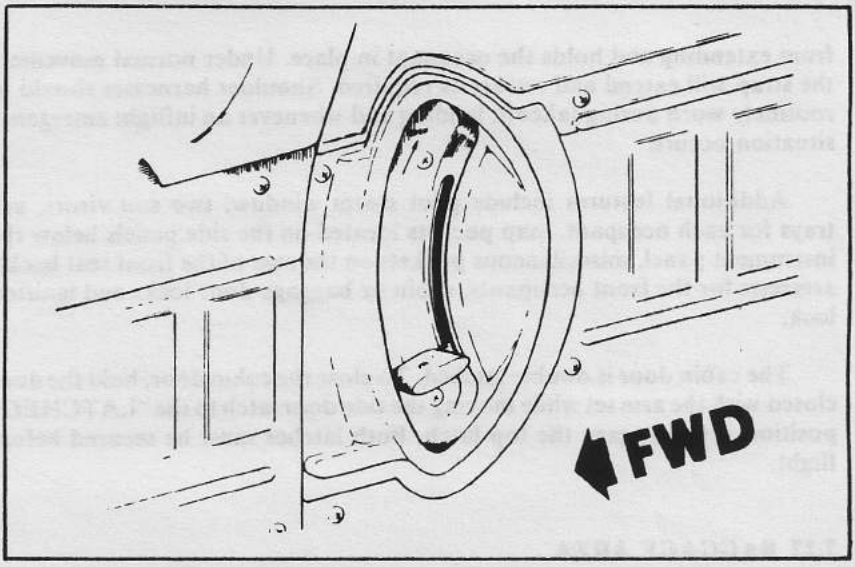
INSTRUMENT PANEL
Figure 7-21

7.23 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 annunciator panel is mounted in the upper instrument panel to warn the pilot of a possible malfunction in the alternator, oil pressure or vacuum systems.



CABIN DOOR LATCH
Figure 7-23

7.25 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 ot 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.

A single strap shoulder harness controlled by an inertial reel, located above the side window, protects each front seat occupant. Optional shoulder straps for the rear occupants are available. 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 inboard hip. 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. 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.

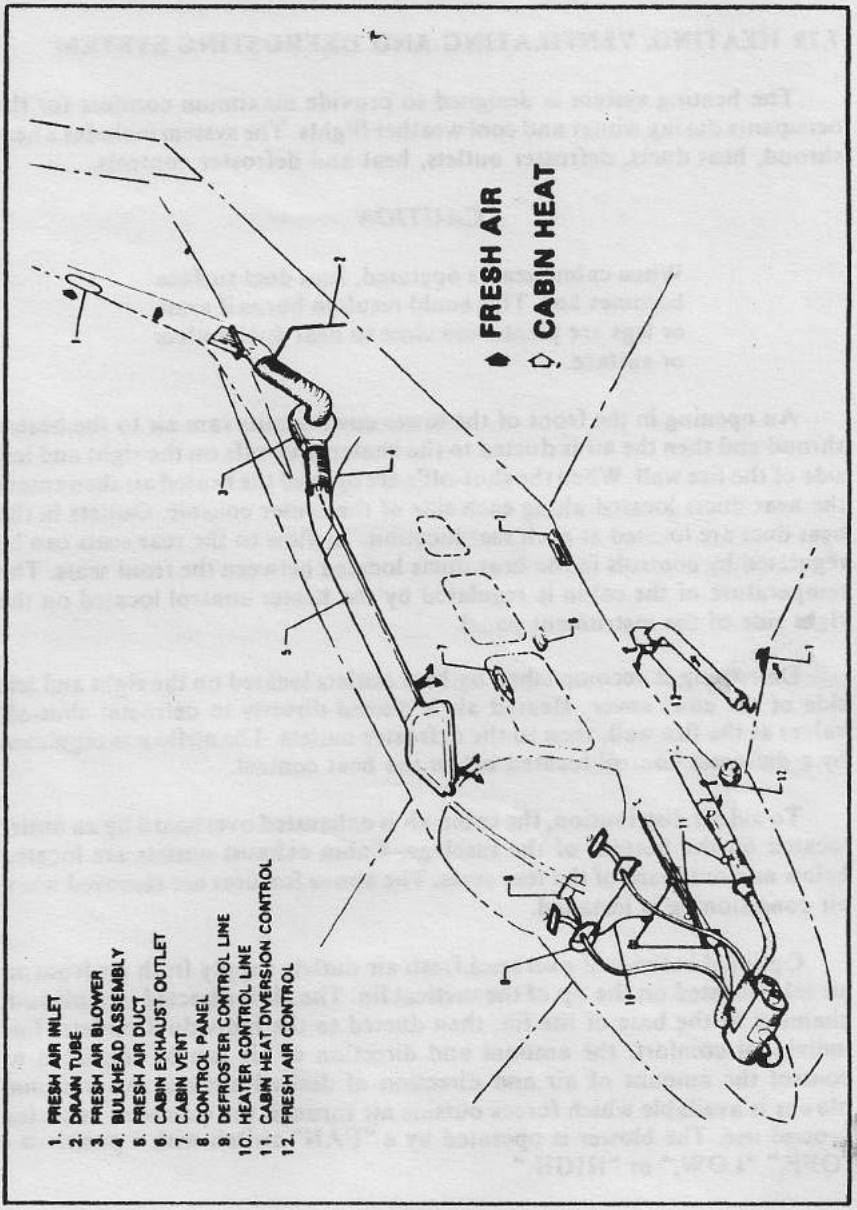
The cabin door is double latched. To close the cabin door, hold the door closed with the arm set while moving the side door latch to the "LATCHED" position. Then engage the top latch. Both latches must be secured before flight.

7.27 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

7.29 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.

Optional individual overhead fresh air outlets supply fresh air from an air inlet located on the tip of the vertical fin. The air is directed to a plenum chamber at the base of the fin, then ducted to the individual outlets. For individual comfort, the amount and direction of air can be regulated to control the amount of air and direction of desired airflow. An optional blower is available which forces outside air through the overhead vents for ground use. The blower is operated by a "FAN" switch with 3 positions - "OFF," "LOW," or "HIGH."

7.31 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.

7.33 FINISH

All exterior surfaces are primed with etching primer and finished with acrylic lacquer. To keep the finish attractive looking, economy size spray cans of touch-up paint are available from Piper Dealers.

7.35 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 front right side of the engine. It has an electric clutch which automatically engages or disengages the compressor to the belt drive system of the compressor.

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.

*Optional equipment

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 the throttle is in the full forward position, it actuates a micro switch which 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 approximately 1/4 inch, the clutch will engage, the scoop will extend, and the system will again supply cool, dry air.

7.37 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 just aft of the fire wall. 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.

7.39 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.

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SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

8.1 GENERAL

This section provides general guidelines relating to the handling, servicing and maintenance of the Arrow IV.

Every owner should stay in close contact with his Piper dealer or distributor and Authorized Piper Service Center to obtain the latest information pertaining to his aircraft and to avail himself of the Piper Aircraft Service Back-up.

Piper Aircraft Corporation takes a continuing interest in having the owner get the most efficient use from his aircraft and keeping it in the best mechanical condition. Consequently, Piper Aircraft from time to time issues Service Bulletins, Service Letters and Service Spares Letters relating to the aircraft.

Service Bulletins are of special importance and should be complied with promptly. These are sent to the latest registered owners, distributors and dealers. Depending on the nature of the bulletin, material and labor allowances may apply, and will be addressed in the body of the Bulletin.

Service Letters deal with product improvements and service hints pertaining to the aircraft. They are sent to dealers, distributors and occasionally (at the factory's discretion) to latest registered owners, so they can properly service the aircraft and keep it up to date with the latest changes. Owners should give careful attention to the Service Letter information.

Service Spares Letters offer improved parts, kits and optional equipment which were not available originally and which may be of interest to the owner.

If an owner is not having his aircraft serviced by an Authorized Piper Service Center, he should periodically check with a Piper dealer or distributor to find out the latest information to keep his aircraft up to date.

Piper Aircraft Corporation has a Subscription Service for the Service Bulletins, Service Letters and Service Spares Letters. This service is offered to interested persons such as owners, pilots and mechanics at a nominal fee, and may be obtained through Piper dealers and distributors.

A service manual, parts catalog, and revisions to both, are available from your Piper dealer or distributor. Any correspondence regarding the airplane should include the airplane model and serial number to insure proper response.

8.3 AIRPLANE INSPECTION PERIODS

The Federal Aviation Administration (FAA) occasionally publishes Airworthiness Directives (ADs) that apply to specific groups of aircraft. They are mandatory changes and are to be complied with within a time limit set by the FAA. When an AD is issued, it is sent to the latest registered owner of the affected aircraft and also to subscribers of the service. The owner should periodically check with his Piper dealer or A & P mechanic to see whether he has the latest issued AD against his aircraft.

Piper Aircraft Corporation provides for the initial and first 50-hour inspection, at no charge to the owner. The Owner Service Agreement which the owner receives upon delivery of the aircraft should be kept in the aircraft at all times. This identifies him to authorized Piper dealers and entitles the owner to receive service in accordance with the regular service agreement terms. This agreement also entitles the transient owner full warranty by any Piper dealer in the world.

One hundred hour inspections are required by law if the aircraft is used commercially. Otherwise this inspection is left to the discretion of the owner. This inspection is a complete check of the aircraft and its systems, and should be accomplished by a Piper Authorized Service Center or by a qualified aircraft and power plant mechanic who owns or works for a reputable repair shop. The inspection is listed, in detail, in the inspection report of the appropriate Service Manual.

An annual inspection is required once a year to keep the Airworthiness Certificate in effect. It is the same as a 100-hour inspection except that it must be signed by an Inspection Authorized (IA) mechanic or a General Aviation District Office (GADO) representative. This inspection is required whether the aircraft is operated commercially or for pleasure.

A Progressive Maintenance program is approved by the FAA and is available to the owner. It involves routine and detailed inspections at 50-hour intervals. The purpose of the program is to allow maximum utilization of the aircraft, to reduce maintenance inspection cost and to maintain a maximum standard of continuous airworthiness. Complete details are available from Piper dealers.

A spectographic analysis of the oil is available from several sources. This system, if used intelligently, provides a good check of the internal condition of the engine. For this system to be accurate, oil samples must be sent in at regular intervals, and induction air filters must be cleaned or changed regularly.

8.5 PREVENTIVE MAINTENANCE

The holder of a Pilot Certificate issued under FAR Part 61 may perform certain preventive maintenance described in FAR Part 43. This maintenance may be performed only on an aircraft which the pilot owns or operates and which is not used in air carrier service. The following is a list of the maintenance which the pilot may perform:

(a) Repair or change tires and tubes.
(b) Service landing gear wheel bearings, such as cleaning, greasing or replacing.
(c) Service landing gear shock struts by adding air, oil or both.
(d) Replace defective safety wire and cotter keys.
(e) Lubrication not requiring disassembly other than removal of non-structural items such as cover plates, cowling or fairings.
(f) Replenish hydraulic fluid in the hydraulic reservoirs.
(g) Refinish the exterior or interior of the aircraft (excluding balanced control surfaces) when removal or disassembly of any primary structure or operating system is not required.
(h) Replace side windows and safety belts.

(i) Replace seats or seat parts with replacement parts approved for the aircraft.
(j) Replace bulbs, reflectors and lenses of position and landing lights.
(k) Replace cowling not requiring removal of the propeller.
(l) Replace, clean or set spark plug clearance.
(m) Replace any hose connection, except hydraulic connections, with replacement hoses.
(n) Replace prefabricated fuel lines.
(o) Replace the battery and check fluid level and specific gravity.

Although the above work is allowed by law, each individual should make a self analysis as to whether he has the ability to perform the work.

If the above work is accomplished, an entry must be made in the appropriate logbook. The entry should contain:
(a) The date the work was accomplished.
(b) Description of the work.
(c) Number of hours on the aircraft.
(d) The certificate number of pilot performing the work.
(e) Signature of the individual doing the work.

8.7 AIRPLANE ALTERATIONS

If the owner desires to have his aircraft modified, he must obtain FAA approval for the alteration. Major alterations accomplished in accordance with Advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic airframe or systems not covered by AC 43.13-2 require a Supplemental Type Certificate.

The owner or pilot is required to ascertain that the following Aircraft Papers are in order and in the aircraft.
(a) To be displayed in the aircraft at all times:
(1) Aircraft Airworthiness Certificate Form FAA-8100-2.
(2) Aircraft Registration Certificate Form FAA-8050-3.
(3) Aircraft Radio Station License if transmitters are installed.

(b) To be carried in the aircraft at all times:
(1) Pilot's Operating Handbook.
(2) Weight and Balance data plus a copy of the latest Repair and Alteration Form FAA-337, if applicable.
(3) Aircraft equipment list.

Although the aircraft and engine logbooks are not required to be in the aircraft, they should be made available upon request. Logbooks should be complete and up to date. Good records will reduce maintenance cost by giving the mechanic information about what has or has not been accomplished.

8.9 GROUND HANDLING

(a) Towing

The airplane may be moved on the ground by the use of the nose wheel steering bar that is stowed in the rear baggage compartment or by power equipment that will not damage or excessively strain the nose gear steering assembly. The steering bar is engaged by inserting it into the nose wheel axle.

CAUTION

When towing with power equipment, do not turn the nose gear beyond its steering radius in either direction, as this will result in damage to the nose gear and steering mechanism.

CAUTION

Do not tow the airplane when the controls are secured.

In the event towing lines are necessary, ropes should be attached to both main gear struts as high up on the tubes as possible. Lines should be long enough to clear the nose and/or tail by not less than fifteen feet, and a qualified person should ride in the pilot's seat to maintain control by use of the brakes.

(b) Taxiing

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Engine starting and shut-down procedures as well as taxi techniques should be covered. When it is ascertained that the propeller back blast and taxi areas are clear, power should be applied to start the taxi roll, and the following checks should be performed:

(1) Taxi a few feet forward and apply the brakes to determine their effectiveness.
(2) Taxi with the propeller set in low pitch, high RPM setting.
(3) While taxiing, make slight turns to ascertain the effectiveness of the steering.
(4) Observe wing clearance when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.
(5) When taxiing over uneven ground, avoid holes and ruts.
(6) 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.

(c) Parking

When parking the airplane, be sure that it is sufficiently protected from adverse weather conditions and that it presents no danger to other aircraft. When parking the airplane for any length of time or overnight, it is suggested that it be moored securely.

(1) To park the airplane, head it into the wind if possible.
(2) Set the parking brake by pulling back on the brake lever and depressing the knob on the handle. To release the parking brake, pull back on the handle until the catch disengages; then allow the handle to swing forward.

CAUTION

Care should be taken when setting brakes that are overheated or during cold weather when accumulated moisture may freeze a brake.

(3) Aileron and stabilator controls should be secured with the front seat belt and chocks used to properly block the wheels.

(d) Mooring

The airplane should be moored for immovability, security and protection. The following procedures should be used for the proper mooring of the airplane:

(1) Head the airplane into the wind if possible.
(2) Retract the flaps.
(3) Immobilize the ailerons and stabilator by looping the seat belt through the control wheel and pulling it snug.
(4) Block the wheels.
(5) Secure tie-down ropes to the wing tie-down rings and to the tail skid at approximately 45 degree angles to the ground. When using rope of non-synthetic material, leave sufficient slack to avoid damage to the airplane should the ropes contract.

CAUTION

Use bowline knots, square knots or locked slip knots. Do not use plain slip knots.

NOTE

Additional preparations for high winds include using tie-down ropes from the landing gear forks and securing the rudder.

(6) Install a pitot head cover if available. Be sure to remove the pitot head cover before flight.
(7) Cabin and baggage doors should be locked when the airplane is unattended.

8.11 ENGINE AIR FILTER

(a) Removing Engine Air Filter

(1) Remove the upper cowl.
(2) Remove the wing nuts securing the filter box cover. Remove the filter.

(b) Cleaning Engine Air Filter

The induction air filter must be cleaned at least once every 50 hours, and more often, even daily, when operating in dusty conditions. Extra filters are inexpensive, and a spare should be kept on hand for use as a rapid replacement.

To clean the filter:
(1) Tap the filter gently to remove dirt particles, being careful not to damage the filter. DO NOT wash the filter in any liquid. DO NOT attempt to blow out dirt with compressed air.
(2) If the filter is excessively dirty or shows any damage, replace it immediately.
(3) Wipe the filter housing with a clean cloth soaked in unleaded gasoline. When the housing is clean and dry, install the filter.

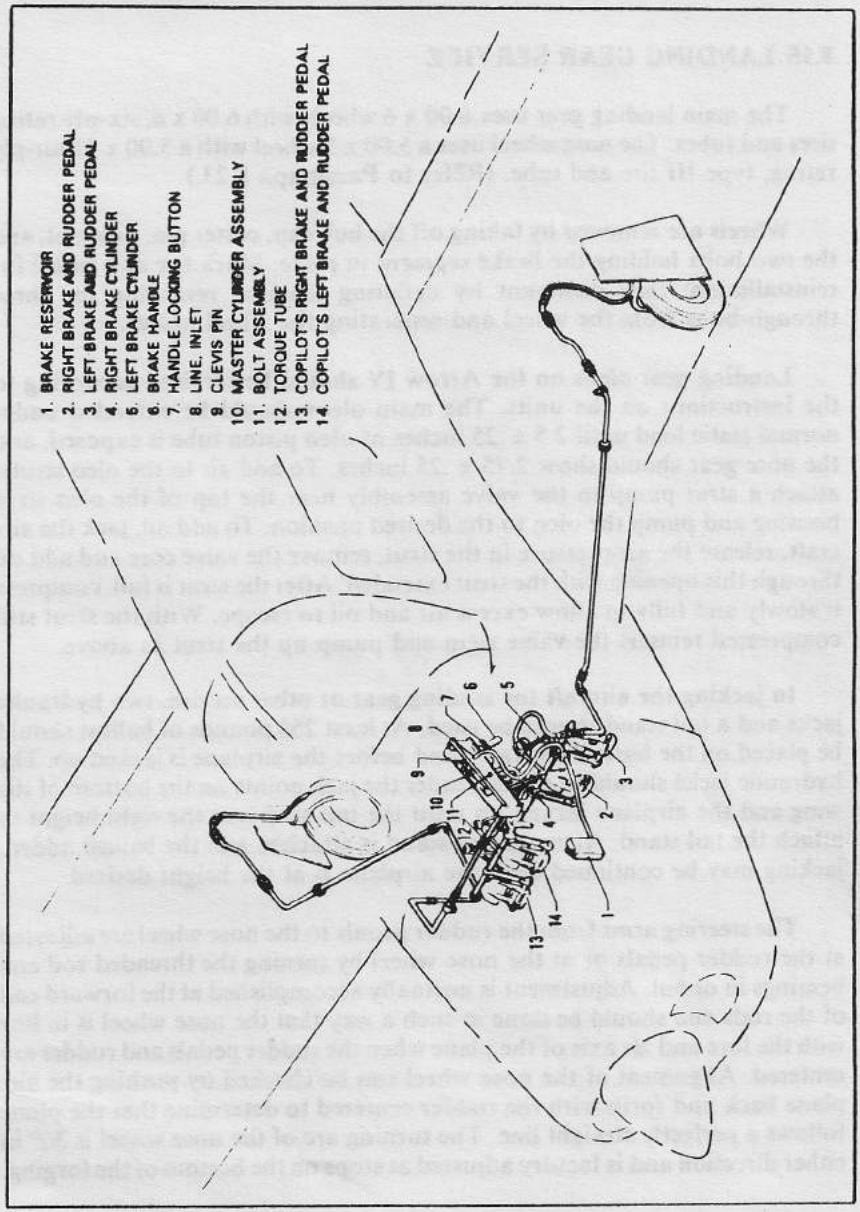
(c) Installation of Engine Air Filter

After cleaning or when replacing the filter, install the filter in the reverse order of removal.

8.13 BRAKE SERVICE

The brake system is filled with MIL-H-5606 (petroleum base) hydraulic brake fluid. The fluid level should be checked periodically or at every 100-hour inspection and replenished when necessary. The brake reservoir is located on the left side of the fire wall in the engine compartment. If the entire system must be refilled, fill with fluid under pressure from the brake end of the system. This will eliminate air from the system.

No adjustment of the brake clearances is necessary. If after extended service brake blocks become excessively worn, they should be replaced with new segments.



BRAKE SYSTEM
Figure 8-1

8.15 LANDING GEAR SERVICE

The main landing gear uses 6.00 x 6 wheels with 6.00 x 6, six-ply rating tires and tubes. The nose wheel uses a 5.00 x 5 wheel with a 5.00 x 5 four-ply rating, type III tire and tube. (Refer to Paragraph 8.23.)

Wheels are removed by taking off the hub cap, cotter pin, axle nut, and the two bolts holding the brake segment in place. Mark tire and wheel for reinstallation; then dismount by deflating the tire, removing the three through-bolts from the wheel and separating the wheel halves.

Landing gear oleos on the Arrow IV should be serviced according to the instructions on the units. The main oleos should be extended under normal static load until 2.5 ± .25 inches of oleo piston tube is exposed, and the nose gear should show 2.75 ± .25 inches. To add air to the oleo struts, attach a strut pump to the valve assembly near the top of the oleo strut housing and pump the oleo to the desired position. To add oil, jack the aircraft, release the air pressure in the strut, remove the valve core and add oil through this opening with the strut extended. After the strut is full, compress it slowly and fully to allow excess air and oil to escape. With the strut still compressed reinsert the valve stem and pump up the strut as above.

In jacking the aircraft for landing gear or other service, two hydraulic jacks and a tail stand should be used. At least 250 pounds of ballast should be placed on the base of the tail stand before the airplane is jacked up. The hydraulic jacks should be placed under the jack points on the bottom of the wing and the airplane jacked up until the tail skid is at the right height to attach the tail stand. After the tail stand is attached and the ballast added, jacking may be continued until the airplane is at the height desired.

The steering arms from the rudder pedals to the nose wheel are adjusted at the rudder pedals or at the nose wheel by turning the threaded rod end bearings in or out. Adjustment is normally accomplished at the forward end of the rods and should be done in such a way that the nose wheel is in line with the fore and aft axis of the plane when the rudder pedals and rudder are centered. Alignment of the nose wheel can be checked by pushing the airplane back and forth with the rudder centered to determine that the plane follows a perfectly straight line. The turning arc of the nose wheel is 30° in either direction and is factory adjusted at stops on the bottom of the forging.

8.17 PROPELLER SERVICE

The spinner and backing plate should be cleaned and inspected for cracks frequently. Before each flight the propeller should be inspected for nicks, scratches, and corrosion. If found, they should be repaired as soon as possible by a rated mechanic, since a nick or scratch causes an area of increased stress which can lead to serious cracks or the loss of a propeller tip. The back face of the blades should be painted when necessary with flat black paint to retard glare. To prevent corrosion, the surface should be cleaned and waxed periodically.

8.19 OIL REQUIREMENTS

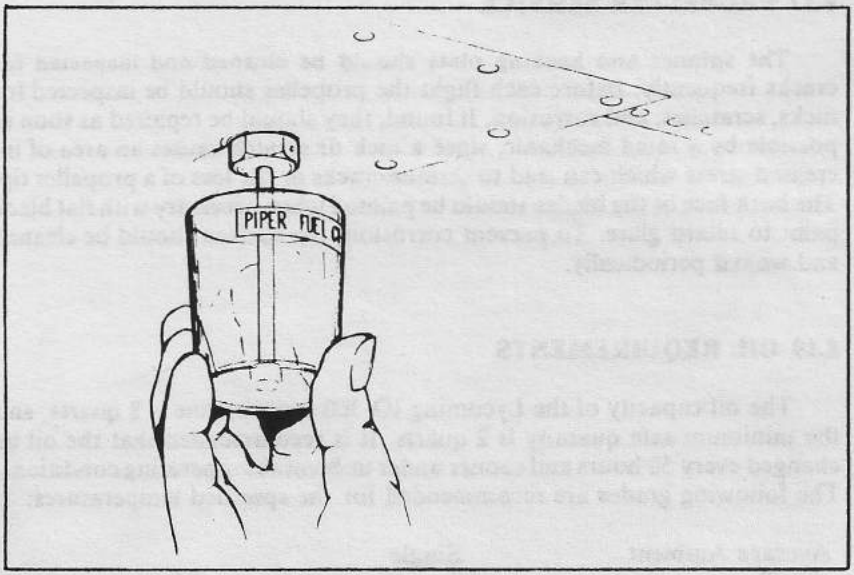
The oil capacity of the Lycoming IO-360 series engine is 8 quarts, and the minimum safe quantity is 2 quarts. It is recommended that the oil be changed every 50 hours and sooner under unfavorable operating conditions. The following grades are recommended for the specified temperatures:

Average Ambient Air Temperature For Starting	Single Viscosity Grade	Multi-Viscosity Grades
Above 60°F	SAE 50	SAE 40 or SAE 50
30° to 90°F	SAE 40	SAE 40
0° to 70°F	SAE 30	SAE 40 or 20W-30
Below 10°F	SAE 20	SAE 20W-30

8.21 FUEL SYSTEM

(a) Servicing Fuel System

At every 50-hour inspection, the fuel screen in the strainer must be cleaned. The fuel strainer is located on the forward left lower side of the fire wall. It is accessible by removing the lower cowling. After cleaning, a small amount of grease applied to the gasket will facilitate reassembly.



FUEL DRAIN
Figure 8-3

(b) Fuel Requirements

Aviation grade fuel with a minimum octane of 100/130 is specified for this airplane. Since the use of lower grades can cause serious engine damage in a short period of time, the engine warranty is invalidated by the use of lower octanes. Refer to latest issue of Lycoming Service Instruction 1070 for approved alternate grade fuels.

(c) Filling Fuel Tanks

Observe all safety precautions required when handling gasoline. Fill the fuel tanks through the filler located on the forward slope of the wing. Each wing holds a maximum of 38.5 U.S. gallons. When using less than the standard 77 gallon capacity, fuel should be distributed equally between each side.

(d) Draining Fuel Strainer, Sumps and Lines

The fuel strainer, located on the lower left side of the fire wall, is provided with a quick drain which should be drained before the first flight of the day or after refueling, to check for fuel contamination. If contamination is found, fuel should be drained until the contamination stops. If contamination persists after draining fuel for a minute, contact a mechanic to check the fuel system.

Each fuel tank is provided with a fuel quick drain to check for contamination. Each tank should be checked for contamination in accordance with the above procedure.

(e) Draining Fuel System

The bulk of the fuel may be drained from the fuel cells by the use of a siphon hose placed in the cell or tank through the filler neck. The remainder of the fuel may be drained by opening all the drain valves.

CAUTION

When draining fuel, be sure that no fire hazard exists before starting the engine.

8.23 TIRE INFLATION

For maximum service from the tires, keep them inflated to the proper pressure of 27 psi for nose tire and 30 psi for main tires. All wheels and tires are balanced before original installation, and the relationship of tire, tube and wheel should be maintained upon reinstallation. In the installation of new components, it may be necessary to rebalance the wheels with the tires mounted. Unbalanced wheels can cause extreme vibration in the landing gear. When checking tire pressure, examine the tires for wear, cuts, bruises and slippage.

8.25 BATTERY SERVICE

Access to the 12-volt battery is gained by removing the upper cowl. It is mounted to the forward right side on the face of the fire wall. The battery container has a plastic drain tube which is normally closed off with a cap. The cap should be opened periodically to remove battery acid which may have collected in the tube.

The battery fluid level must not be brought above the baffle plates. It should be checked every 30 days to determine that the fluid level is proper and the connections are tight and free of corrosion. Do not fill the battery with acid - use water only.

If the battery is not properly charged, recharge it starting with a rate of four amperes and finishing with a rate of two amperes. The battery should be removed from the airplane for charging, and quick charges are not recommended.

The external power receptacle, if installed, is located on the right side of the fuselage just aft of the fire wall.

Refer to the Arrow IV Service Manual for battery servicing procedure.

8.27 CLEANING

(a) Cleaning Engine Compartment

Before cleaning the engine compartment, place a strip of tape on the magneto vents to prevent any solvent from entering these units.

(1) Place a large pan under the engine to catch waste.

(2) With the engine cowling removed, spray or brush the engine with solvent or a mixture of solvent and degreaser. In order to remove especially heavy dirt and grease deposits, it may be necessary to brush areas that were sprayed.

CAUTION

Do not spray solvent into the alternator, vacuum pump, starter, or air intakes.

(3) Allow the solvent to remain on the engine from five to ten minutes. Then rinse the engine clean with additional solvent and allow it to dry.

CAUTION

Do not operate the engine until excess solvent has evaporated or otherwise been removed.

(4) Remove the protective tape from the magnetos.
(5) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart.

(b) Cleaning Landing Gear

Before cleaning the landing gear, place a plastic cover or similar material over the wheel and brake assembly.

(1) Place a pan under the gear to catch waste.
(2) Spray or brush the gear area with solvent or a mixture of solvent and degreaser, as desired. Where heavy grease and dirt deposits have collected, it may be necessary to brush areas that were sprayed, in order to clean them.
(3) Allow the solvent to remain on the gear from five to ten minutes. Then rinse the gear with additional solvent and allow to dry.
(4) Remove the cover from the wheel and remove the catch pan.
(5) Lubricate the gear in accordance with the Lubrication Chart.
(6) Caution: Do not brush the micro switches.

(c) Cleaning Exterior Surfaces

The airplane should be washed with a mild soap and water. Harsh abrasives or alkaline soaps or detergents could make scratches on painted or plastic sufaces or could cause corrosion of metal. Cover areas where cleaning solution could cause damage. To wash the airplane, use the following procedure:

(1) Flush away loose dirt with water.
(2) Apply cleaning solution with a soft cloth, a sponge or a soft bristle brush.
(3) To remove exhaust stains, allow the solution to remain on the surface longer.

(4) To remove stubborn oil and grease, use a cloth dampened with naphtha.
(5) Rinse all surfaces thoroughly.
(6) Any good automotive wax may be used to preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas.

(d) Cleaning Windshield and Windows

(1) Remove dirt, mud and other loose particles from exterior surfaces with clean water.
(2) Wash with mild soap and warm water or with aircraft plastic cleaner. Use a soft cloth or sponge in a straight back and forth motion. Do not rub harshly.
(3) Remove oil and grease with a cloth moistened with kerosene.

CAUTION

Do not use gasoline, alcohol, benzene, carbon tetrachloride, thinner, acetone, or window cleaning sprays.

(4) After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.
(5) A severe scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge. Smooth both sides and apply wax.

(e) Cleaning Headliner, Side Panels and Seats

(1) Clean headliner, side panels, and seats with a stiff bristle brush, and vacuum where necessary.
(2) Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. Carefully follow the manufacturer's instructions. Avoid soaking or harsh rubbing.

CAUTION

Solvent cleaners require adequate ventilation.

(3) Leather should be cleaned with saddle soap or a mild hand soap and water.

(f) Cleaning Carpets

To clean carpets, first remove loose dirt with a whisk broom or vacuum. For soiled spots and stubborn stains use a noninflammable dry cleaning fluid. Floor carpets may be cleaned like any household carpet.

8.29 WINTERIZATION

For winter operation a winterization kit is installed on the inlet opening of the oil cooler outboard chamber of the plenum chamber. This kit should be installed whenever the ambient temperature is 50° F or less. When the kit is not being used it can be stowed on the bracket provided for this purpose on the top side of the oil cooler plenum chamber.