National Defence / Défense nationale

A-CR-CCP-402/MB-001

OPERATING MANUAL

AIR CADET GLIDING PROGRAM
CESSNA 182
AIRCRAFT OPERATING INSTRUCTIONS

ENGLISH

Supersedes: October 2015 Version 7

Issued by the Commander Royal Canadian Air Force under the authority of the Chief of Defense Staff

OPI: 2 Canadian Air Division / Director Air Force Training **2017-01-31**

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FOREWORD

1. A-CR-CCP-402/MB-001 ACGP Cessna C182 Aircraft Operating Instructions is issued by the Commander RCAF under the authority of the CDS.

2. This publication is effective on receipt and supersedes all previous editions and amendments, which are to be withdrawn and destroyed.

3. Comments and suggestions should be forwarded through the appropriate Regional Chain of Command to the NCA Ops O at NATL CJCR SP GP, info 2 CDN AIR DIV / Dir AF Trg / ACGPSET.

4. The Cessna Pilot Operating Handbook is the legal controlling document that must be carried on board the aircraft during flight. There is no need to carry the AOIs in the aircraft. For the list of documents used to compile these AOIs, refer to LIST OF REFERENCES.

5. All speeds are IAS unless indicated otherwise.

6. Note, Caution, and Warning headings in this manual are defined as follows:

NOTE

To point out a procedure, event or practice which it is desired or essential to highlight.

CAUTION

To emphasize operating procedures, practices, etc., which, if not correctly followed, could result in damage to or destruction of equipment.

WARNING

To emphasize operating procedures, practices, etc., which, if not correctly followed, could result in personal injury or loss of life.

Contact Officer: OC ACGPSET, 2 Cdn Air Div / Dir AF Trg

RECORD OF AMENDMENTS

The portion of the text affected by the latest change is indicated by a black vertical line (**I**) in the margin of the page.

The date of issue of original and amendment list pages are contained in the following figure:

Version Number	Revision Date	Change	Amendments Entered	
			Date	Entered By
1.0	15 Jan 10	Draft - Provisional Operational Airworthiness Clearance (POAC)	N/A	N/A
2.0	01 Feb 10	Revised Draft –for review only	N/A	N/A
3.0	01 Mar 10	Revised Draft – for review only	N/A	N/A
4.0	02 Jun 10	Initial Release – Operational Airworthiness Clearance (OAC)	N/A	N/A
5.0	17 Nov 10	Update and Complete Document Re-Issue	N/A	N/A
5.1	09 Feb 11	Update and Complete Document Re-Issue	N/A	N/A
6.0	27 Jan 12	Update and Complete Document Re-Issue	N/A	N/A
7.0	22 April 15	Update and Complete Document Re-Issue	N/A	N/A
7.0	October 2015	Update of 7.0 following NTA review	N/A	N/A
	Nov 16	Re-release of Version 7.0 - formatted as per RCAF Flight Publication Manual	Nov 16	DOAM - reissue

TEMPORARY REVISIONS INDEX

Temporary Revision No.	Date Inserted	Date Removed	Part/Page/Paragraph Affected

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LIST OF ANNEXES

LIST OF REFERENCES

The following references have been used in the development of these Aircraft Operating Instructions:

Ref:	Details
A	Cessna Model 182P Pilot's Operating Handbook
B	Cessna Model 182 - FAA Type Certificate Data Sheet 3A13 - Revision 69
C	Continental Aircraft Engine Operators Manual, IO520 Series Engines
D	Hartzell Propeller Owner's Manual, Number 115N, Revision 7
E	Continental IO520D / Hartzell Prop for C182P STC No SA00152WI Flight Manual Supplement
F	Trolltune C182 Gross Weight Increase STC No SA03608AT Flight Manual Supplement
G	Airglas Heavy Duty Nose Gear STC SA02069AK Flight Manual Supplement
H	F. Atlee Dodge Dual Calliper Brakes STC No SA02331AK Flight Manual Supplement
I	Heavy Duty Engine Mount, STC No SA01573NY Installation Instructions
J	Sportsman STOL Kit, STC No SA4303WE Installation Instructions
K	ART Wing Extensions STC No SA00276NY Flight Manual Supplement
L	MicroAir Vortex Generators STC No SA00834SE Flight Manual Supplement
M	Rosen Sun Visors STC No SA00871SE Installation Instructions
N	Great Lakes Aero Bubble Windows STC No SA00897CH Flight Manual Supplement
O	Bas Inc Four Point Seat Belts STC No SA2067NM Flight Manual Supplement
P	Seaton Engineering Pulse Light STC SA01861SE Flight Manual Supplement
Q	EDM 930 Pilot's Guide (Rev E)
R	EDM 930 Engine Monitor STC SA01435SE Flight Manual Supplement 930-0001 Rev C
S	Garmin GMA-340 Audio Panel Pilot's Guide
T	Garmin GTX-327 Transponder Pilot's Guide

Ref:	Details
U	Garmin SL40 VHF Transceiver Pilot’s Guide
V	Garmin Aera 500 GPS Pilot’s Guide
W	VAM 28VDC Electrical System STC O-LSA11-217D Flight Manual Supplement
X	VAM Glider Towing Package STC O-LSA12-028D Flight Manual Supplement
Y	Pacific Region Maintenance Policy Manual Chapter 10 – Maintenance Standards
Z	RCA Ops (Pac) Orders and Instructions Volume 4 – Aircraft Maintenance
AA	C182 C-FCGS Evaluation Plan & Results – RCA Ops (Pac)
BB	C182 C-FTUG Evaluation Plan & Results – RCA Ops (Pac)
CC	Aero Twin MLG Gravel Deflectors STC SA02312AK Installation Instructions

ABBREVIATIONS AND ACRONYMS

Terminology	Details
AOI	Aircraft Operating Instructions – The CF approved manual governing operation of the aircraft
Basic Empty Weight	Empty weight of the aircraft, including un-useable fuel and any standard equipment
BHP	Brake Horsepower – the total power developed by the engine
CAS	Calibrated Airspeed – IAS corrected for position and instrument error
CG	Centre of Gravity – the balance point of the aircraft
CHT	Cylinder Head Temperature – the measured temperature of an individual cylinder head
DA	Density Altitude – altitude corrected for pressure and temperature variations
Demonstrated Crosswind	Maximum crosswind for which adequate control on takeoff and landing was demonstrated during certification tests
EGT	Exhaust Gas Temperature – the measured temperature of the exhaust gas, normally at the cylinder exhaust manifold
FACU	Fuel-Air Control Unit
GPH	Gallons Per Hour – fuel consumption rate
Gross Weight	The loaded weight of the aircraft
ICO	Idle Cut-Off – the mixture setting at which combustion at idle power is no longer sustainable
IAS	Indicated Airspeed – airspeed as displayed on the airspeed indicator
ISA	International Standard Atmosphere – SL conditions 15 deg C, alt setting 29.92 in-Hg, standard lapse rates
KCAS	Knots Calibrated Airspeed
KIAS	Knots Indicated Airspeed
KTAS	Knots True Airspeed

Terminology	Details
Max Ramp Weight	Maximum allowable loaded weight of the aircraft on the ground
Max Takeoff Weight	Maximum allowable loaded weight of the aircraft at the start of the takeoff run
Max Landing Weight	Maximum allowable loaded weight of the aircraft at landing touchdown
Max Rated Power	The maximum power at which the engine can be operated under any conditions, usually for a specified / limited time
Max Continuous Power	The maximum power at which the engine can be operated on a continuous basis
MAP	Manifold Pressure – pressure measured in the engine air induction system
MP	Manifold Pressure – alternate abbreviation for MAP
MSL	Mean Sea Level
OAT	Outside Air Temperature – free static air temperature
PA	Pressure Altitude – the altitude displayed when the altimeter subscale is set to 29.92 in-Hg
RAD	Remote Auxiliary Display – a secondary display of the EDM930 engine monitoring system
RPM	Revolutions Per Minute – rotational speed of the propeller
SHP	Shaft Horsepower – the power delivered to propeller, which is BHP less power to drive accessories and power losses
SL	Sea Level
STC	Supplemental Type Certificate – the basis of certification for approved major aircraft modifications
STOL	Short Takeoff and Landing
TAS	True Airspeed – CAS corrected for altitude and temperature variations
Useable Fuel	Fuel that can be consumed in flight and is available for flight planning purposes

Un-useable Fuel	Fuel that cannot safely be consumed in flight, and cannot be considered available for flight planning purposes
Useful Load	The difference between maximum takeoff weight and the basic empty weight
%HP	The current power output of the engine, expressed as a percentage of the maximum rated horsepower
V_{NE}	Never Exceed Speed – airspeed that is not to be exceeded at any time
V_{NO}	Maximum Normal Operating Speed – the speed which should not be exceeded except in smooth air
V_A	Manoeuvring Speed – the maximum speed at which you may use full, abrupt control deflection
V_{FE}	Maximum Speed with Flaps Extended – maximum permissible speed at the prescribed flap position
V_S	Stalling Speed, Flaps Up – the airspeed at which the airplane stalls, or minimum controllable airspeed
V_{SO}	Stalling Speed in Landing Configuration – the stalling airspeed in the landing configuration, most forward CG
V_X	Best Angle of Climb Speed – airspeed which gives the greatest altitude gain for horizontal distance travelled
V_Y	Best Rate of Climb Speed – airspeed which gives the greatest altitude gain in a given time

PART 1 – GENERAL DESCRIPTION

GENERAL

1. The Cessna 182 is a four-place, single engine, high-wing monoplane of all metal semi-monocoque construction with fixed, tricycle landing gear.

2. The aircraft employed by the Air Cadet Gliding Program (ACGP) are highly modified for glider towing operations. The following major modifications have been incorporated in accordance with a Supplemental Type Certificate (STC):

Item Description	STC Holder	STC Number
Continental IO-520 D engine and Hartzell PHC-L3YF-1RF Prop	Air Plains	SA00152WI
Heavy duty engine mount	Seaplanes West	SA01573NY
STOL kit – leading edge cuffs on wings	Stene Aviation Inc	SA4303WE
Wing X kit for reinforcement of wings and installation of wing tip extensions	Air Research Technology Inc.	SA00276NY
Vortex Generator Kit	Micro AeroDynamics	SA00834SE
Heavy Duty Nose Landing Gear	Airglas Inc.	SA02069AK
Sun Visors	Rosen Sunvisor Systems	SA00871SE
Brackett Air Filter	Brackett	SA71GL
EDM 930 Engine Management System	JP Instrument	SA01435SE
Flap Roller Kit	McFarlane Aviation	SA01074WI
RMD HID Pulse Lights for Modified Wingtip	RMD	SA4337NM
Bubble Door Windows	Great Lakes Aero Products	SA00897CH
Landing Light Controller	Seaton Engineering	SA01861SE
Gross Weight Increase to 3100 lbs	Trolltune Corp	SA03608AT
TSO Front Seat Belts - 4 point with rotary buckle and non-lockable inertia reel	Bas Inc	SA2067NM
Heavy Duty Dual Caliper Brakes	F. Atlee Dodge Aviation	SA02331AK
28VDC Electrical System	Victoria Air Maintenance	O-LSA11-217D
ACGP Tow Modifications (tow hook, release mechanism, and mirrors)	Victoria Air Maintenance	O-LSA12-028D
Main Landing Gear Gravel Deflectors	Aero Twin	SA02312AK

Figure 1-1 STC List

PHYSICAL CHARACTERISTICS

3. Key physical characteristics of the aircraft are detailed below.

Aircraft Dimensions and Weights

Length	28' 6.5"	8.72m
Wingspan	39' 7"	12.1m
Height (rudder)	8' 0" ± 6"	2.4m ± 0.152m
Height (prop)	8' 2" ± 2"	2.5m ± 0.05m
Prop diameter	78"	2.03m
Prop ground clearance	18" ± 2"	0.46m ± 0.05m
Length	28' 6.5"	8.72m
Maximum Ramp Weight	3110 lbs	
Maximum Takeoff Weight	3100 lbs	
Maximum Landing Weight	2950 lbs	
Basic Empty Weight	Approximately 1850 lbs	
Useful Load	Approximately 1250 lbs	

Figure 1-2 Dimensions and Weight

Fuel Tank Capacities

	Total Fuel			**Useable Fuel**		
	USG	Litres	Pounds	USG	Litres	Pounds
Left Tank	40	151	240	37.5	142	225
Right Tank	40	151	240	37.5	142	225
TOTAL	80	303	480	75	284	450

Figure 1-3 Fuel Tank Capacities

CAUTION

Only 100LL AVGAS shall be used.

Oil Capacity

	US Quarts	**Litres**	**Weight – lbs**
Total capacity	12	11.4	22.2
Minimum for takeoff	9	8.5	17.5

Figure 1-4 Oil Capacity

CAUTION

Refer to the Aircraft Journey Log to confirm the type and grade of oil in use.

AIRFRAME

Fuselage

4. The fuselage is a conventional, formed sheet metal semi-monocoque structure constructed with bulkheads, formers, stringers, and stressed skin. Major components include the following:

a. front and rear wing carry-through spars in the upper cabin area to which the wings are attached;

b. a bulkhead incorporating the rear door posts, which includes forgings at the base of the rear door posts for attachment of the main landing gear;

c. a bulkhead incorporating the front door posts, which includes fittings for attachment of the wing struts;

d. four engine mount stringers connecting the forward door posts / bulkhead to the engine firewall; and

e. a stainless steel engine firewall, which provides a fire barrier between the engine compartment and the cabin, and is also a major structural component for attachment of the engine mounts and the nose landing gear.

Figure 1-5 C182 Airframe

Wings

5. The wings are externally braced cantilever wings attached to the fuselage at the wing carry through spars. The wing structure is conventional with spars, ribs, and stressed skin. Major components include the following:

a. the front spar, which provides bending strength / stiffness;

b. the rear spar, which provides torsional strength / stiffness, and provides structure for attachment of the flaps and ailerons;

c. the strut, which enhances bending strength / stiffness; and

d. conventional ailerons and single slotted flaps, attached to the training edge of the wings.

6. The wings have been extensively modified to enhance performance at the reduced airspeeds associated with glider towing operations. These modifications reduce stalling speed, increase lift coefficient, improve slow speed aileron response, and reduce takeoff roll. These modifications include:

a. leading edge cuffs (Stene Aviation Sportsman STOL Kit);

b. wingtip extensions (Air Research Technology Wing-X STOL); and

c. vortex generators (Micro Aerodynamics).

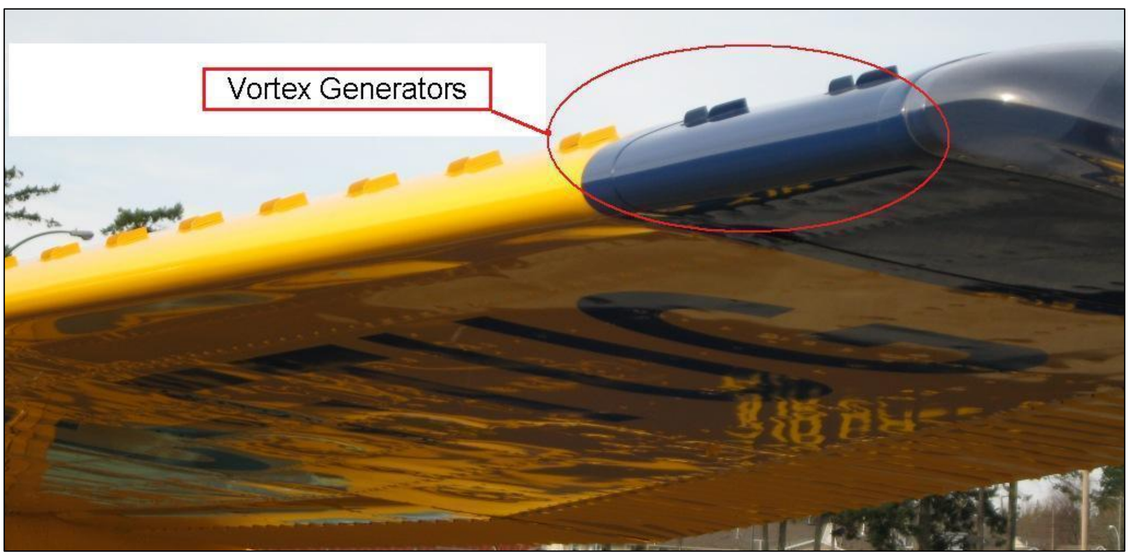


Figure 1-6 Wing Vortex Generators

Empennage

7. The empennage is of conventional configuration and all metal construction with the following characteristics:

a. an elevator trim tab located on the right hand elevator;

b. rudder trim which adjusts the neutral position of the rudder;

c. vortex generators applied to the lower trailing edge of the horizontal stabilizer to enhance low speed pitch control;

d. vortex generators applied to the trailing edge of the vertical stabilizer to enhance low speed directional control; and

e. horn style balance weights on both the rudder and elevator.

Figure 1-7 Tail Vortex Generators

Windshield and Windows

8. The windshield and windows are single piece acrylic plastic panels. Domed bubble windows have been fitted to the doors for enhanced visibility. The left hand door window opens and is secured by two rotating latches.

CAUTION

Do not exceed 120 MPH IAS with bubble window open.

CAUTION

To avoid scratching the windshield, never place headsets on the glare shield, and never hang headsets from the V-brace. .

CAUTION

To avoid scratching and / or crazing the windshield and windows, use only cleaning products certified for use on acrylic plastic. Apply lightly with a micro-fibre or flannel cloth. Never use paper towels.

9. The forward windshield is equipped with a fully articulating glare shield at both the pilot and co-pilot positions to enhance pilot visibility when cruising directly into bright sunlight conditions.

Figure 1-8 Glare Shield

CAUTION

To avoid scratching the windshield, care should be taken when repositioning the articulating glare shield.

Cabin Doors

10. The aircraft is fitted with left and right cabin doors, each equipped with:

a. a recessed exterior door handle to open the door from the outside;

a. an interior door handle used to pull the door closed from the inside;

b. an interior latch handle to lock and unlock the door from the inside; and

c. a bubble window.

Figure 1-9 Door Exterior and Interior

11. Due to configuration differences between model years, there are two configurations of interior latch handles in use on the C182 fleet:

a. Rotary Style Latch Handle. Tug 1, 5 and 6 are equipped with a rotary style latch handle shown below:

Figure 1-10 Rotary Latch Handle

b. Paddle Style Latch Handle. Tug 2 and Tug 3 are equipped with a paddle style latch handle shown below:

Figure 1-11 Paddle Latch Handle

CAUTION

Both cabin doors must be locked prior to takeoff.

Doors shall be pulled closed only using the D-shaped door handle. Latch handles shall not be used for pulling doors closed as they are not designed to withstand the required force.

The latch handle shall not be moved until after the door has been pulled closed. Doing so often results in inadvertent extension of the latch bolt causing it to strike and damage the aircraft exterior skin and paint.

Front Seats

12. Both pilot seats are fully articulating:

a. the seat is positioned fore / aft by lifting the tubular handle under the centre of the seat bottom. Slide the seat into position, release the lever and ensure that the locking pins are engaged on the seat track;

b. the seat height is adjusted up / down by rotating the large crank handle located on the inboard lower corner of the seat. If additional upward adjustment is required for proper visibility over the nose, an approved and properly secured seat cushion may be used;

c. the seat back angle is adjusted with the small crank handle on the outboard lower corner of the seat. The seat bottom angle changes with the back angle;

d. both seat backs may be folded forward for easier access to the rear cabin; and

e. a safety strap and locking reel is provided under the pilot's seat to prevent inadvertent rearward movement under acceleration should the seat locking pins fail.

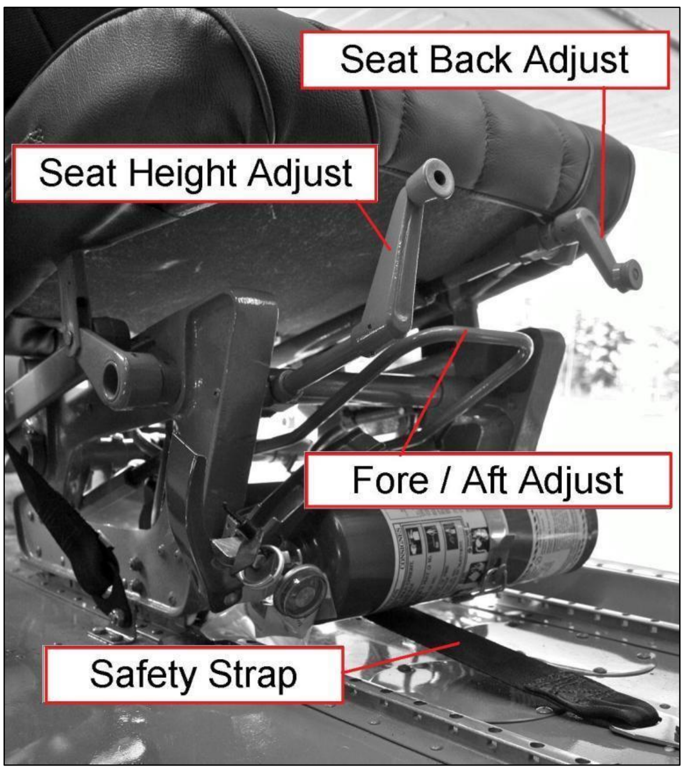


Figure 1-12 Seat Controls

Rear Seats

13. Rear passenger seats consist of a fixed one-piece seat bottom with individually adjustable seat backs. To adjust either seat back, lift the adjustment lever on the outside bottom corner of the seat back and reposition the seat back. Seat backs should not be adjusted in flight.

Seat Harnesses

14. The pilot seats are equipped with a four point harness with a rotary buckle and non-lockable inertia reel on the shoulder harnesses. The rear seats are equipped with a three point harness with a non-lockable inertia reel on the shoulder harness.

Baggage Compartment

15. A baggage compartment is located behind the rear seats. Cargo tie-down rings are provided to secure items in the compartment. Refer to Part 4 Figure 4-19 for specific weight limits in the baggage compartment. The baggage compartment is accessible either over the rear seat, or through an external door on the left hand side of the fuselage. The baggage door is fitted with a locking latch mechanism.

WARNING

Ensure that all items carried in the baggage compartment are properly secured prior to flight.

CAUTION

To prevent inadvertent opening in flight, the baggage door must be locked prior to flight.

Removable Ballast

16. A removable ballast block weighing 20 lbs is installed in the aft baggage compartment to optimize the centre of gravity position for normal operations. The ballast block is contained in a metal box mounted to the floor of the baggage compartment, and is secured using a pip pin. The ballast block can be removed when the aircraft is heavily loaded, or is loaded towards the rear centre of gravity limit.

FLIGHT CONTROLS

Primary Flight Controls

17. The aircraft is fitted with conventional dual flight controls that can be operated from either front seat:

a. control yokes provide aileron and elevator control through a combination of push-pull rods, cables, pulleys and bell cranks; and

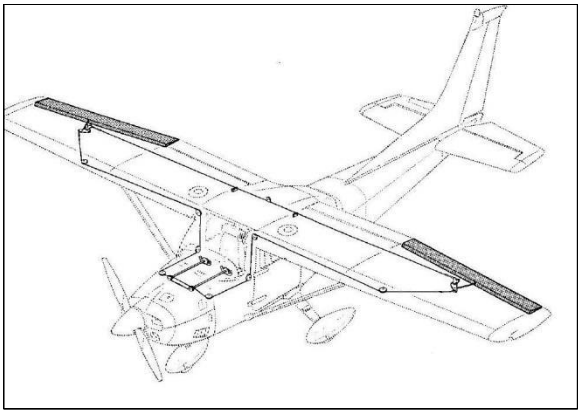


Figure 1-13 Aileron Controls

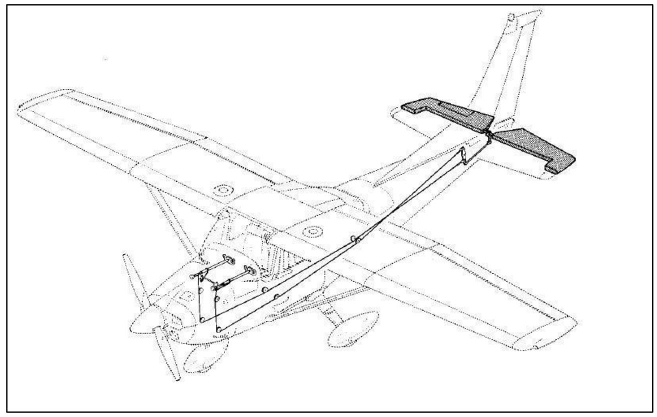


Figure 1-14 Elevator Controls

b. rudder pedals provide both rudder and nose wheel steering control, and incorporate conventional toe brakes.

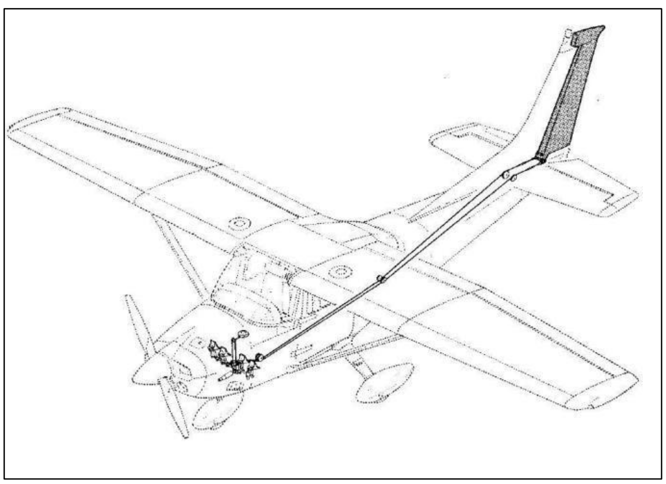


Figure 1-15 Rudder Controls

Control Lock

18. The ailerons and elevator may be locked in position for parking by inserting a control lock in the pilot's control column. The control lock consists of a shaped steel rod with a red "REMOVE BEFORE FLIGHT" flag attached. To install, align the hole in the side of the pilot's control wheel shaft with the hole in the shaft collar on the instrument panel and insert the rod into the aligned holes.

Figure 1-16 Control Locks

Trim

19. Elevator and rudder trim tabs are cable actuated from control wheels located on the centre console. These control wheels are labelled NOSE UP, NOSE DOWN, NOSE LEFT and NOSE RIGHT. A tab position indicator is adjacent to each wheel to indicate the neutral (centred) trim position.

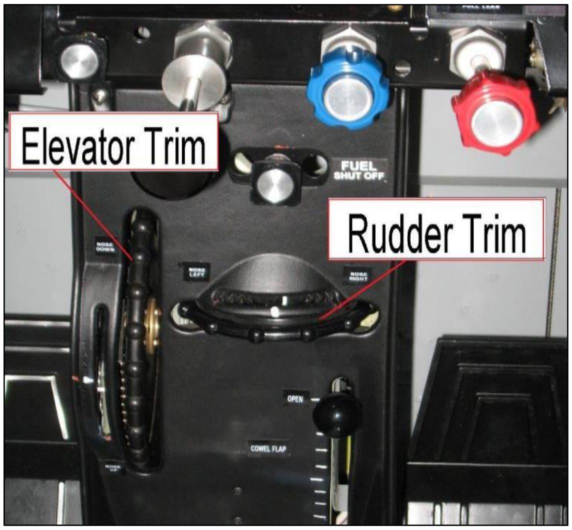


Figure 1-17 Trim Controls

CAUTION

Once at the travel limit, only a modest application of further pressure will result in the rudder trim mechanism disengaging from the track and jamming in the fully deflected position.

Wing Flaps

20. Single-slotted wing flaps are electrically actuated through a range of 0º to 35º by a wing flap selection lever on the instrument sub-panel. The switch lever is positioned up or down in a slotted panel with detents at the 10º, 20º, and 35º settings. For flap settings greater than 10º, move the switch lever to the right to clear the detent and then position as required. A scale and pointer to the left of the switch lever indicates flap travel in degrees. The wing flap system circuit is protected by a 15 amp circuit breaker on the left instrument sub-panel.

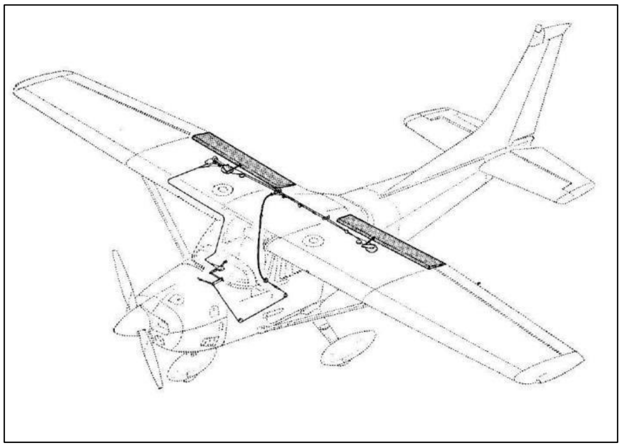


Figure 1-18 Flap Controls

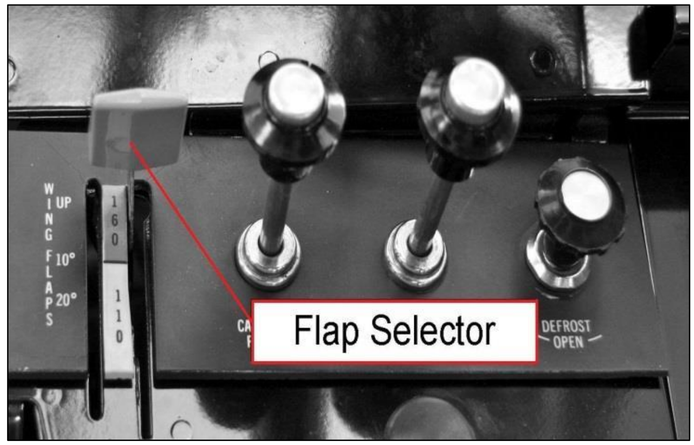


Figure 1-19 Flap Selector

NOTE

Flaps are limited to 35 degrees of travel in compliance with STC SA00152WI (Continental IO520D Engine Installation).

NOTE

Takeoff Flap is restricted to a maximum of 20 degrees with STC SA00152WI (Continental IO520D Engine Installation).

UNDERCARRIAGE

Landing Gear

21. The fixed, tricycle landing gear consists of tubular spring-steel main landing gear struts enclosed by streamlined fairings. The nose gear strut is a conventional air / oil strut incorporating a shimmy dampener.

22. The aircraft is equipped with an Airglas Inc. nose fork assembly to permit the use of an 8.50-6 tire. This fork increases the length of the nose fork by approximately 4 inches, and does increase the risk of wheel-barrowing compared to a standard C182. The nose wheel is steerable through a spring-loaded steering bungee connected to the rudder pedals. The rudder pedals will turn the nose wheel through an arc of ±11º of centre. By applying brake, the degree of turn may be increased to a maximum of ± 29º of centre. Through the use of brakes, the aircraft can be pivoted about the outer wing strut fitting, achieving a turn radius of approximately 27 feet.

Figure 1-20 Side View

CAUTION

The extended nose fork assembly increases the potential for wheel-barrowing compared to a standard C182.

Wheels, Brakes and Tires

23. All three wheels are equipped with 8.50-6 tires with tubes, inflated to 30 psi. The hydraulic brake system is comprised of two master cylinders, each incorporating a small reservoir and located immediately forward of the pilot's rudder pedals, single-disc dual calliper brake assemblies, and interconnecting brake lines. Brakes are actuated by applying pressure to the top of the rudder pedal(s).

Parking Brake

24. The parking brake system uses a handle and ratchet mechanism located under the pilots instrument panel. The handle is connected by a cable to a linkage at the master cylinders.

a. the parking brake is activated by pulling the handle out to apply brake pressure and rotating the handle to a vertical orientation to lock in position; and

b. the parking brake is released by pulling slightly on the handle to relieve tension, rotating the handle to the horizontal position, and then pushing the handle fully in.

Figure 1-21 Parking Brake Handle

CAUTION

Reliance on the parking brake when the aircraft is unattended could result in aircraft movement in the event that brake pressure is lost. If the aircraft is to be left unattended, use wheel chocks.

INSTRUMENT PANEL

25. The instrument panel incorporates the following features:

a. primary flight instruments on the main LH panel;

b. a centre-mounted avionics stack;

c. an EDM-930 engine data management system in the main RH panel;

d. a lower sub-panel that incorporates engine controls, electrical switches, controls and circuit breakers;

e. a bin for storing publications / maps / charts on the far right hand side of the main panel; and

f. a glove compartment for storing aircraft documents in lower right hand sub panel.

Figure 1-22 Instrument Panel

POWER UNIT

Engine

26. The aircraft is powered by Continental IO-520-D six-cylinder, horizontally opposed, air cooled, fuel injected engine with a wet sump oil system. The engine is capable of delivering:

a. Maximum Rated Power (5 minutes) - 300 BHP at 2850 RPM; and

b. Maximum Continuous Power - 285 BHP at 2700 RPM.

Figure 1-23 IO-520 Engine

Propeller

27. The aircraft is equipped with a Hartzell PHC-L3YF-1RF/F7691 three-blade, metal, constant speed propeller. Propeller pitch is controlled by an engine mounted propeller governor which uses engine oil as a hydraulic medium. The propeller has a low (fine) pitch setting of 11.1 degrees and a high (coarse) pitch setting of 26.8 degrees.

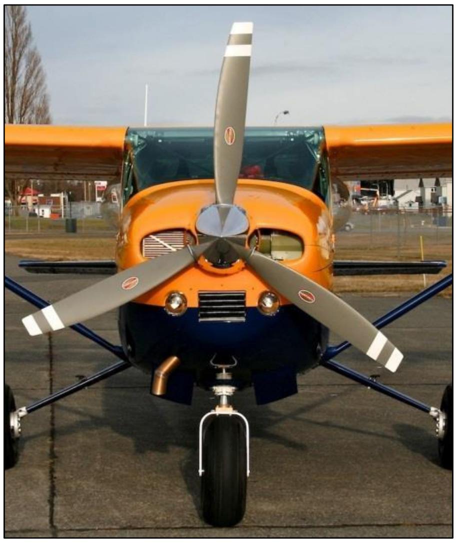


Figure 1-24 Hartzell Propeller

Fuel Injection System

28. The engine is equipped with a fuel injection system consisting of an engine driven fuel pump, a fuel/air control unit, a fuel manifold, a fuel flow indicator, and air bleed type injector nozzles. Some key characteristics of the fuel injection system are:

a. fuel is delivered by the engine driven pump to the Fuel / Air Control Unit (FACU) on the bottom of the engine. The FACU proportions the fuel flow to the induction air flow, which is controlled by the throttle;

b. the FACU contains a mixture control valve which is directly connected to the cockpit mixture control;

c. vapour and excess fuel from the engine driven pump and the FACU are returned to the RH fuel tank by a vapour return line;

d. air is delivered to the cylinders through intake manifold tubes and metered fuel is delivered by the FACU to the fuel manifold on the top of the engine;

e. the fuel manifold evenly distributes the fuel to an air bleed type injector nozzle in the intake valve of each cylinder; and

f. a pressure line is connected to the fuel manifold and provides fuel pressure indications to the EDM 930 display.

Power Unit Controls

29. The three primary power-plant controls (throttle, propeller, mixture) are push/pull actuators centrally located on the lower instrument panel. They are colour coded and each has a distinctive shape for ease of visual and tactile recognition.

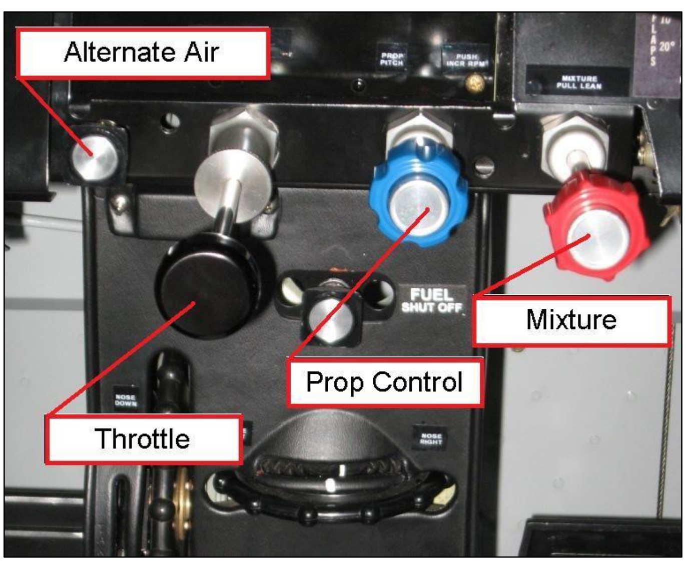


Figure 1-25 Power Unit Controls

Throttle Control

30. The Throttle Control is black and actuates the throttle valve in the FACU. In the forward / full in position the Throttle Control is fully open (full throttle), and in the aft / full out position the Throttle Control is fully closed (idle). The throttle control incorporates a pilot adjustable friction lock to prevent unintended movement of the control. Rotating the lock clockwise increases tension and vice versa.

Propeller Control

31. The Propeller Control is blue. It is used to set and control engine RPM. When the control is pulled out, propeller blade angles become more COARSE, and RPM is reduced; when the control is pushed in, propeller blade angles become more FINE, and RPM is increased.

32. The Propeller Control incorporates a vernier control feature which provides fine adjustments. Rotate the control clockwise to increase RPM and vice versa. Rapid or large adjustments can be made by depressing the button on the end of the control knob and reposition control as required.

33. Key aspects of propeller operation and control are summarized below:

a. propeller RPM is regulated by speed sensing device (governor) which senses RPM changes and adjusts blade angle to maintain the RPM selected by the pilot. Maximum and minimum blade angles are established using mechanical stops;

b. the governor uses an internal oil pump driven by the engine. This pump increases engine oil pressure for supply to the propeller as a control medium;

c. propeller blade angle change is accomplished via a hydraulic piston / cylinder mounted on the forward end of the propeller hub. One end of the cylinder holds a sealed air charge, the other side reacts to changes in oil pressure;

d. a transient (un-commanded) increase in RPM sensed by the governor will result in an increase in oil pressure to cause extension of the hydraulic piston. The linear motion of the piston is transmitted to each blade by a pitch change rod, which increases the blade angle against a mechanical return spring until hydraulic forces, spring tension, and inertial forces establish equilibrium. The system thus increases blade angle by an appropriate amount, increasing propeller torque to counter the transient increase in propeller speed, thus maintaining a constant RPM;

e. a transient (un-commanded) decrease in RPM sensed by the governor results in a reduction in hydraulic pressure, which causes the blade angle to be reduced by tension in the mechanical return spring until the hydraulic forces, spring tension, and inertial forces re-establish equilibrium. The system thus decreases blade angle by an appropriate amount, decreasing propeller torque to counter the transient decrease in propeller speed, thus maintaining a constant RPM;

f. when throttle is reduced (such as during descent or approach), the propeller governor will automatically reduce blade angle to reduce propeller torque commensurate with the reduction in engine power to maintain a constant propeller speed. This process can be continued until the blade angle is reduced to the low pitch stop. At this point, the propeller will behave like a fixed (fine) pitch propeller, and further reductions in engine power will result in a drop in propeller RPM. This is referred to as the “minimum governing power setting”; and

g. if oil pressure is lost at any time for any reason, the mechanical return spring will reduce the blade angle to the minimum stop (fine pitch).

Mixture Control

34. The Mixture Control is red and it regulates the amount of fuel being fed to the fuel injection system. Pushing the control full in / forward is the FULL RICH position, pulling the control out progressively leans the mixture until the IDLE CUTOFF position is reached.

35. The Mixture Control incorporates a vernier control feature which provides slow and/or fine adjustments. Rotate the control clockwise to enrich the mixture and vice versa. Rapid or large adjustments can be made by depressing the button on the end of the control knob and reposition control as required. Detailed instructions on correct use of the mixture control are provided in Part 2.

NOTE

To optimize cylinder cooling during towing operations, the fuel system is set for maximum fuel flow at high power settings. The resultant rich mixture may result in spark plug fouling during prolonged low RPM ground idling. During ground idle, the throttle should normally be set to 1000 RPM. During extended ground idling in high density altitude conditions, it may be necessary to manually lean the mixture to prevent spark plug fouling. Minor spark plug fouling can usually be cleared as follows:

a. Magnetos both on;

b. Throttle 2200 RPM; then

c. Mixture moved toward idle cut-off until RPM peaks, hold for 10 seconds and return to full rich

Power Management

36. Engine power management is accomplished by selecting an appropriate throttle setting combined with an appropriate propeller RPM. Propeller RPM is set using the tachometer as the reference instrument, while engine power (throttle) is set using Manifold Pressure (MAP) as the reference instrument.

37. Theoretically, there are infinite combinations of throttle and propeller settings that can be used. In practice, power management is exercised using a limited number of propeller RPM settings tailored for the specific regime of flight. Detailed power settings for Takeoff, Climb, Cruise, Landing and Glider Towing are provided in *Part II*. These are established based on the following considerations:

a. Takeoff - during takeoff and initial climb, aircraft performance is optimized with the blade angles at fine pitch / high RPM;

b. Climb - after takeoff, the propeller speed can be decreased for noise abatement reasons;

c. Cruise - during cruise, performance is optimized by selecting coarser pitch and thus reducing propeller RPM; and

d. Landing - during landing, once power has been reduced below the minimum governing condition, the propeller RPM is set FULL FINE as a precaution in case of an overshoot.

38. Power management also requires proper sequencing of engine and propeller controls, specifically:

a. when increasing power, adjust propeller RPM first, then apply throttle; and

b. when reducing power, adjust throttle first, then adjust propeller RPM.

CAUTION

Do not exceed 20 inches MAP below 2250 RPM.

Engine Oil System

39. Oil for engine lubrication and propeller governor operation is supplied from a sump on the bottom of the engine.

a. an oil filler cap is located on the top of the crankcase, accessed through a door in the front of the upper engine cowling; and

Figure 1-26 Oil Filler Cap Location

b. an oil dip stick is located on the left side of the crankcase, accessed through a door in the left side of the upper engine cowling.

Figure 1-27 Oil Dip Stick Location

c. the dipstick is unlocked by turning counter clockwise prior to removal. When reinstalling the dipstick, the locking clip must be engaged.

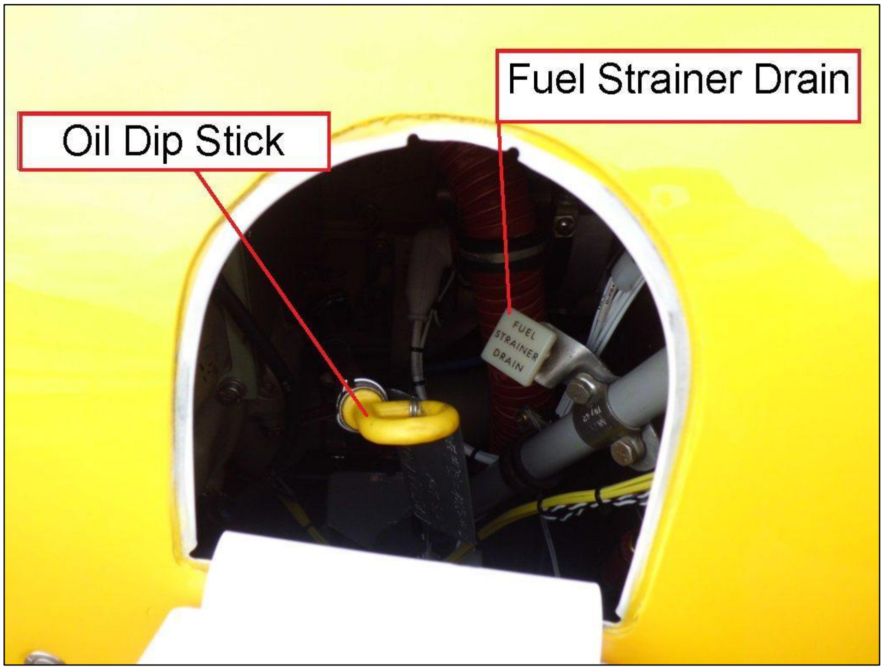


Figure 1-28 Oil Dip Stick and Fuel Strainer Drain

40. In normal operation, oil is drawn from the sump by the oil pump, passed through an oil filter and thermostatically controlled oil cooler to the engine lubrication points and propeller governor. The oil then returns to the sump by gravity.

41. As per Figure 1-4, the total system capacity is 12 US quarts (11.4 litres) and minimum operating level is 9 US quarts (8.5 litres). For normal operations, maintain the oil level between 10 and 11 quarts, and top up if the level drops below 10 quarts.

CAUTION

Failure to ensure the dipstick locking clip is engaged may result in the dipstick coming loose with a significant loss of engine oil through the open tube end.

Prior to adding oil, check the Journey Log to confirm the correct type and grade of oil is being added.

If checking oil within 1 hour of engine operation, the oil level may appear low as oil has not fully drained into the sump. Do not overfill with oil as serious engine damage can result.

Ignition System

42. Engine ignition is provided by two engine driven magnetos which fire two spark plugs per cylinder. Ignition and starter operation is controlled by a key-operated rotary switch on the lower instrument panel labelled OFF, R, L, BOTH and START. The engine should be operated with the ignition switch in the BOTH position except for magneto checking and emergency purposes.

Figure 1-29 Ignition Switch

Starter

43. The aircraft is equipped with a high energy starter. When the master switch is in the ON position and the rotary ignition switch is rotated to the START position, the starter will engage.

44. The starter motor is equipped with an adapter that is subject to progressive breakdown and failure through normal use. When the starter is engaged, a properly functioning adapter will immediately begin turning the propeller. A starter adapter that slips, slowly or intermittently turns the propeller indicates a serious malfunction which immediately renders the aircraft unserviceable until assessed by an RCA Ops (Pac) AME. These conditions can result in metal flakes entering the engine oil system; They are not indicators of a minor progressive breakdown where the aircraft can continue operating so long as it ultimately starts.

CAUTION

Do not engage the starter while the propeller is turning.

CAUTION

The engine may partially fire on start, usually due to insufficient priming. When this occurs, immediately release the starter and allow the engine to either fully catch or quit. Do not keep the starter engaged in an attempt to keep the engine running.

CAUTION

Do not engage the starter for periods longer than 30 seconds as the starter may overheat. If the starter has been engaged for an extended period without a successful start, wait at least 3 minutes before attempting another start.

Air Induction and Alternate Air

45. The engine receives filtered ram air through an intake and air box on the lower front portion of the engine cowling. As the engine is fuel injected, and there is no carburettor, there is no requirement for carburettor heat. There is an alternate air selector located to the left of the throttle:

a. should the primary air intake be blocked by snow, impact ice or other contaminants, the alternate air control should be selected FULL ON by pulling it all the way OUT. This will open the alternate air valve and draw unfiltered air from inside the engine compartment; and

b. at all other times, the alternate air should be OFF.

Figure 1-30 Alternate Air Control

CAUTION

Other than when required during the run-up, alternate air should not be employed on the ground as the air entering the engine will be unfiltered.

NOTE

When selecting alternate air ON, full throttle manifold pressure may drop by approximately 1 inch.

Exhaust System

46. Exhaust gases from the cylinders pass through riser assemblies to a muffler and tailpipe. The muffler is in a shroud which forms a heating chamber for cabin heat.

Engine Cooling System

47. Ram air for engine cooling enters the front of the cowling, is directed through and around the cylinders and oil cooler by baffles, and is exhausted through the cowl flaps on the lower aft edge of the cowling.

48. The flow of cooling air can be controlled by cowl flaps mechanically operated by the Cowl Flap Lever on the right side of the centre control pedestal. The lever is raised to open the cowl flaps for takeoff and high power operations and lowered to close the cowl flaps for cruise and descent. Intermediate positions can be used to maintain optimum engine operating temperatures. The lever must be moved to the right to clear detents before being moved.

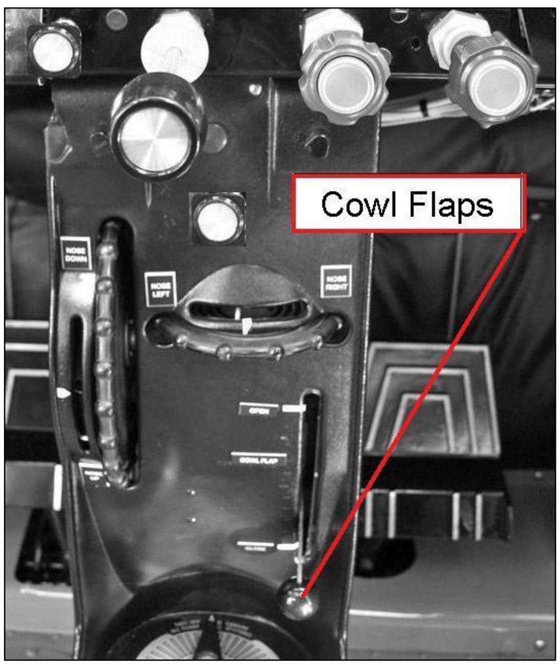


Figure 1-31 Cowl Flaps Control

CAUTION

The IO520D is a high displacement / high power engine that can be prone to cylinder damage associated with frequent shock cooling. Careful management of CHT is critical to ensuring engine longevity.

FUEL SYSTEM

Fuel System Components

49. The aircraft fuel system consists of the following major components:

    a. two bladder style vented fuel tanks;

    b. vent system / check valve;

    c. fuel quantity indicators for each tank;

    d. rotary fuel selector valve;

    e. fuel header tank;

    f. fuel shutoff valve;

    g. fuel strainer;

    h. electric auxiliary fuel pump;

    i. engine driven fuel pump;

    j. fuel injection system; and

    k. vapour return line.

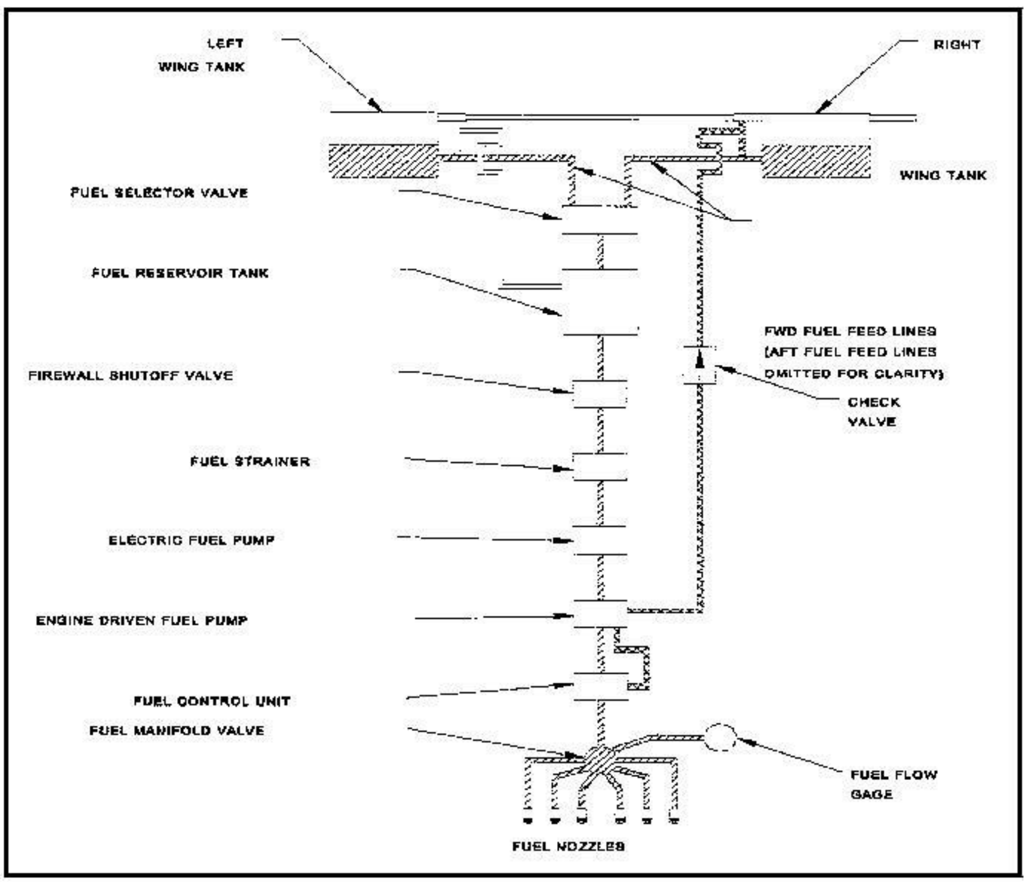


Figure 1-32 Fuel System Components

Fuel Tanks

50. Fuel is carried in two bladder style vented tanks (one in each wing). Fuel capacities (total and useable fuel) are provided in Figure 1-3. Tank drains at the rear, inboard corner of each tank are provided for fuel sampling.

Figure 1-33 Fuel Tank Drain

Fuel Strainer

51. A fuel strainer is installed in the engine compartment to filter out any remaining water or contaminants from the fuel before it reaches the fuel injection system. The fuel strainer drain valve is adjacent to the oil dip stick and is accessed through a door on the left side of the engine cowling. During the pre-flight inspection, the strainer should be opened to drain for approximate 4 seconds to clear any water or sediment.

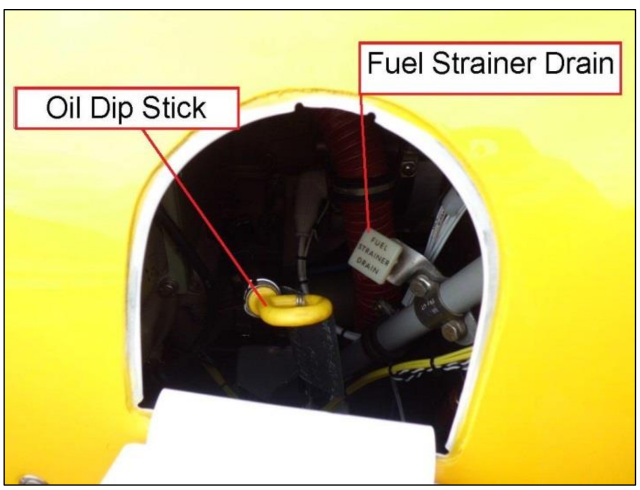


Figure 1-34 Oil Dip Stick and Fuel Strainer Drain

Fuel Vent System

52. The left tank is fitted with a vent line incorporating a check valve which protrudes from the bottom of the left wing near the strut attachment point. Venting of the right tank is accomplished through an interconnecting vent line.

Fuel Quantity Indicators

53. Fuel Gauges. Fuel quantity is measured by a float operated, variable resistance transmitter in each tank and input to the EDM 930 Engine Data Management System. Useable fuel in each tank is displayed on the EDM 930 in US gallons. The fuel gauges in this aircraft are not reliable for precise measurement of fuel remaining. Pilots shall follow the guidelines detailed in Part 2 – Fuel Management.

54. Fuel Totalizer. The EDM 930 features a fuel quantity totalizer system. The pilot must manually enter the total useable fuel at the start of each flight, and through monitored fuel flow the EDM 930 calculates the useable fuel remaining. This system has been proven to be accurate to within 5% if the starting fuel quantity is entered correctly.

Rotary Fuel Selector Valve

55. Fuel is fed from the wing fuel tanks by gravity through a three position rotary selector valve and strainer. Fuel is then collected in the header tank, from where it is fed through the firewall to the engine. Fuel will flow to the header tank whenever the Fuel Selector Valve is in the BOTH, LEFT or RIGHT positions.

Figure 1-35 Fuel Selector Valve

NOTE

The OFF position of the fuel selector valve is disabled in compliance with STC SA00152WI.

NOTE

Except when required to correct a significant fuel imbalance in flight, the aircraft should be operated with the fuel selector in BOTH at all times.

Fuel Header Tank

56. A fuel header tank which holds approximately 1 USG is mounted on the aft face of the engine firewall behind the cockpit centre console. This is a “feeder tank” that collects fuel flowing through the fuel selector valve and provides a steady, uninterrupted flow of fuel to the fuel injection system on the engine.

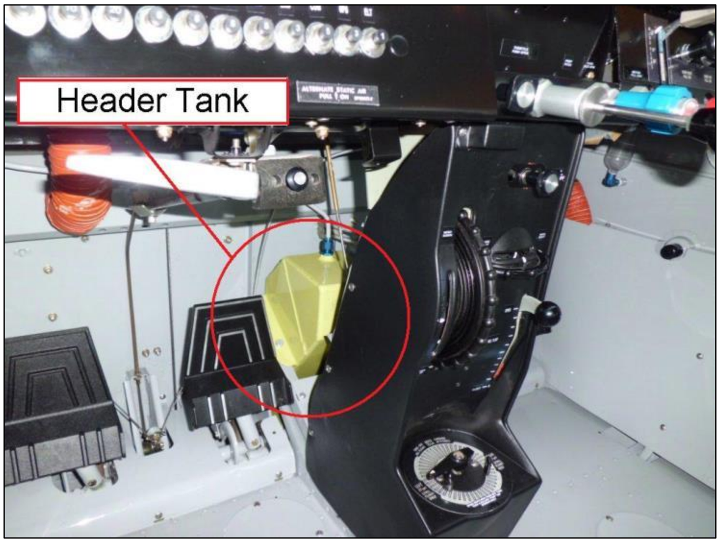


Figure 1-36 Header Tank

57. A fuel drain for the header tank is installed in the aircraft belly aft of the firewall, just behind the nose gear scissors. This allows water and contaminants to be drained from the header tank during the pre-flight inspection.

Figure 1-37 Header Tank Drain

Fuel Shutoff Valve

58. A fuel shutoff valve is installed between the header tank and the fuel strainer to shut off all fuel to the engine in case of an emergency. The fuel shutoff valve control is located on the centre pedestal. When the control is:

a. pushed FULLY IN, the valve is OPEN and permits the normal flow of fuel; and

b. pulled FULLY OUT, the valve is CLOSED and shuts off all fuel flow to the engine.

Figure 1-38 Fuel Shutoff Valve

NOTE

The fuel shutoff valve is only used during a critical emergency. The NORMAL position for the valve control is OPEN, or pushed FULLY IN.

Auxiliary Fuel Pump

59. An electric auxiliary fuel pump is provided for engine starting, minor vapour purging, and emergency operation should the engine driven fuel pump fail. The unit is a two stage pump. With the throttle open to a cruise power setting, the pump operates at a high enough capacity to supply sufficient fuel to maintain flight with an inoperative engine driven fuel pump. When the throttle is moved to the closed position, the flow rate is automatically reduced, preventing an excessively rich mixture when the engine is operated at low power settings.

60. The pump is controlled by a switch located on the left hand side of the pilot's lower sub panel, immediately below the Master Switch.

61. The auxiliary fuel pump switch is a three position switch operated as follows:

a. Switch Up – PRIME (spring loaded back to OFF)

b. Switch Centred - OFF

c. Switch Down – ON

Figure 1-39 Auxiliary Fuel Pump Switch

WARNING

The auxiliary fuel pump shall not be used in flight, except in an emergency. With the auxiliary and engine driven pumps simultaneously operating, excessively rich fuel mixture will result in rough running and possibly engine failure.

ENGINE DATA MANAGEMENT SYSTEM

General

62. A J.P. Instruments EDM-930 Engine Data Management System is installed in place of conventional engine instruments. Information on the key functions of the EDM-930 is incorporated into the Pilot's Checklist, Emergency Procedures and Operating Data. ***Refer to Annex A for more detailed operating instructions***. This instrument provides the following functions:

a. all primary engine instrument indications including:

   (1) propeller RPM,

   (2) manifold pressure,

   (3) fuel pressure,

   (4) oil temperature,

   (5) oil pressure,

   (6) cylinder head temperature,

   (7) exhaust gas temperature, and

   (8) voltmeter / ammeter;

b. fuel tank quantity indication, fuel flow and fuel totalizer functions;

c. EGT and CHT bar graph display of individual cylinders;

d. Percentage of maximum rated horsepower (%HP);

e. "LeanFind" function for precise leaning;

f. Shock cooling monitoring;

g. Remote Auxiliary Display (RAD);

h. Alert displays of all CAUTION and LIMIT parameters; and

i. Data storage (up to 30 hrs depending on selected sampling rate), data retrieval and analysis software.

Main Display

63. The main display screen of the EDM930 is configurable. For normal operations, the EDM930 display configuration will be as shown below:

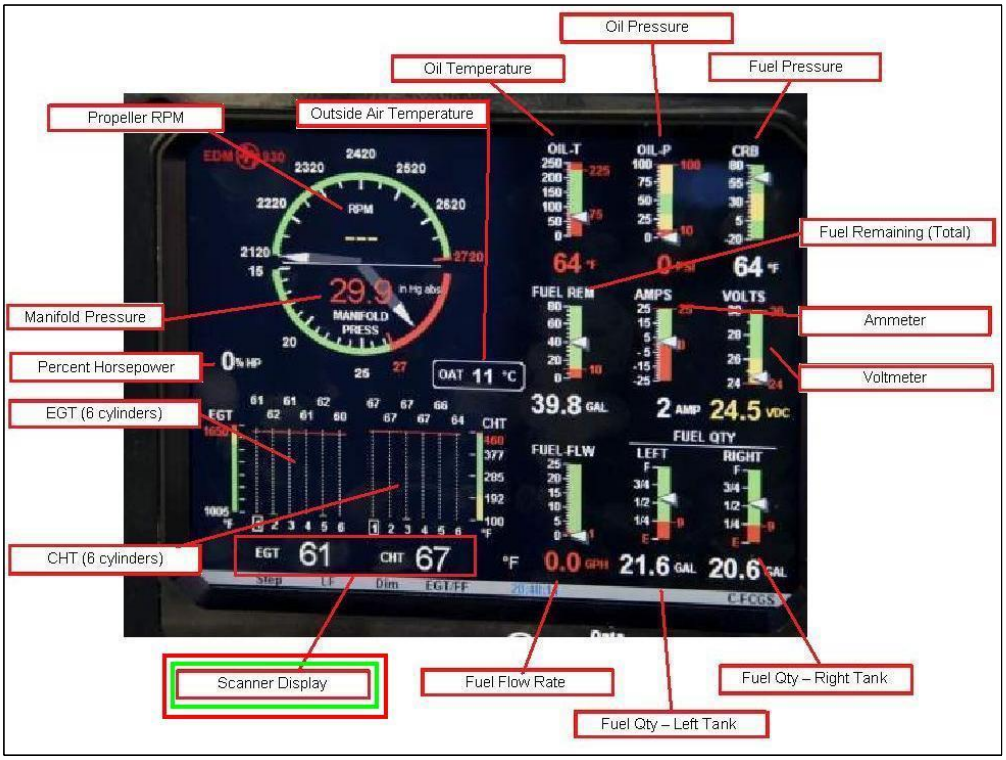


Figure 1-40 Main Display

Display Parameter	Identifier	Notes
Propeller RPM	RPM	
Manifold Pressure	MANIFOLD PRESSURE	
Exhaust Gas Temperature	EGT	
Cylinder Head Temperature	CHT	
Oil Temperature	OIL-T	
Oil Pressure	OIL-P	
Fuel Pressure	FUEL-P	
Fuel Remaining	FUEL REM	Calculated parameter
Ammeter	AMPS	
Voltmeter	VOLTS	
Fuel Flow Rate	FUEL FLW	
Fuel Quantity	FUEL QTY	
Outside Air Temperature	OAT	
Percent Brake Horsepower	%HP	

Figure 1-41 Display Parameters

Scanner Display

64. The ***Scanner Display*** portion of the screen on the bottom left hand side of the display can be used to display pilot selectable parameters, including the following:

Display Parameter	Typical Display
Exhaust Gas Temperature	1354 EGT
Cylinder Head Temperature	375 CHT
Fuel Remaining (USG)	33.4 REM
Fuel Used Since Reset	24 USD
Fuel Time to Empty	02:45 H:M
Rate of Shock Cooling	-30 CLD
Max Difference between EGTs	80 DIF

Figure 1-42 Scanner Display Parameters

Remote Auxiliary Display (RAD)

65. A Remote Auxiliary Display (RAD) using LEDs is mounted on the upper left hand side of the instrument panel. During normal operations, the RAD will display a secondary indication of Propeller RPM and Manifold Pressure. When an alert is triggered, the RAD will flash and display the nature of the alert. The RAD must be functioning for the aircraft to be airworthy.

Figure 1-43 Remote Auxiliary Display

Alerts

66. The EDM 930 provides a range of ***visual alerts*** that will bring important information to the attention of the pilot. The EDM 930 provides Primary and Secondary Alerts as detailed below:

a. **<u>Primary Alerts.</u>** These are alerts that indicate imminent or actual exceedance of a published engine or system limitation. When a measurement falls outside a programmed limit, the main display will blink **ALERT** in **red** and the parameter will appear on the display and the RAD:

Alert Display	Alert Description	Notes
O-T	Oil Temperature Out of Limits	High or Low
O-P	Oil Pressure Out of Limits	High or Low
F-P	Low Fuel Pressure	See note below
EGT	EGT Out of Limits	High or Low
MAP	Over-Boost Manifold Pressure	
RPM	High RPM Over Redline	
BUS	Battery Voltage Out of Limits	High or Low
AMP	Current Flow Out of Limits	High or Low

Figure 1-44 Primary Alerts

b. **<u>Secondary Alerts.</u>** These are Alerts that indicate important operational information not related to a published engine or system limitation. When a measurement falls outside a programmed caution point, the main display will blink **ALERT** in **amber** and the measurement will appear in the scanner display:

Alert Display	Alert Description	Notes
TK-LOW	Fuel Tank Low Quantity	
MIN	Low Fuel Endurance Remaining	
REM	Low Fuel Quantity Remaining	
DIF	Excessive EGT Span	
CLD	Excessive CHT Cooling Rate	Above 60 deg/min
BAL	Fuel Level Out Of Balance	
FF	Low Fuel Flow Rate	

Figure 1-45 Secondary Alerts

Response to Alerts

67. Alerts issued by the EDM 930 are of a cautionary nature. They are intended to enhance the pilot's situational awareness and to draw his / her attention to specific aircraft parameters that may be of concern. As such, ***it is critical not to become distracted by an alert.*** It is most important to maintain control of the aircraft, and then deal with the alert when it is safe to do so. Alerts should be handled as a non-critical emergency in accordance with ***Part 3 – Emergency Procedures***.

Low Fuel Pressure Alerts

68. The low fuel pressure alert is triggered when fuel pressure drops below 3.5 psi. When operating with the throttle fully closed, fuel pressure may drop as low as 3.0 psi, triggering an alert. This is an entirely normal engine operation, and a low fuel pressure alert when the throttle is fully closed requires no immediate action by the pilot.

Shock Cooling Alerts

69. A shock cooling alert is triggered when the average CHT cooling rate on any cylinder exceeds 60 degrees F per minute. The IO520D is a high displacement / high power engine that may experience cylinder damage associated with frequent shock cooling. Careful management of CHT, particularly during towing operations, is critical to ensuring engine longevity. Response to shock cooling alerts should conform to the following:

a. during towing operations, during post-release descent, increase power and / or reduce airspeed if safe and practical to do so;

b. during routine descents, increase power and / or reduce airspeed if safe and practical to do so;

c. during practice forced landings, smoothly apply mid-range power for 2-3 seconds every 1000 feet to minimize shock cooling effects; and

d. during circuits, approach, and landing, no specific action is required.

Mandatory Sensors

70. The EDM930 provides information through a variety of sensors. ***In order to meet the minimum equipment requirements of CAR 605.14 and 605.16, the following mandatory parameters / sensors must be functional***:

Mandatory Parameters	**Non Essential Parameters**
Propeller RPM	Exhaust Gas Temperature
Manifold Pressure	CHT (Cylinders 2 thru 6)
1 Cylinder Head Temperature	Fuel Remaining
Oil Temperature	Fuel Flow Rate
Oil Pressure	Outside Air Temperature
Fuel Pressure	Percent Brake Horsepower
Ammeter	
Voltmeter	
Left & Right Fuel Quantity	

Figure 1-46 Mandatory Parameters

ELECTRICAL SYSTEM

General

71. Electrical power is supplied by a 28-volt direct current system with the following characteristics:

a. power is generated by an engine driven 28 Volt 60 amp alternator;

b. power for starting and for emergency situations is provided by a sealed 11 amp-hr battery located in the tail, aft of the baggage compartment;

c. power is supplied to all electrical circuits through a split bus bar, one side serving electronic circuits and components and the other side serving general electrical system components;

d. electrical circuits and equipment are protected by push-to-reset type circuit breakers;

e. a split rocker style Master Switch is used to connect the alternator and the battery to the electrical system;

f. a Radio Master Switch is used to isolate the electronic circuits from transient voltage spikes during start-up and shutdown; and

g. battery voltage, electrical loads, alternator output and associated limit alerts are displayed on the EDM-930.

72. A basic schematic of the aircraft electrical system is provided on the following page.

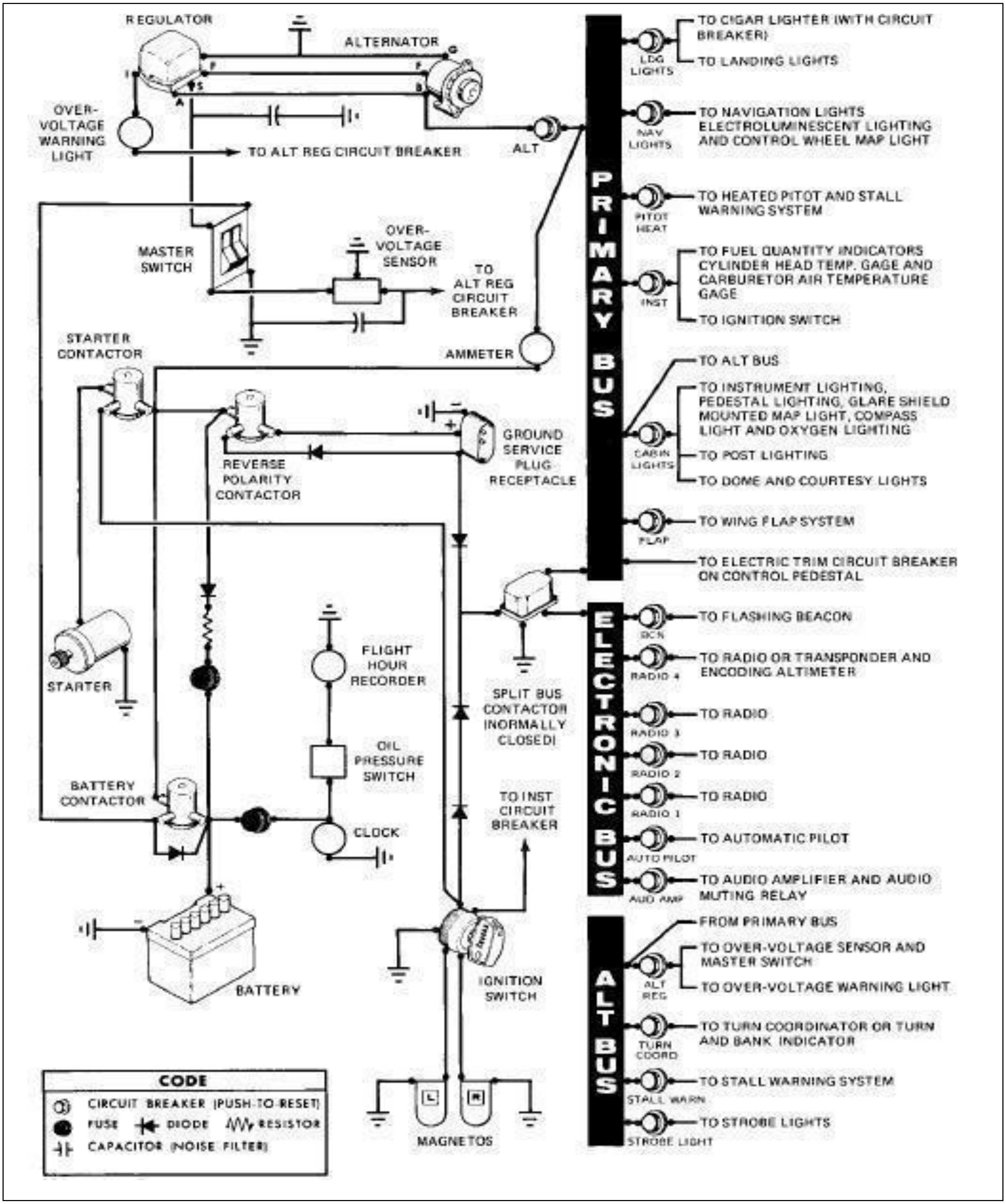


Figure 1-47 Electrical Schematic

Master Switch

73. The split-rocker Master Switch is located on the lower left sub-panel. The Master switch is selected ON in the UP position. The right half, labelled MASTER, controls all electrical power to the aircraft and connects the battery to the DC bus. The left half, labelled ALT, controls the alternator. In normal operation, both sides of the switch are used simultaneously; however, the MASTER side may be turned on separately to power electrical equipment on the ground. The ALT side of the switch, when selected OFF, removes the alternator from the system.

CAUTION

Continued operation with the alternator OFF will eventually reduce battery power, resulting in loss of power to the alternator field, precluding a restart.

CAUTION

Do not turn off the alternator in flight, except in an emergency.

Other Electrical Switches and Controls

74. All electrical switches and controls are located on the lower left side of the instrument sub-panel. With the exception of the clock, all electrical circuits are protected by either push-to-reset type circuit breakers or breaker-switches located on the pilots instrument sub-panel.

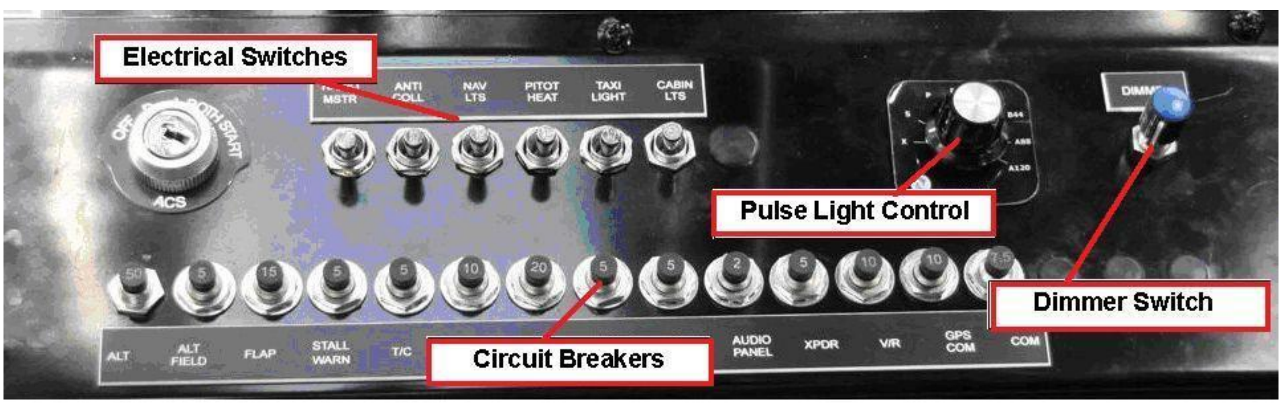


Figure 1-48 Electrical Panel

LIGHTING SYSTEMS

Exterior Lighting

75. Conventional navigation lights are installed in the wing tips and tail cone. Anti-collision strobe lights are mounted on the wing tips. A high intensity LED anti-collision light is mounted on top of the vertical stabilizer. High intensity LED anti-collision pulse lights are mounted in the wing leading edges at the tips, and dual high intensity LED taxi / landing lights are mounted in the lower nose cowling. All are controlled by switches on the pilot's lower instrument panel.

Figure 1-49 Exterior Lights

76. The high intensity LED pulse lights are controlled by a rotary control switch located on the instrument sub-panel. The controller has eight positions, labelled as detailed below. ***To optimize daytime visibility, it is recommended that the pulse light controller be set to A88***:

a. X – both lights off

b. S – starboard (right) light on

c. P – port (left) light on

d. S+P – both lights on

e. A44 - lights alternate at 44 pulses per min (PPM)

f. B44 – both lights flash at 44 PPM

g. A88 – lights alternate at 88 PPM (preferred daytime setting)

h. A120 – lights alternate at 120 PPM.

Interior Lighting

77. Flight instruments are continuously illuminated by adjacent post lights controlled by a dimmer switch on the lower instrument panel. The avionics and EDM-930 both have self-adjusting internal lighting. Adjustable LED map / cabin lights with red filters are mounted on the forward door posts and are activated using the CABIN LTS switch.

Lighting Controls / Switches

78. Switches and controls are all positioned on the lower left hand sub-panel.

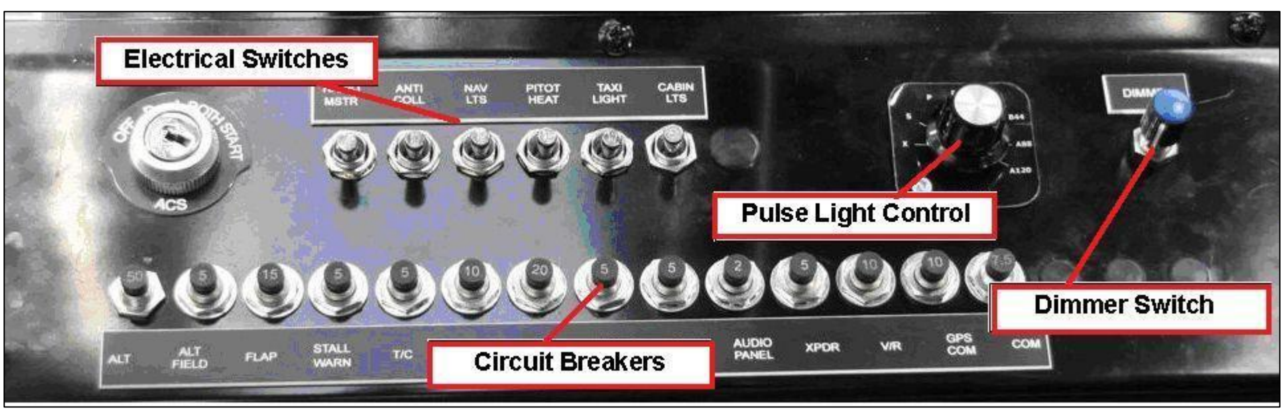


Figure 1-50 Electrical Panel

HEATING AND VENTILATION SYSTEM

General

79. The heating and ventilation system is depicted in the schematic below:

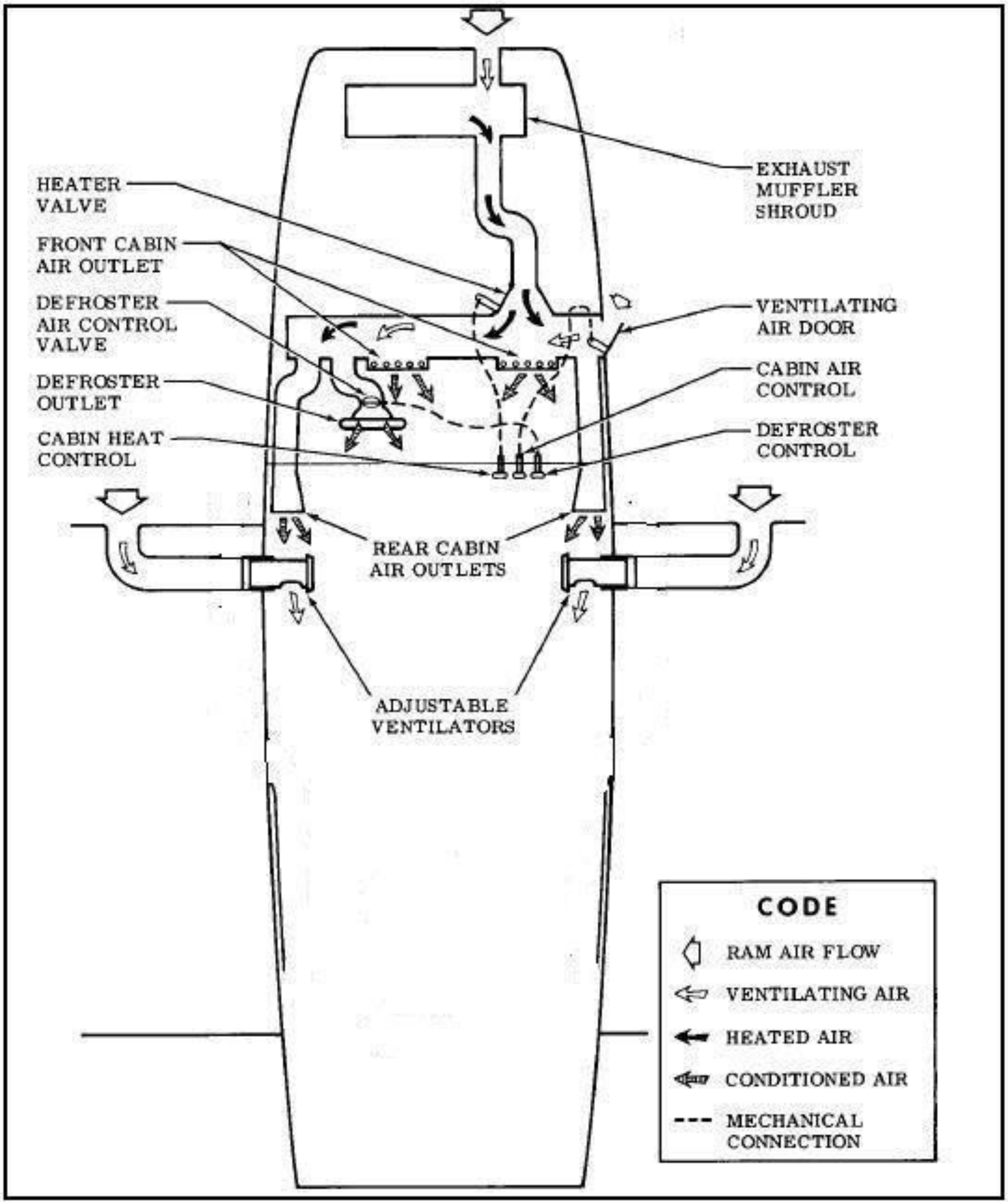


Figure 1-51 Heating and Ventilation Schematic

Heating

80. Heated air is supplied by ram air being ducted through a shroud on the exhaust muffler to a manifold mounted on the firewall above the rudder pedals. Outlet holes in the manifold and two ducts located just forward of the door posts supply heated air to the cabin. Airflow to the manifold is controlled by a push-pull knob labelled CABIN HEAT, located on the right hand instrument subpanel. To select cabin heat, depress the button on the knob and pull the control out to the desired position.

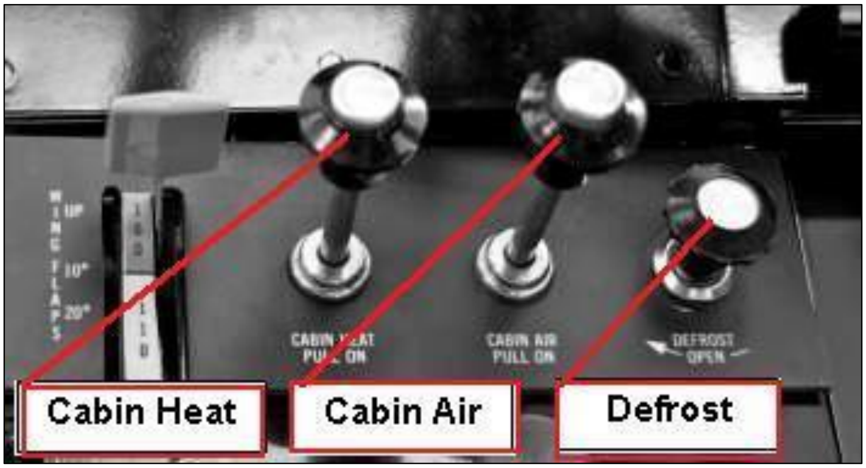


Figure 1-52 Heat and Air Controls

81. Windshield defrost air is ducted from the cabin heat manifold to an outlet on the pilot's side of the glare shield, and is controlled by a rotary knob labelled DEFROST on the right hand subpanel.

NOTE

The CABIN HEAT must be ON to get warm defrost air.

Ventilation

82. Ventilating (cool) air is supplied through the heating manifold by pulling out the CABIN AIR knob on the right subpanel. Additional (limited) ram air ventilation is available through two ventilators located in the wing roots on the upper left and right corners of the windshield.

NOTE

The temperature of heated air entering the cockpit may be moderated by selecting CABIN AIR in conjunction with CABIN HEAT.

FLIGHT INSTRUMENTS

Pitot Static System

83. Pitot Tube. A heated pitot tube on the left wing supplies pitot pressure to the airspeed indicator. The pitot heat switch is located on the left subpanel. Pitot heat should be used only when necessary to prevent icing.

84. Static Ports. Two static pressure ports located on both sides of the fuselage just aft of the engine cowling supply static pressure to the altimeter, ASI and VSI.

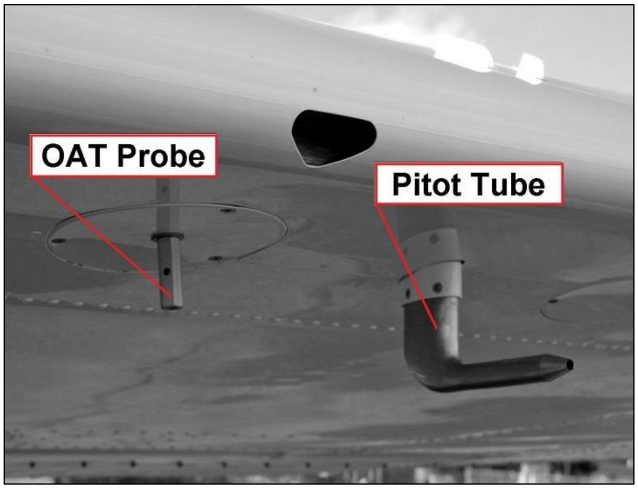


Figure 1-53 OAT Probe and Pitot Tube

85. Alternate Static Air. An alternate static air valve is located adjacent to the parking brake handle. Actuation of this valve (pull out) supplies static pressure from the cabin and should be selected when erroneous instrument reading are suspected due to icing/clogging of the static ports or water in the system.

Figure 1-54 Alternate Static Air

CAUTION

Cabin static pressure will vary depending on heat/vent settings which may induce errors in instrument indications when the alternate static source is selected.

Vacuum System

86. An engine driven vacuum pump provides the suction necessary to operate the attitude indicator and directional indicator. The system incorporates a vacuum relief valve and air filter. A suction gauge located to the left of the flight instruments is calibrated in inches of mercury and indicates the suction currently available. A suction range of 4.5 to 5.5 in-Hg is desired for reliable operation of the attitude indicator and directional indicator.

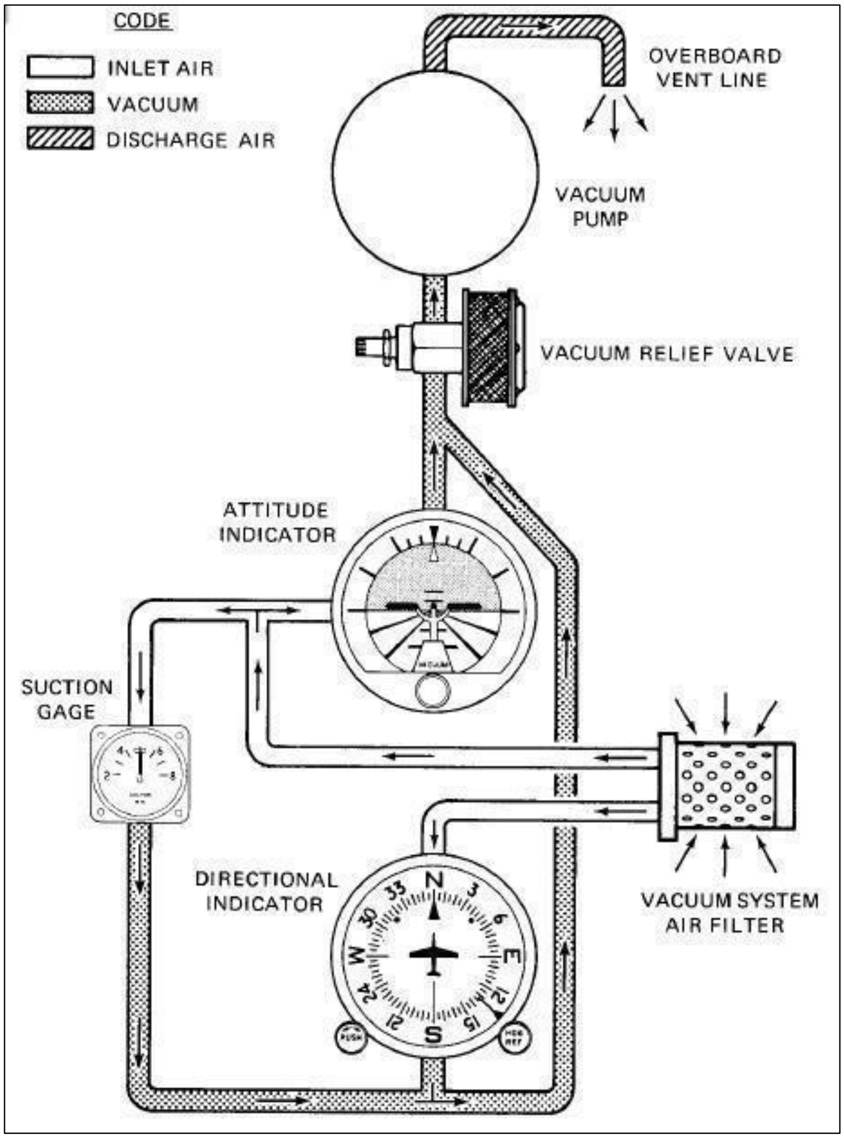


Figure 1-55 Vacuum System

Stall Warning System

87. A vane type stall warning unit is located in the left wing leading edge which electrically activates an audible stall warning horn located under the instrument panel. ***The horn is not connected to the intercom system***. The horn is activated at speeds approximately 5-10 mph above the stall in all configurations.

Flight Instruments

88. A grouping of six conventional flight instruments is provided, installed in the left hand instrument panel. The suite of flight instruments includes the following:

Figure 1-56 Flight Instruments

a. Airspeed Indicator (ASI) – calibrated in MPH with a concentric subscale in knots. Range/limitation markings are in satisfaction of STC SA00152WI (ref D) and are as follows:

(1) white arc – 47 - 110 mph
(2) green arc – 55-165 mph
(3) yellow arc – 165 – 206 mph
(4) red line – 206 mph

WARNING

A placard located immediately above ASI limits VNE to 180 MPH. This limitation is associated with the wing extensions installed under STC SA00276NY.

b. Attitude Indicator (AI) – Vacuum operated with an adjustable split bar (miniature airplane);

c. Altimeter – a standard barometric type altimeter with encoding capability and altimeter setting subscale;

d. <u>Turn Coordinator (TC)</u> – An electrically driven instrument, powered whenever the MASTER SWITCH is selected ON. This instrument provides rate of turn indications, with the ball providing indication of slip or skid. L and R turn indices indicate a standard rate one turn (3º / sec);

e. <u>Directional Indicator (DI)</u> – Vacuum operated with rotating compass card;

f. <u>Vertical Speed Indicator (VSI)</u> - Instrument is actuated by static pressure changes and depicts rate of climb or descent in feet per min.

g. <u>Magnetic Compass</u> – A rotating card magnetic compass is mounted to the centre of the front windscreen.

Figure 1-57 Magnetic Compass

AVIONICS

General

89. The avionics suite installed in a vertical stack in the centre of the instrument panel consists of:

- a. Garmin GMA 340 Audio Panel / Intercom;
- b. Garmin SL40 VHF Transceiver (Comm 1);
- c. Garmin Aera 500 VFR GPS;
- d. Garmin GTX 327 Transponder; and
- e. Artex ME-406 MHz ELT (mounted in the aft baggage compartment).

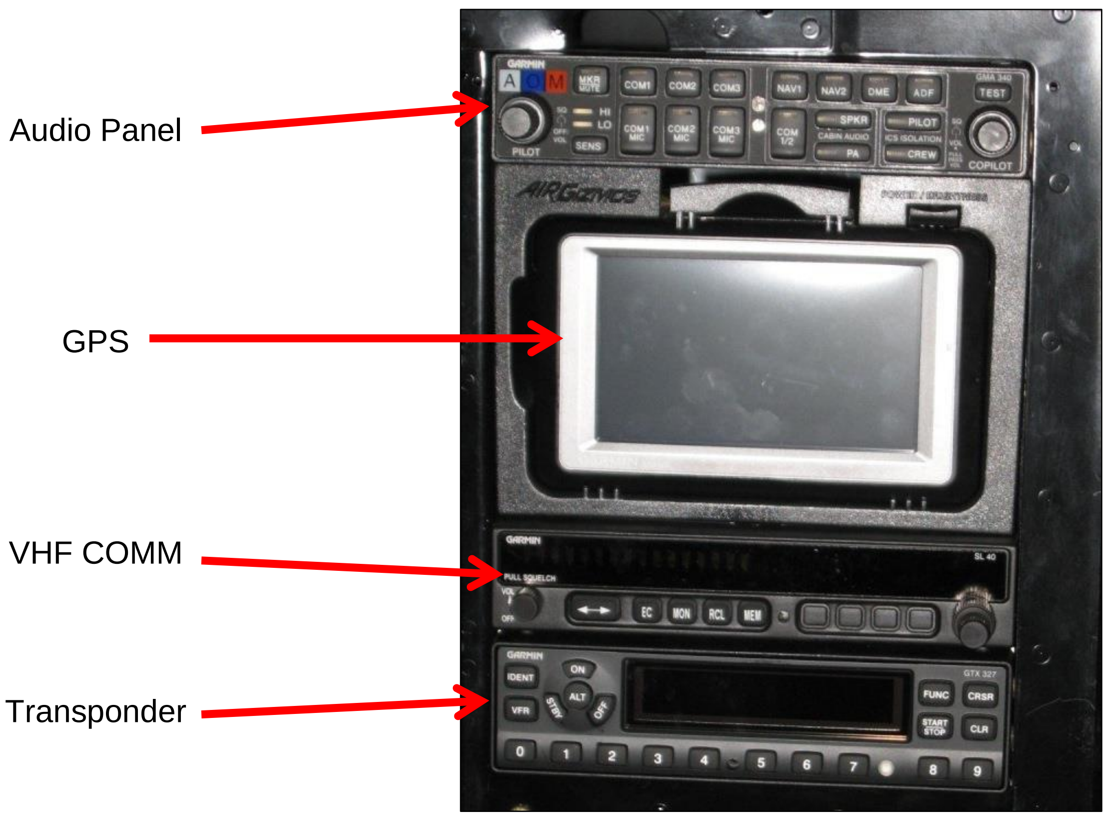
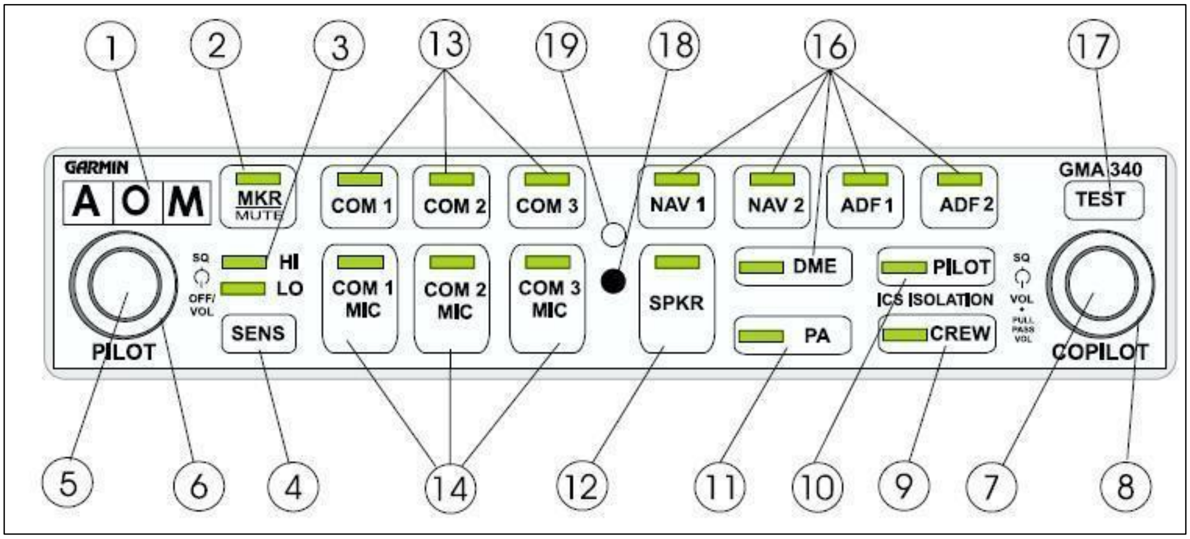


Figure 1-58 Avionics Suite

90. All avionics except the ELT are controlled through the RADIO MASTER switch on the left subpanel. To prevent voltage spikes from damaging the avionics, the RADIO MASTER switch must be selected OFF prior to engine start and prior to engine shutdown.

Audio Panel

91. Radio (COM) and intercom (ICS) audio functions are controlled through the Garmin GMA 340 Audio Panel. Information on the key functions of the audio panel is incorporated into the Pilots Checklist, Emergency Procedures and Operating Data. ***Refer to Annex D for more detailed operating instructions***.



1-4	Marker beacon indication and control switches – *all inoperative*.
5	Pilot ICS volume and unit ON/OFF control. Fully CCW (in detent) is OFF.
6	Pilot ICS squelch – CW rotation increases level of mic input to break squelch.
7	Co-pilot and passenger ICS volume. Pull knob to out position to adjust pax volume.
8	Co-pilot and passenger ICS squelch.
9	ICS Crew Isolation button – when pressed (LED lit), Crew mode places pilot and co-pilot on discreet ICS channel, isolated from pax. Passengers can continue to communicate with each other but cannot communicate with the pilots or hear the aircraft radios.
10	ICS Pilot isolation button – when pressed isolates pilot (and radio) from all others on the ICS.
11	Passenger PA – *inoperative*.
12	Speaker function – *inoperative*.
13	Radio audio selector buttons – selects audio source *(only COM 1 is operative)*.
14	Radio audio/mic buttons – selects radio for transmission. LED blinks when transmitting.
16	NAV audio buttons – *inoperative*.
17	Test button – checks the function of all LEDs on the panel.
18	Locking screw access.
19	Photocell – controls LED intensity.

Figure 1-59 Audio Panel

92. Normal operation is achieved by selecting COM 1 MIC and setting pilot/co-pilot volumes/squelch levels as required. All other buttons can be deselected (LEDs OFF). A fail safe circuit connects the pilot's headset and microphone directly to the radio if the audio panel fails or is turned off. The LED lighting intensity is controlled by the photocell on the panel face. Nomenclature backlighting is controlled by the instrument lighting dimmer control.

GPS

93. A Garmin Aera 500 GPS is installed using an Air Gizmo panel mount adaptor with a permanent antenna mounted to the right hand glare shield. The unit is certified for VFR navigation only, and provides the following capabilities:

a. 5 inch touch screen with color display;

NOTE

Do not touch the screen with anything other than your finger, and use only light finger pressure. The screen is cleaned using a soft, clean, lint free cloth with water, isopropyl alcohol, or eyeglass cleaner.

b. navigational database including data for airports, aerodromes and navigation aids, and controlled / restricted airspace boundaries;

c. point-to-point navigation;

d. route navigation;

e. HSI navigation display; and

f. color map navigational displays capable of:

(1) topographical colour coding,

(2) hazardous terrain warnings, and

(3) satellite imagery overlay.

Figure 1-60 Garmin Aera 500

94. The GPS unit automatically powers up when the avionics master switch is selected on.

When the avionics master switch is selected off, the GPS will automatically go into a timed shutdown mode. The pilot should use the touch screen icon to shut down the unit.

NOTE

The power switch is located on the top right corner of the GPS unit. This switch should NOT normally be used to activate or shut down the GPS. However, if the GPS does not turn on when the avionics master switch is selected on, activation of the power switch may correct the problem.

95. Information on the key functions of the Aera 500 GPS is incorporated into the Pilots Checklist, Emergency Procedures and Operating Data. ***Refer to Annex C for more detailed operating instructions***.

WARNING

This GPS is for VFR navigation only.

CAUTION

The GPS database is only updated periodically. Information on airspace boundaries and aerodrome facilities may not be accurate. Such information shall be obtained from current VFR charts and the Canada Flight Supplement.

CAUTION

Do not enter navigational data while taxiing or during critical phases of flight where the risk associated with a loss of situational awareness is high.

NOTE

The GPS shall only be operated in Aviation Mode.

NOTE

The GPS unit shall not be removed from the aircraft except by qualified and authorized maintenance personnel.

VHF COM

96. A Garmin SL40 VHF transceiver is installed and designated as COM 1 on the audio panel. Information on the key functions of the Garmin SL40 is incorporated into the Pilot's Checklist, Emergency Procedures and Operating Data and is described below. ***Refer to Annex B for more detailed operating instructions***.

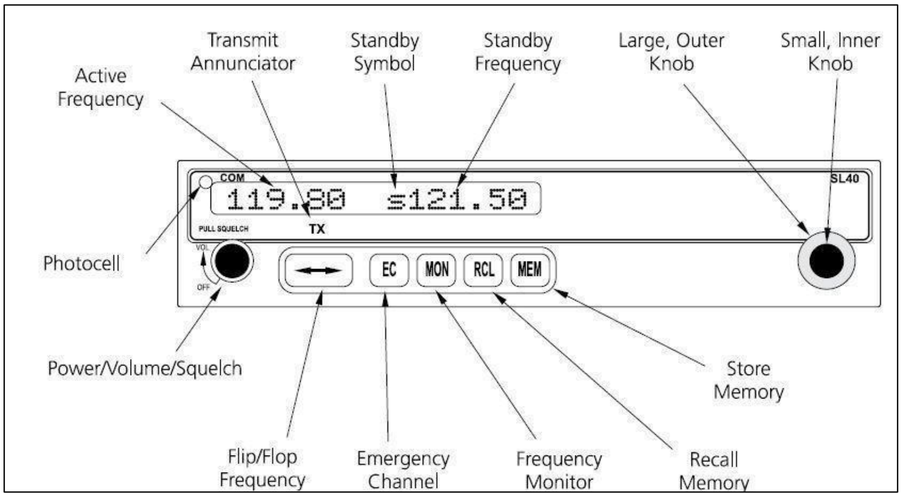


Figure 1-61 VHF COMM

a. **Power / Volume / Squelch** - The knob on the left side of the SL40 controls power on/off, volume, and squelch test. Rotate the knob clockwise (CW) past detent to turn the power on. Rotate the knob to the right to increase volume. Pull the knob out to disable automatic squelch;

b. **Large / Small Knobs** - The dual concentric knobs on the right side of the SL40 are used to select frequencies or to view the features available within a function;

c. **Flip Flop Button** - Press the Flip/Flop button to switch between the active (left-most) and standby (rightmost) frequency on the display. Switching between frequencies is disabled when transmitting;

d. **EC Button** - Press the EC button to load the Emergency Channel (121.500 MHz) as the standby frequency. The Monitor function is automatically enabled when the EC feature is exercised;

e. **MON Button** - Press the MON button to listen to the standby frequency. When the active frequency receives a signal, the unit will switch automatically to the active frequency;

f. **RCL Button** - Press the RCL button to retrieve stored frequencies.

g. **MEM Button** - Press the MEM button to store the displayed Standby frequency in memory.

Transponder

97. A Garmin GTX 327 Mode C digital transponder is installed. Information on the key functions of the transponder is incorporated into the Pilots Checklist, Emergency Procedures and Operating Data. ***Refer to Annex E for more detailed operating instructions***. Pressing the STBY, ALT or ON keys turns the unit on, after which it performs an internal self-test. If an internal failure is detected, the screen will display SELF TEST FAILED and the unit must be removed for repair.

Figure 1-62 Garmin GTX 327

a. **OFF** – powers off the unit when held for three seconds;

b. **STBY** – selects standby mode;

c. **ON** – selects Mode A only (no altitude information). Replies to interrogations are indicated by a flashing ® in the display;

d. **ALT** – selects Mode A and C (interrogation replies include altitude output from encoding altimeter). ALT appears in the display;

e. **Code Selection Keys 0-7** – provide 4096 identification codes. Pressing any one begins the code selection process and the new code is active as soon as the fourth digit is entered;

f. **IDENT** – activates special position identifier (SPI) pulse for 18 sec. IDENT will appear in the display when this feature is activated;

g. **VFR** – selects pre-programmed code (set to 1200). Pressing key again restores previous code;

h. **FUNC** – Cycles between several ancillary functions, specifically Pressure Altitude, Flight Time, Count-Up Timer and Count-Down Timer;

i. **START/STOP** – Starts and stops the timers;

j. **CRSR** - Initiates time entry for count down timer and cancels transponder code entry; and

k. **CLR** – Resets timers (when in timer mode, or cancels the previous key selection.

l. **OFF** – powers off the unit when held for three seconds;

Emergency Locator Transmitter (ELT)

98. An Artex ME406 ELT is installed on the right side of the baggage compartment.

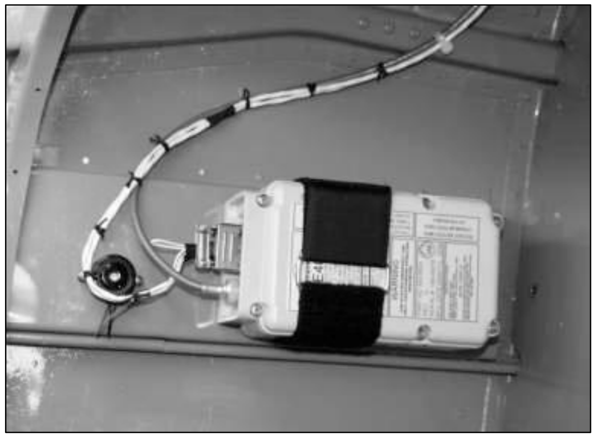


Figure 1-63 Artex ME406

99. Electrical power is provided by the aircraft 24V system which keeps the two D-sized lithium batteries fully charged. When activated, the ELT transmits a swept tone on 121.5 MHz until battery exhaustion and 440 msec data bursts at 50 second intervals for the first 24 hrs. Received by the COSPAS-SARSAT satellite system, the data burst contains aircraft identification data programmed into the beacon and provides location accuracy of approximately 3 km.

100. The ELT is activated either automatically during a crash (a change in velocity or deceleration greater than 4.5 fps ±0.5) or manually by selecting the instrument panel remote switch to ON. Once activated, the ELT may be switched off by selecting either the remote switch or the switch on the ELT case to the ON position and back to ARM.

Figure 1-64 ELT Arm Switch

NOTE

406 ELTs are individually registered to specific aircraft and are not interchangeable without first being re-programmed.

NOTE

406 ELTs as installed in this aircraft are not GPS equipped.

GLIDER TOWING EQUIPMENT

General

101. The C182 is uniquely modified for glider towing operations in accordance with the Supplemental Type Certificate documented at reference X. This modification was developed for RCA Ops (Pac) by Victoria Air Maintenance and incorporates a glider tow hook, glider release mechanism, towing mirrors, and gravel deflectors.

Glider Tow Hook

102. A Tost glider tow hook is installed on a structure mounted on the bottom of the rear fuselage.

103. The Tost mechanism is designed to ensure that the release force required remains constant regardless of tow rope tension or angle.

104. The release mechanism is actuated from the cockpit via a conduit style cable. The release handle is a red "D-Ring" mounted centrally on the instrument panel immediately below the avionics stack.

Figure 1-65 Tost Release Handle

Tow Mirrors

105. A ground-adjustable mirror is mounted at the mid-point of each strut. These mirrors allow the pilot to observe the glider during normal towing operations.

Gravel Deflectors

106. When aircraft will be operated for an extended period from grass surfaces, gravel deflectors will normally be installed on the main wheel assemblies. These gravel deflectors will prevent gravel, rocks, and other debris thrown by the main wheels from hitting the bottom surface and leading edges of the horizontal stabilizer and elevator.

SAFETY EQUIPMENT

Fire Extinguisher

107. A five-pound dry chemical fire extinguisher is floor mounted between the front seats.

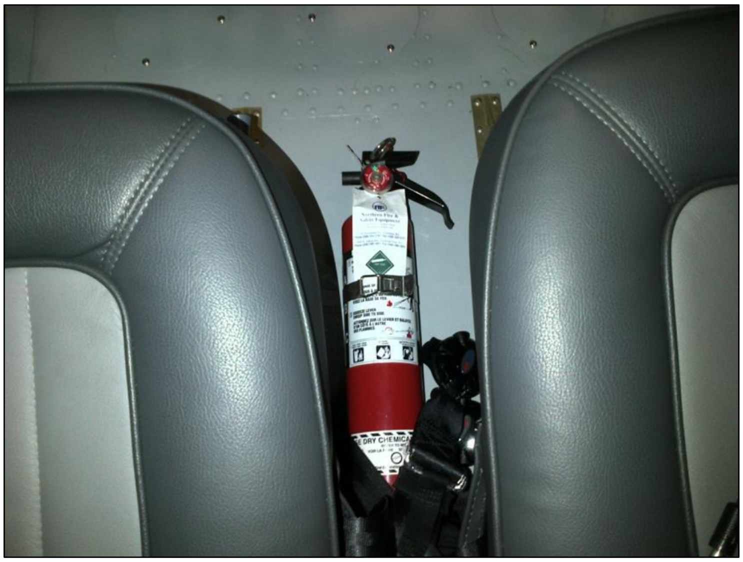


Figure 1-66 Fire Extinguisher

First Aid Kit

108. A first aid kit is mounted below the rear seat.

Carbon Monoxide Detector

109. An adhesive card type Carbon Monoxide (CO) detector is mounted on the instrument panel. The spot turns gray/black in the presence of CO.

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PART 2

NORMAL OPERATING PROCEDURES

GENERAL

1. The following procedures and checks are an expansion of the Pilot's Checklist. While the checklist is the in-flight reference document, a complete understanding of this manual is critical for the safe operation of the aircraft.

GROUND HANDLING

General Ground Handling

2. Ground handling is best achieved utilizing a tow bar which attaches to lugs on the nose gear fork. A collapsible tow bar is stored on the aft wall of the baggage compartment for use during deployed operations. To move the aircraft, push / pull on the wing struts and/or the tow bar. The aircraft may be pivoted about either main wheel by pressing down on the aft fuselage bulkhead just forward of the horizontal stabilizer to raise the nose wheel off the ground.

WARNING

Prior to moving the propeller or moving to a position inside the propeller plane of rotation, visually confirm that the Ignition Switch is in the OFF position and the keys are removed.

CAUTION

When manually moving the propeller blades is necessary, such as repositioning to use a tow bar, the propeller shall only be moved in its normal direction of rotation. Caution shall be exercised as the impulse coupling may trigger an inadvertent start if a magneto is not properly grounding. Regardless, the propeller shall never be turned in reverse as this may damage the starter motor adapter.

CAUTION

Do not attempt to move the aircraft on the ground by pushing or pulling on the propeller, spinner, or horizontal stabilizer assemblies.

CAUTION

To prevent inadvertent damage to the propeller, remove the tow bar when ground handling is complete.

Fuel and Oil Replenishment

3. Oil Replenishment. The oil capacity is 12 US quarts (11.4 litres) with a minimum operating level of 9 US quarts (8.5 litres). For normal operations, maintain the oil level between 10 and 11 quarts, and replenish if the oil level drops below 10 quarts.

NOTE

When replenishing oil, check the Aircraft Journey Log for the correct type and grade of oil to use.

NOTE

When replenishing oil, a ladder or step stool is required to access the oil filler cap through the access door on the top of the engine cowling and prevent oil spillage.

NOTE

If checking oil within 1 hour of engine operation, the oil level may appear low as oil has not fully drained into the sump.

4. Fuel Replenishment. When replenishing fuel, ensure that the aircraft is properly grounded and that the correct type of fuel is available before commencing the pumping of fuel. A ladder is required for refuelling, and a light weight folding ladder is carried in the baggage compartment for use during deployed operations.

NOTE

To ensure maximum fuel capacity during refuelling, place the fuel selector to LEFT or RIGHT to prevent cross-feeding.

CAUTION

Caution must be taken with the refuelling hose and nozzle to prevent damage to the vortex generators on the wing leading edge.

CAUTION

When the aircraft will be stored in a warm hangar, do not fully refuel, in order to prevent fuel venting caused by thermal expansion.

CAUTION

When the aircraft will be stored in a hangar, place the fuel selector to the LEFT or RIGHT to prevent cross feeding to the left tank and subsequent fuel venting.

DAILY INSPECTION

Pre-External Inspection

5. Perform the Pre-External portion of the Daily Inspection as follows:

PRE-EXTERNAL INSPECTION		
ACTION	**CHECK**	**NOTES**
1. Weight and Balance	Check	
2. Journey Log	Maintenance / serviceability	
3. Chocks	In place	As required
4. Covers, Plugs, Tie Downs, Pitot Cover	Remove and stow	
5. First Aid Kit	Secure and in-place	
6. Survival Kit	As required	
7. Magnetos and switches	Confirm off	
8. Control Lock	Remove and stow	
9. Controls	Confirm free and correct movement	
10. Elevator and rudder trim	Confirm functional	Verification of full travel is not required
11. Cowl flaps	Set to full open	
12. Fire Extinguisher	Secure and charged	
13. Pubs, documents, maps	Present	Pubs and navigational materials must be current
14. Battery Master	Select ON	Combine steps 16 through
15. Flaps	Set Full Flaps	
16. Interior/exterior lights	Confirm functioning	a. Interior and taxi / landing light check required for night flight b. Select nav, anti-collision and pulse lights on, check externally
17. Stall Vane	Confirm stall vane functional	
18. Pitot Heat	Confirm pitot tube heat functional	**WARNING** Exercise care when checking pitot heat as serious burns can result.
19. Battery Master	OFF	

20. Fuel status	a. Refuel and/or dip tanks to confirm fuel state b. Ensure filler cap secure and aligned c. Check fuel tank drains for water / sediment. d. Check header tank drain for water / sediment e. Pull fuel strainer drain 4 secs to clear any water/sediment	a. Dip tanks if required to correlate tank quantity with gauge and EDM fuel remaining indications. b. header tank drain is on the belly panel behind the nose landing gear c. If water observed, drain further to ensure that the strainer, tank sumps and fuel selector valve are clear.
21. Oil Quantity	a. Check dipstick, add oil as required b. Ensure oil filler cap is on and secure	Min oil quantity for flight – 9 US quarts indicated on the dipstick. Add oil if quantity is less than 10 US quarts.

Figure 2-1 Pre-External Inspection

External Inspection

6. Perform the external pre-flight inspection by starting at the left main landing gear and proceeding clockwise around the aircraft as follows:

EXTERNAL INSPECTION		
ACTION	**CHECK**	**NOTES**
LEFT MAIN GEAR		
1. Brake line	Condition	Check for any wear, damage, or leaks
2. Brake	Condition and wear	Check rotor and pad for unusual wear
3. Tire	Inflation and wear	Tires may be worn to base of any groove. Check for exposed cord, cracks, cuts or bulges.
FUSELAGE - FRONT		
4. Nose Gear Tire	Inflation and wear	
5. Nose gear strut	Condition, oleo inflation and scissors	Oleo inflation must be between 2 - 4” Clean the oleo strut of residual oil and grime.

6. Cowl flaps	Confirm secure	Check for any foreign objects inside the engine compartment. **CAUTION** During bird nesting season, use a flashlight and carry out a thorough visual check inside the cowl flaps.
7. Cowling – left side	Secure, access panels closed	
8. Left static port	Clear	
9. Propeller	Blades for nicks, Spinner for security, Oil leaks	
10. Landing Lights	Condition and cleanliness	
11. Air intakes	Clear and unobstructed	**CAUTION** During bird nesting season, use a flashlight and carry out a thorough visual check inside the cowl flaps
12. Cowling – right side	Secure	
13. Right static port	Clear	
RIGHT MAIN GEAR		
14. Brake line	Condition	Check for security, wear, chafing or leaking.
15. Brake rotor and pads	Condition and wear	Check for unusual wear.
16. Tire	Inflation and wear	
RIGHT WING		
17. Strut and tow mirror	Condition and security	
18. Leading edge – vortex generators, fresh air vents	Condition	Aircraft is U/S if more than five VGs are missing in total from all surfaces.
19. Wing surfaces – upper and lower	Condition	
20. Wing tip	Condition	
21. Aileron and flap	Movement, condition, hinge points, actuators, static wicks	Closely check flap tracks, brackets and surrounding wing skins for cracking, wear, rubbing, contact or other damage.

22. Fuel filler cap	Secure and in-line	
FUSELAGE - RIGHT REAR		
23. Fuselage skin	Condition	
24. Antennae	Condition and security	XPDR / VHF / GPS / ELT
TAIL SECTION		
25. Vertical and horizontal stabilizers	Condition	
26. Vortex generators	Condition	Aircraft is U/S if more than five VGs are missing in total from all surfaces.
27. Elevators and rudder	Condition, movement, hinge points and actuators, static wicks	
28. Trim tab	Condition and security, set in takeoff position.	Takeoff position is approx ½” downward deflection.
29. Tail cone	Condition	
30. Tow hook	Condition and security, TOST release mechanism for function	
FUSELAGE - LEFT REAR		
31. Fuselage skin	Condition	
32. Belly	Check for oil	
33. Battery vent and drain	Condition and clear	
34. Baggage compartment door	Closed, latched and locked	Door must be locked to ensure it cannot be opened by slipstream
LEFT WING		
35. Fuel filler cap	Secure and in-line	
36. Aileron and flap	Movement, condition, hinge points, actuators, static wicks	Closely check flap tracks, brackets and surrounding wing skins for cracking, wear, rubbing, contact or other damage.
37. Wing tip	Condition	
38. Wing surfaces – upper and lower	Condition	
39. Leading edge – vortex	Condition	Aircraft is U/S if more than

generators, fresh air vents		five VGs are missing in total from all surfaces.
40. Fuel vent, pitot tube,	Condition and unobstructed	
41. Strut and mirror	Condition and security	
DAILY INSPECTION SHEET		
42. DI Sheet	Complete and Sign	

Figure 2-2 External Inspection

BETWEEN FLIGHT INSPECTION (BFI)

7. When conducting multiple flights, or when conducting a pilot change during flight operations, the pilot shall conduct a Between Flight Inspection as follows:

Between Flight Inspection (BFI)		
ACTION	**CHECK**	**NOTES**
1. Engine	Fuel and Oil Leaks	If checking engine oil shortly after (within 1 hr) shutdown, oil level may appear low as oil has not fully drained into the sump. *Do not over-fill.*
2. Oil	Check Qty, Cap Secure, Doors Secure	
3. Fuel	Check Qty, Caps Secure and In-Line	
4. Main Wheels	Check Condition	
5. Nose Wheel Assembly	Check Condition	
6. If Night Flying	Check all lights	

Figure 2-3 Between Flight Inspection

PRE-START CHECK

8. After entering the cockpit, proceed as follows:

PRE-START		
ACTION	**CHECK**	**NOTES**
1. Chocks	Confirm removed	
2. Doors	Closed and locked	**Hold door closed – do not slam**. Ensure handle rotates 90º fwd.
3. Seats	Adjusted and locked.	Ensure seat rail locking pins engaged.

4. Seat harnesses	Adjust and secure	
5. Circuit breakers	All in	
6. Alternate Air	OFF	
7. Cowl flaps	Fully open	Cowl flaps should be open for all ground operations.
8. Fuel selector	On BOTH	
9. Fuel Shutoff Valve	OPEN	Confirm fuel shutoff valve is OPEN, in the FULLY IN position
10. Altimeter	Set	Set to altimeter setting or field elevation.

Figure 2-4 Pre-Start Check

START CLEARANCE

9. For engine starts conducted at military aerodromes, pilots must obtain start clearance from ATC.

START CLEARANCE (If Required)		
ACTION	**CHECK**	**NOTES**
1. Master Switch	On	
2. Radio Master Switch	On	
3. Radio	On / Set	Set to ground frequency
4. Start Clearance	Obtain	Provide ATC with Tug number, location, fuel on board, souls on board, intentions
5. Radio Master Switch	Off	

Figure 2-5 Start Clearance

NORMAL ENGINE START

10. Proper fuel management and throttle adjustments are the critical determining factors in securing an easy start from this fuel injected engine.

11. ***The procedure below is effective under nearly all operating conditions***. Even when attempting to start a warm / hot engine, conduct a NORMAL START using a small amount of PRIME. Unless there is a valid reason to conduct a HOT START or a FLOODED START, the first start attempt should be a NORMAL START.

NORMAL ENGINE START		
ACTION	**CHECK**	**NOTES**
1. Master Switch	Select ON	Ensure both sides are on
2. Anti-collision lights	On	
3. Brakes	Apply	Do not rely on parking brake.
4. Prop area	All clear	
5. Throttle	SET 1/4 INCH	
6. Propeller	FULL FINE	
7. Mixture	FULL RICH	
8. Aux Fuel Pump	PRIME for approximately 3 seconds, then promptly OFF	If engine is **COLD**, more prime may be required If engine is **WARM**, little or no prime is required. If engine is **HOT** and will not start, use HOT START procedure
9. Starter	Engage until engine starts	**CAUTION** Do not engage the starter longer than 30 seconds as it may overheat. If starter has been engaged for extended period, allow to cool for 3 minutes. **CAUTION** Immediately release the starter upon partial firing, and do not re-engage until the prop is completely stopped. **CAUTION** If the propeller does not immediately turn upon

		engaging the starter, the aircraft is U/S.
10. Throttle	Set to 1000 rpm	**Engine will start at approximately 1400 RPM.** Smoothly retard throttle to set approximately 1000 RPM
11. Oil pressure	Normal Indication	If no indication within 30 sec, shutdown immediately.

Figure 2-6 Normal Engine Start

HOT ENGINE START

12. ***Engine starting in extremely hot weather or with a very hot engine is sometimes hampered by vapour formation in the fuel lines***. The large thermal mass of the engine will transfer heat energy to other metal components, including the fuel lines and the engine driven fuel pump. The result is vaporization of fuel, which impedes the normal flow of liquid fuel during a start attempt. The effects of fuel vaporization are most pronounced 15-30 minutes after engine shutdown.

13. If significant fuel vapour is present in the fuel injection system, it can be advantageous to pressurize the fuel system for a short period of time to circulate cooler fuel into the fuel system and force any fuel vapour back to the RH fuel tank through the vapour return line. This process is accomplished by setting the throttle FULL OPEN, setting the mixture to IDLE CUT OFF, and setting the Auxiliary Fuel Pump to PRIME for approximately one minute prior to commencing the start.

HOT ENGINE START		
ACTION	**CHECK**	**NOTES**
1. Master Switch	Select ON	Ensure both sides are on
2. Anti-collision lights	On	
3. Brakes	Apply	
4. Prop area	All clear	
5. Throttle	FULL OPEN	
6. Propeller	FULL FINE	
7. Mixture	IDLE CUT OFF	
8. Aux Fuel Pump	PRIME for 60 seconds, then OFF	
9. Throttle	SET 1 INCH	
10. Mixture	FULL RICH	
11. Starter	Engage until engine starts	**CAUTION** Do not engage the starter longer than 30 seconds as it

		may overheat. If starter has been engaged for extended period, cool for 3 mins. **CAUTION** Immediately release the starter upon partial firing, and do not re-engage until the prop is completely stopped. **CAUTION** If the propeller does not immediately turn upon engaging the starter, the aircraft is U/S.
If engine tends to die after start, turn the auxiliary fuel pump switch momentarily to ON at appropriate intervals to help purge any fuel vapour until the engine is running smoothly.		
12. Throttle	Set to 1000 rpm	**Engine will start at approximately 1400 RPM.** Smoothly retard throttle to set approximately 1000 RPM
13. Oil pressure	Normal Indication	If no indication within 30 sec, shutdown immediately.

Figure 2-7 Hot Engine Start

FLOODED ENGINE START

14. Should it become evident that the engine is flooded, the engine start should be conducted using the Flooded Engine Start procedure detailed below.

FLOODED ENGINE START		
ACTION	**CHECK**	**NOTES**
1. Master Switch	Select ON	Ensure both sides are on
2. Anti-collision lights	On	
3. Brakes	Apply	**CAUTION** The engine will start at **very high RPM**. Ensure that brakes are properly set.
4. Prop area	All clear	
5. Throttle	HALF OPEN	
6. Propeller	FULL FINE	
7. Mixture	IDLE CUT-OFF (ICO)	

8. Aux Pump	OFF	
9. Starter	Engage until engine starts	**CAUTION** Do not engage the starter longer than 30 seconds as it may overheat. If starter has been engaged for extended period, allow to cool for 3 minutes. **CAUTION** Immediately release the starter upon initial firing, and do not re-engage until the prop is completely stopped. **CAUTION** If the propeller does not immediately turn upon engaging the starter, the aircraft is U/S.
10. Throttle	Reduce to 1000 rpm	The engine will start at ***very high RPM***. Smoothly retard throttle to set approximately 1000 RPM.
11. Mixture	Slowly advance to FULL RICH	
12. Oil pressure	Normal Indication	If no indication within 30 sec, shutdown immediately.

Figure 2-8 Flooded Engine Start

CAUTION

There is an elevated risk of a fire when conducting a flooded engine start. Fuel leaking onto the ground can catch fire, or fuel in the exhaust system can “torch” resulting in aircraft damage.

POST START

Pre-Taxi

15. After engine is running smoothly and prior to taxiing, perform the pre-taxi check as follows:

PRE-TAXI		
ACTION	**CHECK**	**NOTES**
1. Radio Master	ON	Needed to activate intercom and radios.
2. Fuel Quantity	SET on EDM 930	
3. Magneto	Check for Live Magneto	Switch momentarily to OFF then back to BOTH.
4. Flaps	Retract	Select UP or as required for takeoff.
5. Audio Panel	Set	
6. Radio	On and Set	
7. GPS	Confirm Initializing	
8. Transponder	Standby	
9. Landing & Nav Lights	ON for night operations	

Figure 2-9 Pre-Taxi

Taxi

16. While taxiing, perform the following actions:

TAXI		
ACTION	**CHECK**	**NOTES**
1. Brakes	Ensure functional	
2. Nose wheel steering	Ensure functional	
3. Flight instruments	Ensure functional	In turns, ensure that turn coordinator, ball, directional gyro function correctly, compass moves freely, and artificial horizon remains steady.

Figure 2-10 Taxi

GROUND OPERATIONS

17. The aircraft shall be taxied with the following considerations:

   a. taxi at the lowest possible speed commensurate with safety, especially when taxiing with a strong crosswind or a tailwind;

   b. when taxiing in congested areas, near aircraft or other obstructions, manoeuvre slowly, and be vigilant for wing tip and tail clearances;

CAUTION

The aircraft has an extended wing span. If in doubt about obstacle clearance while manoeuvring, have ground crew verify clearances, or shut down and manoeuvre by hand.

   c. avoid taxiing with flaps down, especially in high winds;

   d. avoid excessive use of brake during taxiing. Use power settings that do not require continuous use of brake to control speed. Note that when taxiing in very strong crosswinds, some brake may be required to maintain directional control.

   e. when taxing over soft / rough surfaces, hold the control yoke fully aft to avoid damage to the nose gear and to maximize ground clearance of the propeller; and

   f. position the flight controls appropriate to the wind speed and direction as shown below:

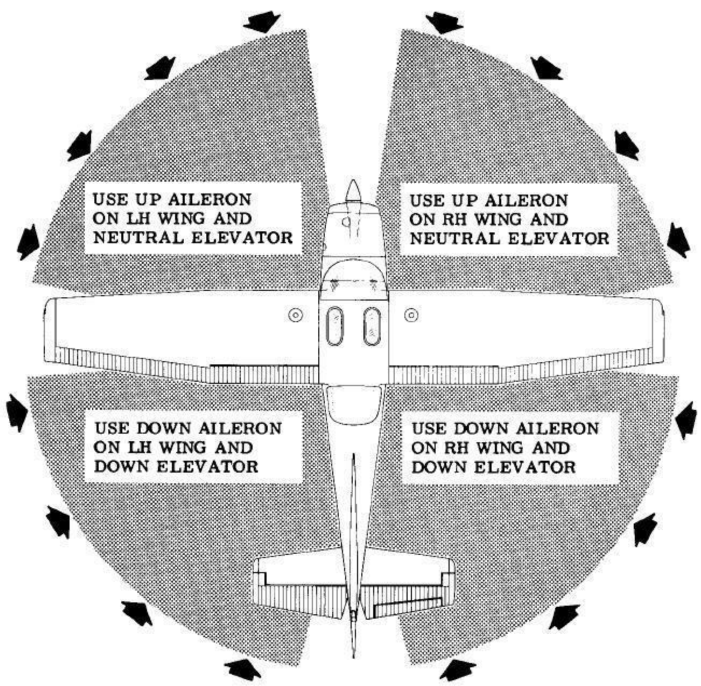

Figure 2-11 Control Positions during Taxi

RUN UP

18. Position the aircraft so that the prop wash will not create a hazard, ensure the nose wheel is straight, apply and hold the brakes firmly (do not use the parking brake) and perform the run-up check as follows:

PRE-TAXI		
ACTION	**CHECK**	**NOTES**
1. Area	All Clear	Ensure area behind aircraft is clear.
2. Brakes	Apply	Do not use parking brake.
3. Mixture	FULL RICH	
4. Temperatures and pressures	As required for run-up	Min temps for run-up are 75º for oil temp and 200º CHT.
5. Throttle	Set 1700 rpm	
6. EDM 930	Select NORMALIZE	Hold LF button for 3 seconds or until NRM appears on display
7. Magnetos	Select LEFT – BOTH – RIGHT - BOTH	a. Check EGT rise / all cylinders b. Check normal RPM drop **CAUTION** RPM drop > 150 or an RPM differential > 50 may indicate plug fouling or a faulty magneto
NOTE Clear minor plug fouling as follows: a. throttle - 2200 RPM b. mixture - lean until RPM peaks then hold for 30 seconds c. reselect full rich d. magnetos - recheck		
8. EDM 930	Select STANDARD	Hold LF button for 3 seconds or until NRM disappears from display
9. Alternate Air Function	Check - Select full ON, then back to OFF	Confirm an RPM drop and recovery

10. Prop	Cycle - move toward low rpm (coarse pitch)	RPM decrease of 200-300 RPM, then reset full fine **CAUTION** Monitor MAP to ensure 20" is not exceeded
11. Suction	Confirm 4.5 – 5.5 in HG	
12. Alternator	Confirm charging	
13. Idle Check	Confirm IDLE at 650-750 RPM,	
14. Throttle	Set 1000 RPM	
15. Mixture	Function	Lean gradually until engine falters, then IMMEDIATELY reset to full rich to prevent engine shutdown. Very little movement of the mixture control is required.

Figure 2-12 Run-up

PRE-TAKEOFF CHECK

19. Perform pre-takeoff check as follows:

PRE-TAKEOFF CHECK		
ACTION	**CHECK**	**NOTES**
1. Doors and windows	Secure	a. door handles fully forward b. latches on window secure
2. Harnesses	Secure	
3. ELT Switch	Confirm on ARM	
4. Master switch	ON	
5. Aux Pump	OFF	
6. Magnetos	BOTH	
7. Circuit breakers	All IN	
8. Landing Light	ON	For daytime anti-collision and for night ops
9. Pitot heat	OFF	Takeoff shall not be attempted in conditions requiring pitot heat.
10. Pulse Lights	ON for daytime ops	Optimum setting for daytime visibility is A88
11. Gyro instruments	Set	
12. Altimeter	Set	
13. Radio	Set as required	
14. GPS	Set as required	**CAUTION** Do not enter data into GPS while taxiing or during critical regimes of flight
15. Transponder	Code Set & ALT ON	
16. Alternate Air	OFF	
17. Prop	FULL FINE	
18. Mixture	FULL RICH	
19. Trim – elevator and rudder	Set for takeoff	
20. Cowl flaps	Full OPEN	
21. Fuel Selector	BOTH	

22. Fuel Shutoff Valve	OPEN	Confirm fuel shutoff valve is OPEN, in the FULLY IN position
23. Flaps	Set for Takeoff	0 - 20º flap for takeoff.
24. Temps and pressures	NORMAL	All temperatures in the green.
25. Controls	Free	
26. Pre Take-Off Brief	Carry Out / Complete	• Runway and Winds • Departure Plan • Threats • Decision Gates

Figure 2-13 Pre-Takeoff Check

TAKEOFF

Normal Takeoff

20. A normal takeoff is used when no special considerations exist. A normal takeoff is accomplished as follows:

a. set trim for takeoff and **set flaps to 10º**;

b. line up on the centre of the runway or takeoff path;

c. release brakes and smoothly apply full throttle to commence takeoff roll;

d. ensure full power is achieved by confirming approximately 2850 RPM and approximately 28” MAP and that EGTs increase on all six cylinders;

e. maintain directional control with nose wheel steering and rudder;

f. apply gentle back pressure on the yoke so that the aircraft becomes airborne at approximately 60 mph;

g. adjust yoke position to set required climb attitude; and

h. complete the post-takeoff check.

Short Field Takeoff

21. A short field takeoff is used when the available takeoff surface is limited in length. The determination of whether the available field length is “short” must be based on calculated takeoff performance, with due consideration for aircraft weight, winds, and density altitude. ***As a general guideline, takeoff surfaces less than 1,800 ft long should be carefully assessed.*** A short field takeoff is accomplished as follows:

a. set trim for takeoff and **set flaps to 20º**;

b. line up on the centre of the runway or takeoff path, positioning the aircraft to provide maximum takeoff surface;

c. apply brakes, then apply full throttle against braking. Once full power is achieved (see para 20(d)), release brakes to commence the takeoff roll;

d. maintain directional control with nose wheel steering and rudder;

e. apply gentle back pressure on the yoke so that the aircraft becomes airborne at approximately 60 mph;

f. adjust yoke position to set required climb attitude; and

g. complete the post-takeoff check.

Soft / Rough Field Takeoff

22. A soft / rough field takeoff is used when operating from grass, dirt, or gravel strips. The objective is to minimize the potential for damage to the nose gear and main landing gear by minimizing load on the nose gear, getting the aircraft off the ground as quickly as possible, and accelerating to safe climb speed in ground effect. A soft / rough field takeoff is accomplished as follows:

a. while taxiing on soft / rough surfaces, hold the yoke fully aft to keep weight off the nose gear to the greatest extent possible;

b. set trim for takeoff and **set flaps to 10º**;

NOTE

The C182 POH specifies 20º of flap for a soft field takeoff. However, the aerodynamic enhancements on this aircraft allow optimum soft field takeoff performance with 10º flaps.

c. line up on the centre of the runway or takeoff path, positioning the aircraft to provide maximum takeoff surface;

d. with the yoke held approximately 2/3 full aft, smoothly apply full throttle for takeoff. As aircraft starts to roll, the nose will come up brusquely, slightly relax backpressure on the yoke as required to prevent the tail from contacting the ground, while maintaining a nose high attitude;

e. maintain directional control with nose wheel steering and rudder;

f. due to the high angle of attack, the aircraft will become airborne in ground effect at between 50-60 MPH (dependant on aircraft weight);

WARNING

Do not allow the aircraft to climb out of ground effect until safe flying speed of 60 MPH or higher is achieved. Premature climb out of ground effect could result in a stall.

g. once safe flying speed has been achieved (60 MPH), smoothly adjust the yoke position to achieve the desired climb attitude;

h. complete the post-takeoff check.

Crosswind Takeoff

23. Takeoffs in moderate to strong crosswinds will require appropriate modifications to the selected takeoff technique:

a. crosswind takeoffs are performed with minimum flaps necessary, with due consideration for field type, field length, and departure end obstacles;

b. maintain into-wind aileron during the takeoff roll, progressively reducing aileron deflection as the aircraft accelerates;

c. allow the aircraft to accelerate to a slightly higher speed before rotating to ensure a positive lift-off. With proper aileron position for the crosswind, the downwind wheel should lift off slightly before the upwind wheel; and

d. once airborne, make a coordinated turn into wind to correct for drift.

Post-Takeoff

24. The Post-Takeoff Check is completed once a safe altitude (minimum 100 ft AGL) has been achieved, and a positive rate of climb has been confirmed.

PRE-TAKEOFF CHECK		
ACTION	**CHECK**	**NOTES**
1. Flaps	UP once above 100 ft AGL ***and*** positive rate of climb confirmed	Min retraction speed 70 mph **If towing, maintain 10°flap.**
2. Climb Profile	SET	Use desired climb profile settings **RPM** – 2500 for noise abatement, or 2700 if required **MP – 28.8” or lower as required** **Airspeed** – as required.
3. Cowl flaps	As required	

4. Mixture	Adjust as required	
5. Landing Light	OFF for night operations	Landing light on in flight can provide distracting illumination that makes horizon recognition difficult at night

Figure 2-14 Post-Takeoff

NOTE

The post-takeoff check shall be committed to memory.

CLIMB PROFILES

25. Several climb profile options exist, depending on the operational requirement. With the exception of maximum performance climbs, these profiles are recommended to provide an optimum combination of performance, visibility, engine cooling, economy and passenger comfort. When climbing to altitudes above 3000' AGL, lean the engine in accordance with the Part 2 – Management of Ancillary Controls – Mixture Control.

CLIMB PROFILES				
TYPE	**RPM**	**MAP**	**MPH**	**NOTES**
Max Rate Climb	2700	FT	90	Airspeed for Max Rate Climb decreases by approximately 2 MPH every 5,000 feet, to 86 mph @ 10,000 ft ASL.
Max Angle Climb (20º flap)	2700	FT	63	Used for obstacle clearance takeoffs and climbs.
Max Angle Climb (no flap)	2700	FT	73	May be used for terrain clearance climbs during cruise phase when flaps have not been selected.
Normal Climb	2700	FT	110	Standard / default climb profile. The normal climb allows for the optimum combination of rate of climb, ground speed, forward visibility and engine cooling.
Cruise Climb	As Set	As Set	As Set	For cruise climb, maintain the RPM and MAP that have been set for cruise, and trim slightly nose to climb at reduced IAS. Progressively increase throttle to maintain MAP until full throttle reached.
Towing	2500	FT	70	Glider towing is normally conducted with full power and 2500 RPM for noise abatement. 2700 RPM may be used when increased performance is necessary.
Noise Abatement	2500	As Set	As Set	When necessary, propeller RPM may be

				reduced to 2500 RPM for noise abatement. This will reduce rate of climb by approximately 15%
Max Rate Climb	2700	FT	90	Airspeed for Max Rate Climb decreases by approximately 2 MPH every 5,000 feet, to 86 mph @ 10,000 ft ASL.

Figure 2-15 Climb Profiles

WARNING

Noise abatement procedures will reduce climb performance by approximately 15%. Do not initiate noise abatement procedures if a rate of climb appropriate to local terrain and obstructions cannot be maintained. If observed rate of climb is not adequate, immediately apply full power (full throttle and propeller full fine).

CRUISE

Cruise Profiles

26. Normal level flight power settings are between 55% and 75% BHP. ***Continuous cruise power settings shall not exceed 75% BHP***. Select a cruising speed appropriate to the in-flight conditions (i.e. turbulence) and desired range and economy. Refer to the Cruise Performance Charts in Part 4 for detailed cruise settings, ***or use one of the following generic settings (2,000 MSL)***:

	RPM	**MAP**	**Typical Performance at 2,000 ft MSL**			
			IAS (MPH)	**TAS (KTS)**	**Fuel Flow (GPH)**	**Range[1] (NM)**
Max Speed Cruise	2500	25	144	130	18.2	470
Normal Cruise	**2400**	**24**	**138**	**125**	**16.6**	**500**
Slow Cruise	2400	22	128	116	15.2	515
Best Range Cruise	2300	19	122	110	12.3	615
Notes: 1. Range in still air (no wind) from full tanks to min 30 minute reserve						

Figure 2-16 Cruise Profiles

NOTE

For local operations in the practice area, level flight power settings can be set at 2400 RPM / 24 MAP, which will give an IAS of approximately 135 MPH. MAP may be reduced as desired to achieve lower airspeed.

Level-Off Cruise

27. After stabilizing in cruise, perform level-off check as follows:

LEVEL-OFF / CRUISE CHECK		
ACTION	**CHECK**	**NOTES**
Power	SET Throttle and Prop	Refer to performance data chart for cruise power settings.
Trim	As required	
Cowl flaps	CLOSE	Maintain appropriate CHTs and minimize cooling drag.
Mixture	Lean to **50 ºF Rich of Peak**	Refer to EDM 930 manual for “LeanFind” procedure.
Cowl flaps	As required to manage CHT	After leaning, cowl flaps may be opened as required to maintain desired CHT.

Figure 2-17 Level-Off / Cruise Check

FLIGHT MANOEUVRES / FLIGHT CHARACTERISTICS

Turns

28. The C182 does not exhibit significant adverse yaw due to aileron drag. As a result, only minimal rudder deflections are required to coordinate turns. Steep turns will require the addition of power and aft control column pressure to achieve a slightly raised nose attitude to maintain level flight.

Slow Flight

29. Slow flight is a proficiency manoeuvre, which can be practised clean or with any amount of flap. Establish a trimmed, level-flight attitude and reduce power. Apply flaps as required once airspeed is below Vfe. Adjust attitude to maintain altitude as the airspeed falls and when the stall warning horn blows, note the horn speed and maintain that speed. Power may need to be applied to maintain altitude. Fine trim adjustments are required to produce the accuracy desired.

Stalls

30. The stall characteristics of the Cessna 182 are extremely benign. Due to the aerodynamic modifications to the aircraft, aileron effectiveness is maintained well into the stall, and the aircraft does not exhibit noteworthy wing-drop tendencies. The Stall Speed Chart is provided in Part IV of this manual.

31. Stall recoveries are emergencies demanding prompt action and a minimum loss of altitude. While just lowering the nose will recover the aircraft from a stall, the loss of altitude will usually be unacceptable. The immediate application of power will reduce the altitude loss to almost zero with very little attitude change.

32. Stall Recovery. The stall recovery procedure for this aircraft is consistent with most general aviation aircraft and follows the acronym **PP (Push – Power)** is as follows:

a. **P** - Push - Lower the nose when the stall is detected. If the wing drops during the stall, correct with opposite rudder;

b. **P** - Power – Apply full power simultaneously with lowering the nose; and

c. after recovering from the stall, raise any flaps in steps and establish a climb to a safe altitude.

NOTE

Stall recoveries are a critical emergency procedure and shall be committed to memory.

Spins

33. Spins are not approved in the Cessna 182. As the aircraft does not exhibit wing-drop tendencies, incipient spins require aggressive entry technique and are likely to result in a full spin. **Deliberate incipient spins or full spins are prohibited**.

34. Spin Recovery. In the case of an unintentional spin, the recovery procedure is consistent with most general aviation aircraft and follows the acronym **PARE (Power – Aileron – Rudder – Elevator)**. Spin recovery is accomplished as follows:

a. **P** – Power – bring throttle to idle.

b. **A** – Ailerons – centralize the control column. Raise flaps if required;

c. **R** – Rudder – apply full rudder opposite to the direction of rotation;

d. **E** – Elevator – ease the yoke forward to break the stall; and

e. once rotation stops, centralize the rudders, level the wings, ease out of the ensuing dive, and establish a climb to a safe altitude.

NOTE

Spin recoveries are a critical emergency procedure and shall be committed to memory.

Spiral Dives

35. Spiral dives are steep descending turns characterized by rapidly increasing airspeed and rate of descent (in a spin, the airspeed and rate of descent remain relatively low and constant). Left uncorrected, a spiral dive usually leads to structural failure. Attempts to recover using aft control column will only tighten the spiral.

36. Spiral Dive Recovery. The spiral dive recovery procedure for this aircraft is consistent with most general aviation aircraft and follows the acronym **PRP (Power – Roll – Pull):**

a. **P** – Power – reduce power to idle;

b. **R** – Roll – roll to a wings level attitude with full aileron deflection;

c. **P** – Pull – pull the nose up to ease out of the ensuing dive; and

d. after recovery from the spiral dive, apply power as required to establish a climb to a safe altitude.

NOTE

Spiral dive recoveries are a critical emergency procedure and shall be committed to memory.

PRE-STALL CHECK

37. Prior to practising slow flight, stalls, spiral dives, or unusual attitude recoveries, perform the following (ASCOT) check:

PRE-STALL (ASCOT)		
ACTION	**CHECK**	**NOTES**
A - Altitude	As required	Ensure that manoeuvre recoveries can be accomplished above min designated altitudes.
S - Straps	Tight	Ensure unused straps secure.
C - Cockpit / Configuration	a. Prop --------------- A/R b. Mixture ----------- RICH c. Fuel -------------- BOTH d. Flaps ------------- A/R e. Temp / Press --- GREEN f. Doors ------------- SECURE	
O - Objects	Secure loose objects	
T - Traffic/Terrain	Clear	Check for conflicting traffic and ensure clear of obstructions.

Figure 2-18 ASCOT Check

PRE-DESCENT

38. Prior to commencing a descent, perform descent check as follows:

PRE-DESCENT		
ACTION	**CHECK**	**NOTES**
1. Mixture	Enrich as required	May be done progressively in extended descents to ensure continued smooth running of the engine
2. Cowl flaps	Close	
3. Throttle	Reduce Slowly	

Figure 2-19 Pre-Descent Check

CAUTION

To avoid engine damage due to shock cooling, reduce power in a smooth, gradual manner. Monitor EDM930 and maintain cylinder cooling rates below 60º / min.

Rapid descents at high RPM / low MAPs are to be avoided.

Do not permit CHTs to drop below 300ºF for periods exceeding 5 minutes.

TRAFFIC PATTERN

39. For easy transition to final approach speeds it is recommended that pilots slow to approximately 125 MPH upon entering the traffic pattern. Specific guidance on the traffic pattern is as follows:

a. slowing to approximately 125 MPH can be accomplished with a power setting of 2400 RPM and 20” MAP;

b. if desired, a slower airspeed of approximately 115 MPH can be achieved with power setting of 2400 RPM and 18” MAP. At this airspeed, it is recommended to select flaps to 10 degrees to prevent an excessive nose-up attitude in the circuit; and

c. if desired, higher throttle settings / higher airspeeds may be used, but will require careful circuit planning to permit deceleration to Vfe without creating an unusually high / fast final approach.

40. Perform the pre-landing check as follows:

PRE-LANDING		
ACTION	**CHECK**	**NOTES**
1. Mixture	Full RICH	Depending on density altitude, leaning may be required for smooth engine operation
2. Fuel selector	On BOTH, check quantity	
3. Cowl flaps	As required	Normally closed for landing, but kept open for multiple circuits.
4. Temperatures & pressures	Normal	“in the green”.
5. Harnesses	Secure	
6. Brakes	Check pressure	
7. Landing Light	ON for night ops	
8. Flaps	As required	
9. Prop	Full FINE	Set the prop full fine ***after*** power has been reduced below governing range.

Figure 2-20 Pre-Landing Check

NOTE

The pre-landing check shall be committed to memory.

FINAL APPROACH

41. The final approach path flown will depend on the type of landing to be carried out, and the presence of any approach end obstacles.

a. Normal Approach. Conducted with 0° to 35° of flap, with either 20º or 35º used most commonly, and some engine power to provide a margin for glide path control; and

b. Obstacle Clearance Approach. The final approach will be executed with 35º of flap, an approach speed of 70 MPH IAS, propeller full fine, and throttle at idle to ensure the steepest possible approach.

LANDING

General

42. As with all tricycle gear aircraft, landings are accomplished by flaring the aircraft to a slightly nose-high attitude and progressively easing back on the control column to delay touchdown so as to accomplish a two point landing on the main wheels, followed by gently lowering the nose wheel.

43. The C182 is a slightly nose heavy aircraft, and the aircraft operated in the ACGP are also equipped with an extended nose fork and oversize tire which raise the normal nose position by approximately 4 inches. The aircraft has a slight nose up attitude on the ground (as shown by the deck angle below) and pilots may tend to land in an inappropriately flat attitude which could allow the nose gear to touch down prematurely.

Figure 2-21 Deck Angle

CAUTION

Pilots must exercise care to ensure that a proper nose-up landing attitude is achieved prior to touchdown to ensure that a two-point landing on the main gear is accomplished. Failure to do so can result in significant damage to the nose landing gear and supporting structure.

Approach Speeds

44. Precise control of approach airspeed is important as the aircraft is prone to “floating” in ground effect if flown at an excessively high airspeed:

Flap Setting	Approach Speed	Gusty Winds
0º	80-90 MPH IAS	In gusty wind conditions, add half the gust spread to the final approach speed
20º	75-85 MPH IAS	
35º	70-80 MPH IAS	

Figure 2-22 Approach Flap Settings

Normal Landing

45. A normal landing is used when there is ample runway length available and no other special circumstances exist. A normal landing is accomplished as follows:

a. establish a final approach with **20º flaps** and IAS of **75-85 MPH**. If desired, to achieve a steeper approach angle, the approach may be flown with **35º flaps** and IAS of **70-80 MPH**;

b. as the aircraft is flared for landing, smoothly reduce power to idle. A small amount of power may be retained to assist in achieving a nose up attitude at touchdown, but will increase the landing roll;

c. smoothly increase backpressure on the yoke to hold off the touchdown, establish a nose high landing attitude;

d. touch down on the main landing gear;

e. after touchdown, hold the yoke aft, raise the flaps, and smoothly apply brakes as required.

CAUTION

To minimize loading on the nose gear, complete the landing roll with the yoke fully aft and use the minimum braking required for the landing distance available.

Short Field Landing

46. A short field landing is used when the available landing surface is of limited length. The determination of whether the available field length is “short” must be based on calculated landing performance, with due consideration for aircraft weight, winds, and density altitude. As a general guideline, surfaces less than 1,800 ft long should be carefully assessed. A short field landing is accomplished as follows:

a. establish a final approach with **35º flaps** and IAS of **70 MPH**;

b. conduct the final approach with an aim point just prior to the threshold, so as to touch down close to the threshold of the usable landing surface;

c. as the aircraft is flared for landing, smoothly reduce power to idle;

d. smoothly increase backpressure on the yoke to hold off the landing, establish a nose high landing attitude;

e. touch down on the main landing gear;

f. after touchdown, hold the yoke aft, immediately raise the flaps, and smoothly apply brakes as required.

CAUTION

Do not apply heavy braking before flaps have been fully retracted. Overly aggressive braking with flaps down will result in main wheel lock-up, and can result in significant tire damage or a blown tire.

Soft / Rough Field Landing

47. A soft / rough field landing is used when operating from grass, dirt, or gravel strips. The objective is to minimize the potential for damage to the nose gear and main landing gear by achieving a soft touchdown at slow airspeed with the nose gear touchdown being delayed. A soft / rough field landing is accomplished as follows:

a. establish a final approach with **35º flaps** and IAS of **70 MPH**;

b. as the aircraft is flared for landing, smoothly reduce power. A small amount of power should be retained to assist in achieving a nose up attitude at touchdown;

c. smoothly increase backpressure on the yoke to hold off the landing, establish a nose high landing attitude;

d. touch down on the main landing gear at the slowest possible airspeed;

e. after touchdown, hold the yoke aft, slowly reduce power to idle, and raise flaps; and

f. use only minimum required braking. If safe to do so, delay the use of brakes until ground speed is as slow as possible.

CAUTION

Landing flat or prematurely lowering the nose after landing on a soft or rough surface may result in damage to the nose landing gear or supporting structure.

Crosswind Landing

48. When landing in a strong crosswind, use the minimum flap setting required for the field type / length. The wing-low method of crosswind compensation gives the best aircraft control. The aircraft has a demonstrated crosswind limit of 15 knots, and can be landed under such conditions without undue difficulty by a pilot with average ability.

Landing without Flaps

49. Landings are normally conducted with flaps selected to either 20º or 35º. Landings without flaps can be safely accomplished, but will require a slightly longer landing area due to the higher approach speed of **80-90 MPH** IAS and a pronounced floating tendency.

Overshoot

50. If necessary to abort a landing, execute an overshoot as follows:

a. smoothly apply full power and establish a climb attitude;

WARNING

Rapid application of full power with full flaps and approach trim set may cause the aircraft to rapidly pitch to a nose-up attitude. Care must be taken to control pitch attitude until flaps and trim can be reset.

b. immediately raise flaps to 20º to reduce drag; and

c. after all obstacles are cleared, a safe altitude and airspeed are achieved, and a positive rate of climb has been established, slowly retract the flaps.

WARNING

Premature retraction of the last 20º of flaps can result in the aircraft "settling" and a loss of altitude.

CONTINUOUS CIRCUIT OPERATIONS

Stop and Go Landings

51. When conducting multiple circuits, use the Stop and Go check as follows:

STOP AND GO		
ACTION	**CHECK**	**NOTES**
1. Prop	FULL FINE	When extended ground wait is anticipated, aggressively lean the mixture to prevent plug fouling.
2. Mixture	FULL RICH	
3. Cowl flaps	OPEN	Normally can remain open for multiple circuits.
4. Trim	Set TAKEOFF	
5. Flaps	Set as required for takeoff	
6. Temperatures and Pressures	In the green	
7. Fuel	Check quantity	

Figure 2-23 Stop and Go Check

Touch and Go Landings

52. Under certain conditions, it may be operationally advantageous to conduct touch and go landings. When executing touch and go landings, the PIC shall ensure:

a. the runway is 2000' or longer;

b. the aircraft is fully reconfigured by completing the Stop & Go checklist during the landing roll; and

c. there is a minimum of 1500' of runway remaining when the "go" is initiated.

CAUTION

Performing continuous circuits on runways less than 3000' requires a high level of landing accuracy. Pilots must be prepared to abort a planned Stop & Go or Touch & Go landing by either over-shooting, or fully stopping and taxiing back to the normal take-off point.

POST LANDING CHECK

53. Upon termination of a flight, and when clear of the runway, complete the post-landing check as follows:

POST LANDING		
ACTION	**CHECK**	**NOTES**
1. Flaps	Select UP	
2. Cowl Flaps	OPEN	
3. Transponder	OFF	
4. Pitot Heat	OFF	

Figure 2-24 Post Landing Check

SHUT DOWN CHECK

54. Shut-down the aircraft as follows:

SHUT DOWN		
ACTION	**CHECK**	**NOTES**
1. Ground idle	1 min @ 1000 RPM	To stabilize engine temps prior to shutdown (taxi time may be used).
2. Radio master	OFF	
3. Throttle	700 RPM	
4. Magnetos	Live mag check	Select both Mags OFF momentarily, then back to BOTH.
5. Mixture	Idle cutoff	Wait until engine stops before proceeding with remainder of shutdown checklist
6. Magnetos	OFF	Remove keys from ignition
7. All switches	OFF	
8. Master switch	OFF	
9. Fuel Selector	Either Left or Right	To prevent cross feeding during fuelling or when parked on a sloped surface.
10. Control lock	Install	
11. Secure Aircraft	• Keys – Secure as req'd • Cowl Flaps - Open • Fresh Air Vent - Close • Chocks - In • Tie downs - Secure • Plugs - Install • Covers – Install as req'd	**CAUTION** During bird nesting season, it is essential that engine plugs be installed during any shutdown periods of significant duration (greater than 10 minutes).

Figure 2-25 Shut Down Check

MANAGEMENT OF ANCILLARY CONTROLS

Cowl Flap Control

55. Cowl flaps are used to modulate the flow of cooling air through the engine compartment in flight. Opening the cowl flaps creates a low pressure area which effectively pulls air through the engine for increased cylinder and oil cooling. Air flowing through the engine creates a significant amount of drag which is minimized by closing the flaps when enhanced cooling airflow is not required. Cowl flaps are used as follows:

a. **Aircraft Parked** – OPEN – to keep birds from nesting in the cowling;

b. **Start and Ground Operations** – OPEN – to ensure even airflow distribution through engine compartment;

c. **Takeoff and Climb** – OPEN – to ensure maximum cooling airflow;

d. **Cruise** – cowl flaps will normally be CLOSED to maintain appropriate CHTs and to minimize cooling drag. Cruise with cowl flaps open can reduce IAS by 3-5 MPH. Intermediate settings may be required at high density altitudes and / or high power settings to prevent engine overheating; and

e. **Descent and Landing** – CLOSED – to minimize shock cooling of engine. When conducting continuous circuits, the cowl flaps may be left OPEN.

Mixture Control

56. To prevent fouled plugs, rough running and/or engine damage, correct leaning procedures must be followed during all phases of flight. Proceed as follows:

a. **Ground Handling** - full rich unless operating at high density altitudes or extended ground idling is anticipated, in which case the mixture should be leaned aggressively. Return to full rich prior to run-up or takeoff;

b. **Takeoff** - mixture normally set to full rich unless taking off at high density altitude (> 3000’ MSL). For high altitude takeoffs, hold brakes, apply full power, then lean as necessary for smooth running / maximum power;

c. **Climb** - lean progressively in climbs above 3000 ft MSL. Adjust mixture as required to maintain takeoff EGT readings (approx 1100-1300ºF);

d. **Cruise** - after altitude, airspeed and power settings have stabilized, lean to 50ºF Rich of Peak in accordance with the “LeanFind” procedure in EDM-930 manual; and

e. **Descent, Circuit** - mixture normally set to full rich.

FUEL MANAGEMENT

Pre-Flight Fuel Planning

57. Pre-flight fuel planning for cross country operations is essential. Pre-flight fuel planning must incorporate the following:

a. allow for fuel consumed during start, run-up, taxi, and takeoff. A typical planning figure is 1 USG;

b. allow for fuel consumed during the climb to cruising altitude. Refer to Figure 4-10 for Time / Fuel / Distance to Climb data;

c. allow for forecast winds aloft and the effect on estimated time en-route;

d. allow for fuel that may be consumed by reasonably foreseeable contingencies such as airport departure and arrival procedures, en-route altitude changes, en-route course variations for weather, routing changes directed by ATC, etc;

e. incorporate an appropriate VFR fuel reserve. Canadian Aviation Regulations require that pre-flight planning allows for a minimum fuel reserve of:

   (1) 30 minutes for daytime operations, and

   (2) 45 minutes for night operations.

f. identify en-route locations for possible fuel stops; and

g. when operating in areas with long distances between aerodromes with fuel services, determine a “point-of-no-return” (PNR) beyond which you are committed to continuing to your destination. PNR represents a critical decision gate for en-route fuel management.

En-route Fuel Planning

58. This aircraft is equipped with several tools to assist the pilot with the task of fuel management. Of particular significance / use are the following:

a. Fuel Quantity Gauges. Fuel quantity gauges show the useable fuel in each tank. The fuel gauges are considered reliable only when the tanks are completely full, completely empty, or when fuel levels are below 1/2;

b. EDM 930 Fuel Totalizer. The EDM 930 displays total useable fuel remaining, calculated using measured fuel flow rate. The accuracy of the totalizer depends on the pilot entering the correct fuel quantity at the start of the flight. This shall be based on either completely full fuel tanks, or a precise confirmation of useable fuel on board by dipping both tanks;

c. EDM 930 Fuel Management Data. The EDM 930 will display useable fuel remaining, fuel flow rate, and time remaining to empty at current consumption rate;

d. EDM 930 Low Fuel Alerting. The EDM 930 will provide fuel alerts:

(1) Low Fuel Flow. Low fuel flow rate will trigger an alert, as low fuel flow in flight may indicate imminent engine failure. With the throttle closed on the ground, a low fuel flow alert may be triggered;

(2) Low Fuel Quantity – Fuel Tanks. If the fuel quantity in either tank drops below 9 USG, a low fuel alert for the specific tank will be displayed, and

(3) Low Fuel Quantity - Totalizer. If the useable fuel remaining consumed at the current fuel flow rate will provide less than 45 minutes of flight time, a low fuel alert will be displayed.

WARNING

Takeoff shall not be commenced with less than 15 USG total useable fuel as indicated by the totalizer, or with the combined totals of the two fuel tank gauges indicating less than 20 USG.

e. Garmin GPS. When conducting cross country operations, the GPS will provide Estimated Time Enroute (ETE) to the final destination. When compared to the “time remaining to empty” feature of the EDM 930, the pilot can accurately monitor the adequacy of planned fuel reserves throughout the flight.

GLIDER TOWING OPERATIONS

General

59. Glider towing shall be conducted in accordance with procedures detailed in the Air Cadet Gliding Program Manual C-CR-CCP-242/PT-005 as well as the direction detailed below.

Aircraft Performance on Tow

60. Aircraft performance is significantly reduced when conducting glider towing operations. Pilots should expect slower initial acceleration, a longer takeoff roll, and a lower rate of climb.

Prior to First Tow

61. During the pre-flight inspection, inspect the condition and operation of the TOST release mechanism and ensure the mirrors are properly adjusted. Perform a tow rope release check prior to the first tow. Normal pre-takeoff checks are performed prior to the first tow.

Continuous Towing Operation

62. The Stop and Go Check is performed prior to each subsequent tow:

STOP AND GO		
ACTION	**CHECK**	**NOTES**
1. Prop	FULL FINE	
2. Mixture	FULL RICH	When extended ground wait is anticipated, aggressively lean the mixture to prevent plug fouling.
3. Cowl flaps	OPEN	
4. Trim	Set TAKEOFF	
5. Flaps	Set to 10 degrees	
6. Temperatures and pressures	In the green	
7. Fuel	Check quantity	

Figure 2-26 Stop and Go Check

NOTE

During continuous local towing operations, anticipate a fuel consumption rate of approximately 13 – 15 GPH.

Takeoffs with Glider on Tow

63. Take-off with glider in tow is accomplished as follows:

a. complete the STOP AND GO CHECK, ensuring that 10º flap is selected;

b. at the TAKE UP SLACK signal, advance power slightly and relax pressure on the brakes to achieve a slow crawl until all out signal;

c. at the ALL OUT signal, release brakes and slowly and smoothly apply full throttle;

d. commence the takeoff roll with the yoke held approximately 2/3 aft;

NOTE

Due to the high engine power, use of a normal takeoff technique will result in an extremely high rate of climb on liftoff, making it difficult for the glider pilot to transition to the climb. Use of the soft field takeoff technique for towing operations will yield a more gradual transition to the climb.

e. as aircraft starts to roll, slightly relax back pressure to maintain a slightly nose high attitude;

f. due to the high angle of attack, the aircraft will become airborne in ground effect at between 50-60 MPH. As the aircraft becomes airborne, smoothly lower the pitch attitude so that the aircraft accelerates in ground effect;

g. smoothly adjust pitch attitude to establish a 70 MPH climb. Once safety established in a stable climb, reduce propeller RPM to 2700 RPM. For noise abatement, propeller RPM can be reduced to 2500 RPM.

CAUTION

If the glider climbs prematurely prior to tow plane lift-off, forces on the tow rope may cause wheel-barrowing. Apply aft pressure on the yoke to counter such tendency, or release the glider if aircraft control is in doubt.

WARNING

Noise abatement procedures will reduce climb performance. Do not initiate noise abatement procedures if a rate of climb appropriate to local terrain and obstructions cannot be maintained. If rate of climb is not adequate, immediately apply full power (propeller full fine and full throttle).

Glider Tow

64. Complete the tow to altitude as follows:

    a. maintain a climb speed of 70 MPH;

    NOTE

    When operating in high temperatures, if CHT or oil temperature may exceed limitations, a tow speed of 75 MPH may be used. If necessary, reduce throttle while maintaining a safe rate of climb.

    b. expect rudder and elevator trim changes during the tow as the glider moves around. Counter these changes by manually maintaining co-ordinated flight and trimming off elevator pressure if required;

    WARNING

    Rapid movement of the glider to an extreme tow position may result in tow ship upset. When a glider on tow diverges to a tow position producing forces on the tail that cannot be countered with elevator and / or rudder, release the glider.

    c. strive to use a maximum of 15-20 degrees of bank in the turns. Enter and exit each turn smoothly, maintaining rudder co-ordination throughout; and

    d. plan your pattern to arrive at the designated release point at the same time you reach release altitude.

Glider Release

65. Glider release is performed using the following procedure:

    a. approaching the planned release altitude, gradually reduce MAP to approximately 16” while maintaining 70 MPH. This will result in the tow aircraft levelling off or maintaining a gentle climb;

    b. close cowl flaps;

    c. await glider release. As the glider prepares to release it will climb and then dive slightly to ease the tension on the tow rope. This will be felt in the tow aircraft through pitch changes which are manually controlled. Care must be taken to ensure these pre-release actions by the glider are not mistaken for an actual release; and

    d. visually confirm glider release using the two mirrors. Visually observe the tow rope drop and the glider commence a climbing right turn before initiating descent procedures. If in doubt the glider has released, continue flying straight and level until separation is confirmed.

Descent after Release

66. Descent and recovery profiles are designed to minimize the effects of shock cooling on the engine while maintaining operational efficiency. There are two descent profiles which are executed immediately after glider release.

NOTE

To continuously monitor the cooling rate, enter manual mode on the EDM-930 and STEP to the cooling rate parameter.

67. **Primary Descent Profile:**

a. reduce throttle to 21-23” MAP;

b. retract flaps to 0°;

c. ensure the cowl flaps are closed;

d. reduce propeller speed to 2300 RPM for noise abatement;

e. increase IAS to approximately 130 MPH;

f. initial cooling rate should be approximately 40° to 60° /minute;

g. monitor the cooling rate and maintain at less than 60° /minute;

h. as the cooling rate decreases to about 40° /minute, reduce power to 18” MAP;

i. cooling rate will increase, and then begin to decrease;

j. when back down to approximately 40° /minute, reduce power by 2” of MAP;

k. continue repeating this cycle until at about 13” MAP;

l. reduce IAS to below 110 MPH and lower 10° of flap;

m. extend up to full flap below 90 MPH; and

n. complete a circuit and landing IAW local procedures.

68. **Secondary Descent Profile:**

a. reduce throttle to 18-20" MAP;

b. set flaps at 20°;

c. ensure cowl flaps are closed;

d. reduce propeller speed to 2300 RPM for noise abatement;

e. increase IAS to 90 MPH;

f. gradually reduce power in a steady 90 MPH descent;

g. ensure the cooling rate does not exceed 60° /minute; and

h. up to full flap may be extended in the terminal circuit phase when establishing the final landing configuration.

CAUTION

For both descent profiles, the repetitive nature of towing operations places unusual strain on the flap system. Using flaps at the higher end of the certified speed range has been associated with stress cracking in the flap track brackets. To reduce the risk of stress cracking, pilots should not normally extend the first 10° of flaps above 110 MPH, and any further flaps above 90 MPH. Flaps may be lowered at speeds up to the certified limits on an exceptional basis, or whenever prudent for safety.

NOTE

The most effective means of minimizing shock cooling is a slow, gradual reduction in throttle during the level off procedure and throughout the post-release descent. In case of a high cooling rate or a shock cooling alert, increase power and reduce airspeed as required.

Approach and Landing

69. Conduct the approach and landing using techniques appropriate to the landing surface. Pilots must adjust the approach to ensure that the trailing tow rope remains clear of all obstacles.

WARNING

The tow rope will trail behind and below the aircraft, and will "flail" both vertically and laterally. Impact by the glider tow ring can cause serious damage to materiel and serious injury to personnel. With due consideration for rope length, ensure that the rope will be clear of any approach obstacles.

Cross Country Towing Operations

WARNING

Due to the significant power available on this aircraft, care must be taken not to over-speed the glider during the cruise phase of cross country towing operations.

70. To provide an acceptable pitch attitude and to optimize aircraft performance and control during the cruise phase of the cross country tow, the aircraft should be configured as follows:

a. When towing in smooth atmospheric conditions, the aircraft should normally be configured as follows:

(1) flaps set to 10 degrees,

(2) propeller set to 2300 RPM, and

(3) throttle set for IAS of approximately 90 MPH

b. When towing in rough atmospheric conditions, the aircraft should normally be configured as follows:

(1) flaps set to 20 degrees,

(2) propeller set to 2300 RPM, and

(3) throttle set for IAS of approximately 80 MPH

NOTE

Refer to Figure 4-16 for MP, TAS, and fuel burn rate at the planned cruising altitude.

WARNING

When conducting cross country towing in significant lift or convective activity, do not attempt to maintain a constant altitude. This will result in airspeed increases, possibly exceeding Vne of the glider, and make it extremely difficult for the glider pilot to avoid developing slack in the tow rope. If traffic, terrain, and airspace considerations allow, it is generally best to maintain a constant airspeed and accept moderate variations in altitude.

WARNING

Should high sink rates be encountered requiring the establishment of a climb, advance the throttle as required. In extreme circumstances it may also be necessary to advance the propeller RPM to achieve an adequate rate of climb.

SEVERE WEATHER OPERATIONS

Rain

71. No special precautions need to be taken during flight in rain other than remaining vigilant for icing conditions and unexpected reductions to visibility. During take-off and landing, directional control may be more difficult as a result of reduced friction both on paved and grass surfaces. Both take-off and landing should be flown with a nose high attitude on grass surfaces as unseen heavy wet grass or deep puddles could cause wheel-barrowing.

Icing Conditions

WARNING

Flights into conditions where icing should reasonably be expected are prohibited. This specifically includes flight in freezing rain or freezing drizzle, flight in wet snow, or flight in clouds.

72. This aircraft is not equipped for flight in icing conditions. There is no anti or de-icing equipment for the airframe, propeller, engine air induction system. In the event that icing conditions are inadvertently encountered, pilots must consider the following points and complete the Flight In Icing Conditions Checklist contained in the Emergency Procedures Section:

a. turn back or change altitude to achieve an outside air temperature that is less conducive to icing;

b. should the static system become blocked, or erroneous airspeed, altimeter or vertical speed indicator readings be suspected, the alternate static air valve should be pulled open to supply static air from the cabin;

c. cabin pressures vary with vents and windows open, and with airspeed. Therefore, significant airspeed and altimeter errors will occur;

d. with vents and windows closed, the airspeed indicator and altimeter may read up to 5 MPH and 50 feet high, respectively. Opening the vents will reduce these errors to near zero;

e. with the windows open variations in readings can be as much as:

(1) 12 MPH and 50 feet low when near the stall; and

(2) 12 MPH and 100 feet high when in cruise.

f. as little as ¼ inch of ice accumulation on the leading edges will significantly increase the stall speed by as much as 20-30%;

g. control may become increasingly sluggish and heavy feeling as ice accumulates; and

h. flaps should remain retracted. With severe ice accumulation on the horizontal tail, the change in wing wake airflow with flap extension may result in loss of elevator effectiveness.

Turbulence and Thunderstorms

73. Flights into strong turbulence are discouraged. If strong turbulence is accidentally encountered, set airspeed as close to manoeuvring speed as practical and fly a constant pitch attitude. This technique combats the tendency to chase wildly fluctuating airspeeds and altitudes caused by differential barometric pressures in the storm.

WARNING

Flights into thunderstorms are prohibited.

Cold Weather Operations

74. Operating the Cessna 182 in cold weather involves greater than normal care of the airframe if it is stored outside, and more concern with the strains that cold temperatures put on the engine and propeller. Cold weather may also create additional hazards such as slippery ramp / taxiway / runway surfaces, as well as the possibility of ice / snow accumulation on the aircraft.

75. When operating in cold weather, the following precautions shall be observed:

a. the external check must ensure all contamination is carefully removed from the airframe. Removal of snow and light frost may be accomplished using light sweeping with a soft broom. More substantial accumulations may be removed using de-ice fluid, if local de-icing services are available;

WARNING

Ensure that all surface contamination is removed prior to flight.

WARNING

Ensure that any ladders or maintenance stands used are free of ice and snow.

CAUTION

Do not attempt to remove surface contamination by scraping or chipping, as you will damage the aircraft.

b. in temperatures of 10°F (-12°C) and below, it may be necessary to pre-heat the engine using a high volume hot air heater. Pre-heating shall only be performed after consultation with an RCA Ops AME;

WARNING

Use of small electric heaters is prohibited as they may result in superficial heating causing disastrous results for the engine.

c. with the Ignition Switch and the Master Switch both OFF, pull the propeller through about five turns, but only in the normal direction of rotation to avoid damaging the starter motor adapter;

WARNING

Prior to moving the propeller or moving to a position inside the propeller plane of rotation, visually confirm that the ignition switch is in the OFF position and the keys are removed.

d. perform a Normal Start in accordance with the checklist;

e. after start, monitor oil pressure / temperature and cylinder heat temperatures closely to ensure operating minimums and maximums are maintained. Warm the engine slowly at 1000 RPM, and do not close the cowl flaps to accelerate the warm-up process;

f. when taxiing, be alert for slippery conditions and check that all instruments are operating properly;

g. prior to take-off, ensure no snow or frost has accumulated on the wings and tail;

h. to prevent shock cooling of the engine, avoid power-off descents. If a low power descent is required, clear the engine periodically by applying moderate power every 30 seconds;

i. land normally with due consideration for the runway surface conditions;

j. during landings, make allowances for reduced braking effectiveness on snow or ice covered runways; and

k. when securing the aircraft, take steps to ensure that snow and ice will be prevented from entering critical areas.

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PART 3

EMERGENCY OPERATING PROCEDURES

GENERAL

Priorities

1. In any emergency, the first priority is to maintain aircraft control, and then take the necessary actions to eliminate or mitigate the problem.

2. The ability of a pilot to react quickly and correctly in a stressful emergency situation will depend in large measure by how well these emergency procedures have been reviewed, practiced, and committed to memory.

3. It should also be noted that in these emergency procedures “as soon as possible” means immediately, i.e., land in the nearest field, while “as soon as practicable” means at the nearest suitable aerodrome.

Cautionary Information

4. The EDM 930 provides a range of visual alerts that will bring important information to the attention of the pilot. These alerts are of a cautionary nature. They are intended to enhance the pilot’s situational awareness and to draw his / her attention to specific aircraft parameters that may be of concern.

Non-Critical Emergencies

5. Non-critical emergencies are those that do not pose an immediate threat to the safety of the aircraft or the personnel on board. These are circumstances where there is sufficient time available to assess the situation, consider available options, and determine a suitable course of action. Non-critical emergencies are also referred to as “Yellow Page Emergencies” as they are printed on yellow paper in the aircraft checklist. ***Pilots are to refer to written checklists in responding to a non-critical emergency.***

Critical Emergencies

6. Critical emergencies are those that pose an immediate threat to the safety of the aircraft or the personnel on board. These circumstances require immediate and correct response by the pilot. Critical emergencies are also referred to as “Red Page Emergencies” as they are printed on red paper in the aircraft checklist. ***Pilots shall commit critical emergency checklists to memory***.

CAUTIONARY INFORMATION

EDM 930 Secondary Alerts

7. Secondary Alerts indicate important operational information that is not related to a published engine limitation. Secondary Alerts are of a cautionary nature and are intended to enhance the pilot's situational awareness. As such, it is important not to become distracted by an alert, to maintain control of the aircraft, and then deal with the alarm when aircraft control will not be jeopardized.

8. Based on the nature of the problem, Secondary Alerts should be handled in accordance with the procedures detailed in Figure 3-1.

EDM 930 SECONDARY ALERTS		
ALERT DISPLAY	**INDICATION OF**	**ACTION**
TK-LOW	Fuel tank low quantity	Confirm that sufficient fuel is available to complete the planned flight
MIN	Low Fuel Endurance Remaining	Confirm that sufficient fuel is available to complete the planned flight
REM	Low Fuel Quantity Remaining	Confirm that sufficient fuel is available to complete the planned flight
DIF	Excessive EGT Span between cylinders	Monitor other engine parameters.
CLD	Excessive CHT Cooling Rate	Assess the situation. Increase power and / or reduce airspeed if safe and practical
BAL	Significant Fuel Imbalance	Adjust the fuel selector as appropriate to correct the imbalance

Figure 3-1 Secondary Alerts

EDM 930 Primary Alerts

9. Primary Alerts are intended to draw the pilot's attention to the exceedance of an engine / system limitation. Based on the nature of the problem, the situation shall be handled in accordance with the procedures detailed in Figure 3-2.

EDM 930 PRIMARY ALERTS		
ALERT DISPLAY	**INDICATION OF**	**ACTION**
O-T	High Oil Temperature	Reduce power and / or increase airspeed for better cooling. Monitor and land if necessary
O-P	Low Oil Pressure	Execute ***Low / Fluctuating Oil Pressure Checklist***
F-P	Low Fuel Pressure	Execute ***Low Fuel Pressure Checklist***
EGT	High EGT	Reduce power and / or increase airspeed for better cooling. Monitor and land if necessary
MAP	Over-Boost Manifold Pressure	Reduce throttle if safe to do so
RPM	High RPM over Red-Line	Reduce propeller RPM if safe to do so
BUS	An under-voltage or over-voltage situation	For Over-Voltage – Execute the ***High Charge Rate Checklist*** For Under-Voltage – Execute the ***Battery Discharge Checklist***
AMP	Battery Discharge	Execute the ***Battery Discharge Checklist***

Figure 3-2 Primary Alerts

NON-CRITICAL EMERGENCIES

Electrical Power Supply Malfunctions

10. Malfunctions in the electrical system can usually be detected by monitoring the voltage and ampere displays and associated alerts and alarms on the EDM-930. Electrical power supply malfunctions usually fall into two categories: excessive and insufficient rates of charge. Although a number of factors may cause electrical problems, the main cause of an alternator failure is most likely a broken drive belt.

11. An excessive rate of charge, indicated by an abnormally high ammeter reading, will cause the battery to overheat and result in evaporation of the electrolyte, overheating, and fire hazard. To prevent this, an over-voltage sensor will shut down the alternator when the charging voltage reaches approximately 30 volts. Note that no specific current flow has been specified as the threshold for “excessive rate of charge”. However, in general terms, once the battery charge has been restored after starting, normal current flow would typically be less than 5 amps.

12. If the ammeter indicates a continuous discharge rate in flight, the alternator is not supplying power to the system and should be shut down since the alternator field circuit could be placing an additional load on the battery

13. For an Excessive Rate of Charge, proceed as follows:

EXCESSIVE CHARGE RATE		
ACTION	**CHECK**	**NOTES**
1. Alternator Switch	OFF	
2. Electrical services	OFF	
3. Alternator Switch	ON	
4. Essential avionics and electrics	ON, selectively	Use only those services essential to the safe completion of the flight.
5. Ammeter	Monitor	
6. Land	As soon as practicable	

Figure 3-3 Excessive Charge Alerts

14. For a Battery Discharge, proceed as follows:

BATTERY DISCHARGE		
ACTION	**CHECK**	**NOTES**
1. Alternator switch	Ensure ON	
2. Alternator and Alternator Field Circuit Breakers	Ensure IN	
If discharge continues:		
1. Alternator Switch	Cycle OFF, then ON	To reset over-voltage sensor.
If discharge continues:		
1. Alternator Switch	Select OFF	
2. Unnecessary electrics	Select OFF	
3. Battery voltage	monitor	Available power highly dependent on battery condition, charge and electrical services selected.
4. Land	As soon as practicable	Reduce all available electrical load, in order to conserve power for EDM930 operation, circuit and landing.

Figure 3-4 Battery Discharge Alerts

NOTE

Battery power is sufficient for normal (VFR) operations for a minimum of 30 minutes.

CAUTION

Total electrical failure will result in the loss of all engine instrument indications on the EDM-930 display. Should this occur, avoid high power settings, avoid rapid power changes and enrich the mixture to maintain smooth engine operation.

Low Oil Pressure

15. Low oil pressure accompanied by normal oil temperatures usually indicates a pressure gauge or relief valve malfunction. Low pressure and high or rising oil temperatures are indicative of oil starvation and imminent engine failure. Fluctuating pressure is indicative of oil pump cavitation and imminent oil exhaustion.

LOW / FLUCTUATING OIL PRESSURE		
ACTION	**CHECK**	**NOTES**
1. Power	Reduce	Continue flight at lowest feasible power setting.
2. Oil temperature	Monitor	If temp remains normal suspect gauge or relief valve malfunction.
3. Land as soon as practicable		
WARNING If low pressure is accompanied by high and rising oil temperatures, anticipate imminent engine failure. Land as soon as possible.		

Figure 3-5 Low Oil Pressure Actions

Low Fuel Pressure

16. Low fuel pressure or loss of fuel pressure indication may signify the failure of the engine driven fuel pump. This may also indicate a malfunction of the fuel pressure sensor, or a problem with the EDM930. To determine if the problem is instrumentation related, determine whether fuel flow is normal or whether there are secondary indications, such as a rough running engine or loss of power. Selecting the auxiliary fuel pump ON for a short period and then OFF may clear the problem.

LOW FUEL PRESSURE		
ACTION	**CHECK**	**NOTES**
1. Check Secondary Indications	Check Fuel Pressure Check Fuel Flow Rate Confirm Smooth Running	With throttle fully closed, fuel pressure as low as 3 psi is entirely normal. If fuel flow rate is normal, suspect an unserviceable pressure sensor. Selecting the auxiliary fuel pump ON for a short period and then OFF may clear the problem
If problem continues:		
2. Auxiliary Fuel Pump	ON	
3. Land as soon as possible		

Figure 3-6 Low Fuel Pressure Actions

Rough Running Engine

17. A rough running engine and / or a partial loss of power can be caused by a number of factors, including but not limited to:

a. incorrect mixture setting;

b. engine driven fuel pump failure (refer to Low Fuel Pressure, Figure 3-6);

c. fuel exhaustion;

d. icing of the air induction system;

e. fouled spark plugs;

f. faulty magneto;

g. stuck valve;

h. loss of lubrication (refer to Low Oil Pressure, Figure 3-5); or

i. major mechanical failure.

18. The actions to be taken in response to a rough running engine should consider:

a. while attempting to identify and correct the problem, it may be appropriate to manoeuvre the aircraft so as to optimize the position for a forced landing should the situation deteriorate;

b. immediate actions should be taken appropriate to the symptoms indicated in Figure 3-7 below; and

c. if the problem cannot be identified and corrected, action should be taken to conduct a precautionary landing as soon as possible.

ROUGH RUNNING ENGINE		
• **Assess the situation** • Consider manoeuvring the aircraft to optimize position for a forced landing should situation deteriorate • Take IMMEDIATE ACTIONS appropriate to the symptoms listed below • If towing, refer to ***Partial Power Loss – Towing*** for additional actions • If problem cannot be corrected quickly, ***land as soon as practicable***		
CONDITION	**SYMPTOMS**	**ACTION**
Incorrect Mixture Setting	Engine roughness	Normally associated with a failure to properly adjust mixture during climbs and descents 1. Adjust mixture as required
Engine Driven Fuel Pump Failure	Sudden reduction in fuel pressure and fuel flow rate, with normal fuel quantity indications	1. Select Aux Fuel Pump ON 2. Land as soon as practicable
Fuel Exhaustion	Sudden reduction in fuel pressure and / or fuel flow rate with low fuel quantity indications	1. Select fullest fuel tank 2. Land as soon as practicable
Air Induction Icing	Reduced Manifold Pressure	1. Select alternate air to ON 2. Land as soon as practicable
Fouled Plugs	High EGT on one or more cylinders	1. Lean mixture 2. If condition persists, land as soon as practicable
Faulty magneto	Sudden engine roughness	1. Attempt to regain smooth operation by reducing power if safe to do so. 2. Land as soon as practicable. **CAUTION** Do not switch to single magneto operation, as engine damage may result.
Stuck Valve	No EGT indication on the affected cylinder	1. Reduce power if safe to do so. 2. Land as soon as practicable.

Figure 3-7 Rough Running Engine Actions

Inadvertent Flight Into Icing Conditions

19. This aircraft is not equipped for flight in icing conditions. There is no anti or de-icing equipment for the airframe, propeller, or engine air induction system.

INADVERTENT FLIGHT INTO ICING		
ACTION	**CHECK**	**NOTES**
Pitot Heat	ON	
Turn back or change altitude	Obtain OAT less conducive to icing	
Cabin Heat	Full ON	
Defroster	Full ON	
RPM	Increase to 2700 RPM	Minimizes ice buildup on propeller blades
MAP	Monitor for decrease	MAP decrease may indicate air induction filter icing
Alternate air	Use as required	Lean mixture if used continuously
Land	As soon as practicable	If ice buildup is extremely rapid, land as soon as possible
Flaps	Leave Retracted	Ice on the horizontal tail and the change in airflow from flap extension may result in a loss of elevator effectiveness
Forward Slip	If necessary for visibility on approach	
Approach Speed	92-103 MPH IAS	Depending on ice accumulation
Landing Attitude	Level	

Figure 3-8 Flight Into Icing Actions

CRITICAL EMERGENCIES

Emergency Shutdown - FMS Check

20. In a critical emergency where an immediate engine shutdown is required, complete the shutdown using the **FMS Shutdown** Check detailed below:

FMS - SHUTDOWN		
ACTION	**CHECK**	**NOTES**
F - Fuel Fuel Shutoff Valve	CLOSE	Confirm shutoff valve CLOSED, in the FULLY OUT position
M - Mixture Mixture	Idle cut-off	
S - Switches Magnetos	OFF	

Figure 3-9 FMS Shutdown

CAUTION

Do not confuse the fuel shutoff valve and the fuel selector valve. In the case of a critical emergency, the FUEL SHUTOFF VALVE must be selected OFF to prevent fuel from the fuel header tank from continuing to be delivered to the engine.

Engine Restart - FMS Check

21. In cases of an engine failure in flight, if time permits, conduct a restart using the FMS – Restart Check detailed below:

FMS - SHUTDOWN			
ACTION		**CHECK**	**NOTES**
F - Fuel	Fuel Selector	BOTH	
	Fuel Shutoff Valve	OPEN	Confirm shutoff valve OPEN, in the FULLY IN position
	Fuel quantity	Check	
	Throttle	SET 1 INCH	
	Aux Pump	ON	Obtain 4-6 GPH fuel flow, then OFF
M - Mixture	Mixture	RICH	
	Alternate Air	ON	
S - Switches	Magnetos	On BOTH	
	Master switch	ON	
	Starter	ENGAGE if prop is not turning	

Figure 3-10 FMS Re-Start

Engine Fire on Start / on Ground

22. The most likely cause of a fire on start is over-priming with subsequent backfiring igniting the excess fuel in the air induction system. The best way of containing such a fire is to continue cranking the engine so as to suck the flames and accumulated fuel into the engine. If at any time on the ground an engine fire is evident from the cockpit, the aircraft should be abandoned as soon as possible.

ENGINE FIRE ON START		
ACTION	**CHECK**	**NOTES**
1. Starter	Continue cranking	Sucks flames and accumulated fuel into engine.
2. Throttle	OPEN – full	
3. Mixture	Idle cut-off	
CAUTION As fuel is sucked in, the engine may start and run at high RPM briefly		
If no further evidence of fire:		
Complete normal shutdown and investigate		
If fire continues:		
Perform engine fire on ground check		

Figure 3-11 Engine Fire on Start

ENGINE FIRE ON GROUND		
ACTION	**CHECK**	**NOTES**
1. FMS Shutdown	CARRY OUT	
2. Abandon aircraft	ASAP	
3. Use fire extinguisher	Discharge extinguisher into air intake and cowl flaps	Exercise caution.

Figure 3-12 Engine Fire on Ground

In Flight Fires

23. In flight fires are the most serious emergency you will face. They may be engine fires, cabin fires, electrical fires, or wing fires.

ENGINE FIRE IN FLIGHT		
ACTION	**CHECK**	**NOTES**
1. FMS – Shutdown	CARRY OUT	
2. Cabin heat control and air vents (except overhead vents)	CLOSE (Fully in to close)	Minimizes ingestion of smoke/fumes into cockpit
3. Airspeed	115 mph	Increase IAS as required to extinguish fire
4. Carry out a forced landing		Do not attempt to restart engine.

Figure 3-13 Engine Fire in Flight

WING FIRE		
ACTION	**CHECK**	**NOTES**
1. Slip away from burning wing		Keep flames away from fuel tank and cabin
2. All lights	OFF	Anti-collision, navigation and pulse lights
3. Pitot heat	OFF	
4. Land	As soon as possible	

Figure 3-14 Wing Fire

CABIN FIRE		
ACTION	**CHECK**	**NOTES**
1. Cabin Heat/Air, all vents	CLOSE	
2. Fire extinguisher	Activate, as required	**CAUTION** After discharging a fire extinguisher within a closed cabin, ventilate cabin.
3. Ventilate Cabin	As required	
4. Land	ASAP	

Figure 3-15 Cabin Fire

ELECTRICAL FIRE		
ACTION	**CHECK**	**NOTES**
1. Master switch	OFF	
2. All electrics	OFF	
3. If Fire Evident	Carry out Cabin Fire Check	
If flight cannot be safely completed without electrics:		
4. Master switch	ON	
5. Electrical service(s)	ON, as required. Check circuit breakers for faulty circuit and DO NOT reset.	Monitor ammeter
6. Land	As soon as practicable	

Figure 3-16 Electrical Fire

Engine Failures

24. An engine failure is an event characterized by a total or near total loss of engine power where altitude cannot be maintained. Engine failures may occur at any point during the flight, and with little or no warning. An appropriate emergency response must consider the altitude, airspeed, and location where the engine failure occurs. Prior to initiating take-off, pilots should have established a course of action to deal with time-critical engine failures.

ENGINE FAILURE ON TAKEOFF		
ACTION	**CHECK**	**NOTES**
1. Throttle	CLOSE	
2. Brakes	APPLY, as required	
3. If towing	Release glider, move left	
4. Flaps	RETRACT	
5. FMS Shutdown	CARRY OUT	

Figure 3-17 Electrical Fire

ENGINE FAILURE AFTER TAKEOFF		
ACTION	**CHECK**	**NOTES**
1. Establish glide	80 MPH	80 MPH if flaps up 75 MPH if flaps extended
2. If towing	Release glider	
3. Throttle	CLOSE	
4. Select landing area	Fly to it	
5. Forced Landing	CARRY OUT	

Figure 3-18 Engine Failure after Takeoff

ENGINE FAILURE IN FLIGHT		
ACTION	**CHECK**	**NOTES**
1. Establish glide	80 MPH	Retract flaps if required
2. If towing	Release glider	
3. Throttle	CLOSE	
4. Select landing area	Fly to it	
5. FMS - Restart	CARRY OUT	
If no indication of restart:		
6. Forced Landing	CARRY OUT	

Figure 3-19 Engine Failure in Flight

Forced Landing

25. Critical emergencies that result in a near-total or total loss of engine power will necessitate a Forced Landing, which shall be accomplished as follows:

FORCED LANDING		
ACTION	**CHECK**	**NOTES**
1. Establish Glide	80 mph	
2. ELT	ON	
3. MAYDAY	Transmit	
4. Transponder	Set 7700	
5. Landing area	Recheck	Re-assess for suitability, approach obstacles, MSL altitude and wind direction and speed.
6. FMS Shutdown	CARRY OUT	
7. Harness	Ensure tight	
8. Brakes	Check	
9. Cabin doors and windows	Unlatch	
10. Flaps	Select as required	Land with full flap if practicable.
11. Master switch	OFF	After final flap selection.
DITCHING In light winds, land parallel to swells. In strong winds, land into wind, tail low on or past crest of wave.		

Figure 3-20 Forced Landing

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PART 4

OPERATING DATA AND LIMITATIONS

GENERAL

1. The operating parameters detailed in Part I provide for the safe and optimum operation of the aircraft. Except in an emergency, these limitations shall be observed.

GENERAL DATA

2. The following general data apply:

Fuel	Acceptable Grades	100 LL
Minimum Takeoff Fuel	EDM 930 Totalizer	15 USG
	Fuel Tank Gauges Total	20 USG
Oil	Acceptable Grades	Journey Log
	Max Capacity	12 US Qts
	Top Up if below	10 US Qts
	Min Level for Take-Off	9 US Qts
Tire Pressures	Main Wheel	30 psi
	Nose Wheel	30 psi
Allowable Flap Settings	Take-Off	0 – 20º
	Landing	0 - 35º
Nose Oleo	Normal Extension	2-4 inches
Vortex Generators	Maximum Number Missing	5
Shock Cooling	Threshold CHT Cooling Rate	60º / min
Fly Over Noise Level (ref D)	Max Continuous Power	81.9 dB (A)
Tow Hook Capacity (ref X)	Max Rated Load	2200 lbs

Figure 4-1 General Data

FLIGHT RESTRICTIONS

General

3. The following basic flight restrictions apply:

   a. the aircraft is certified for operation in the NORMAL category. The normal category is applicable to aircraft intended for non-aerobatic operations and includes any manoeuvres incidental to normal flying, including stalls and steep turns up to 60 degrees angle of bank;

   b. the aircraft is certified for a maximum of four occupants;

   c. aerobatic manoeuvres, as defined by the Canadian Aviation Regulations, are prohibited; and

   d. deliberate spins or incipient spins are prohibited.

Flight Rules

4. The aircraft is equipped and certified for flight in day and night VFR conditions only. Flight in Instrument Meteorological Conditions (IMC) and flight in known icing conditions are both prohibited.

Flight Load Factors

5. The following are the load factor limits:

Flaps Up	+3.8g to -1.5g
Flaps Extended	+2.0g to 0g

Figure 4-2 Flight Load Factor Limitations

ENGINE LIMITATIONS

6. The following engine limitations are applicable:

Engine Horsepower	Maximum (5 minutes – takeoff)	300 BHP
	Maximum Continuous	285 BHP
	Recommended Max Cruise (75%)	215 BHP
RPM	Maximum (takeoff - 5 minutes)	2850 RPM
	Maximum Continuous	2700 RPM
	Normal operating range – all regimes	2250-2700 RPM
	Normal operating range - Cruise	2250-2550 RPM
Manifold Pressure (MAP)	Maximum Continuous	28.8”
	Normal operating range	15-25”
	CAUTION Do not exceed 20” MAP below 2250 RPM.	
Starter	Maximum Duty Cycle / Cooling Period	30 secs / 3 mins
Oil Pressure	Minimum (at idle)	10 psi
	Normal operating range	30-60 psi
	Maximum (cold oil)	100 psi
Oil Temperature	Minimum for run-up	75º F
	Minimum for takeoff	75º F
	Normal operating range	100- 240º F
	Maximum	240º F
Fuel Pressure	Minimum	3.5 psi
	Maximum	19.5 psi
Fuel Flow Rate	Normal Operating Range	7 – 17 GPH
	Maximum	25.2 GPH
Cylinder Head Temp (CHT)	Minimum for run-up	200º F
	Minimum for take-off	200º F
	Maximum (do not exceed)	460ºF
	Normal operating range	200- 400º F
	CAUTION Do not permit CHTs to drop below 300ºF > 5 minutes	
Exhaust Gas Temp	Normal operating range	1100-1500ºF
Suction	Minimum	4.5” Hg
	Maximum	5.5” Hg

Figure 4-3 Engine Operating Limitations

AIRSPEED LIMITATIONS

Airspeed Corrections

7. The following is the airspeed correction figures. All speeds are in MPH:

Flaps Up	**IAS**	60	80	100	120	140	160	180
	CAS	68	83	101	119	139	158	177
Flaps 20-35^0	**IAS**	40	50	60	70	80	90	100
	CAS	55	60	66	74	83	92	102

Figure 4-4 Airspeed Corrections

Airspeed Limitations

8. The following airspeed limitations are applicable:

Airspeed Limitation		**IAS (MPH)**	**Remarks**
V_{NE}		180	Never exceed speed. Do not exceed this speed in any operation.
V_{NO}		164	Maximum structural cruising speed. Do not exceed this speed except in smooth air
V_A	2950 lbs	126	Manoeuvring speed. Do not make full or abrupt control movements above this speed.
	2450 lbs	116	
	1950 lbs	105	
V_{FE}	0-10º flap	160	Maximum flap speed. Do not exceed these speeds with the given flap settings.
	11-35º flap	110	
Maximum window open speed		120	Do not exceed this speed with bubble window open.
Maximum Crosswind - Take-Off		23 MPH (20 KTS)	Maximum allowable crosswind limits are equivalent to Cessna demonstrated crosswind limits
Maximum Crosswind - Landing		17 MPH (15 KTS)	
Maximum Tailwind – Takeoff / Landing		12 MPH (10 KTS)	Pacific Region imposed limit

Figure 4-5 Airspeed Limitations

Normal Operating Speeds

9. The following are the normal operating airspeeds:

		IAS (MPH)	Remarks
Takeoff	Normal - 10º - 20º flap	60	
	Max Perf - 20º flap - 3100 lbs	63	
	Max Perf - 20º flap - 2700 lbs	54	
	Max Perf - 20º flap - 2400 lbs	50	
Climb (0º flap)	Normal Climb	110	Decrease climb airspeed by 2 mph for every 5000'above sea level.
	V_Y - Best Rate	90	
	V_X - Best Angle - 0º flap	73	
	V_X - Best Angle - 20º flap	63	
	Glider Tow	70	
Traffic Pattern	Normal Downwind - 0º flap	~125	2400 RPM / 20 MAP
	Slow Downwind - 10º flap	~115	2400 RPM / 18 MAP
Final Approach	Final Approach - 0º flap	80-90	In gusty winds, add half the gust spread to the FAS
	Final Approach - 20º flap	75-85	
	Final Approach - 35º flap	70-80	
Gliding	Optimum glide – zero wind, prop wind-milling, flaps up	80	

Figure 4-6 Normal Operating Speeds

Stalling Speeds

10. The following stalling speeds are applicable at 3,100 lbs gross weight:

Condition		IAS (MPH) Angle of Bank		
		0º	30º	60º
3,100 lbs	Flaps up	58	66	92
	Flaps 20º	53	60	84
	Flaps 35º	50	56	82

Figure 4-7 Stalling Speeds

PERFORMANCE DATA

Takeoff Distance

11. Takeoff performance data (ground run and total to clear a 50 foot obstacle) are provided below (reference F):

Take-Off Performance										
Gross Weight	IAS at 50'	Head Wind (KTS)	**Sea Level 59 °F**		**2,500 ft MSL 50 °F**		**5,000 ft MSL 41 °F**		**7,500 ft MSL 32 °F**	
			Grd Roll	Total to clear 50 ft obst	Grd Roll	Total to clear 50 ft obst	Grd Roll	Total to clear 50 ft obst	Grd Roll	Total to clear 50 ft obst
3100 lbs	63 MPH	0	800	1550	950	1850	1150	2250	1400	2950
		10	550	1150	650	1400	800	1750	1000	2300
		20	350	850	450	1050	550	1300	700	1750

Governing Conditions

1. 20^0 flaps
2. Hard surface runway
3. Increase distances 10% for each 25^0 F above ISA
4. For dry grass runway, increase distances by 10% of total to clear 50 ft obstacle
5. **For glider towing, increase both ground roll and total takeoff distances by 25% of total to clear 50 ft obstacle**

Figure 4-8 Takeoff Performance

CAUTION

Takeoff performance data is extracted from the Aircraft POH and the applicable STC Flight Manual Supplements. Data is based on best possible performance under ideal conditions. They incorporate no safety margin or allowance for error.

Maximum Rate of Climb Performance

12. Maximum rate of climb data are provided below (refs E & BB):

Maximum Rate of Climb						
Gross Weight	**Press Alt**	**IAS (MPH)**	**Rate of Climb (FPM)**			
			-20º C @ SL	**0º C @ SL**	**20º C @ SL**	**40º C @ SL**
2,950 lbs	SL	90	1,350	1,300	1,200	1,150
	2,000 ft	90	1,250	1,150	1,100	1,050
	4,000 ft	89	1,150	1,050	1,000	950
	6,000 ft	87	1,000	950	900	850
	8,000 ft	87	900	850	800	750
	10,000 ft	86	800	750	700	650
2,500 lbs	SL	90	1,750	1,700	1,550	1,500
	2,000 ft	90	1,600	1,500	1,400	1,350
	4,000 ft	89	1,500	1,350	1,300	1,200
	6,000 ft	87	1,300	1,200	1,150	1,100
	8,000 ft	87	1,150	1,100	1,000	950
	10,000 ft	86	1,000	950	900	850

Governing Conditions

1. Aircraft weight as shown.
2. Flaps UP
3. Power Set 2700 RPM / Full Throttle
4. Cowl Flaps OPEN
5. **For 3,100 lbs, reduce published climb rate for 2,950 lbs by 10%**
6. **For Noise Abatement at 2500 RPM, reduce published climb rate by 15%**
7. **For glider towing at 70 MPH IAS, reduce published climb rate by 40%**

Figure 4-9 Maximum Rate of Climb

Time, Fuel and Distance to Climb

13. Time, fuel and distance to climb performance data are provided below (reference E):

Time, Fuel and Distance to Climb					
Press Alt	**IAS (MPH)**	**Climb Data**			
		ROC (fpm)	**Time (mins)**	**Fuel Used (USG)**	**Distance (NM)**
SL	90	1250	0	0.0	0
2,000 ft	90	1150	2	0.6	2
4,000 ft	89	1050	4	1.3	5
6,000 ft	87	900	6	2.0	8
8,000 ft	87	800	8	2.8	11
10,000 ft	86	700	11	3.6	14

Governing Conditions

1. Flaps UP
2. Power Set 2700 RPM / Full Throttle
3. Cowl Flaps OPEN
4. ISA Conditions
5. Aircraft Weight 2,950 lbs
6. Add 2 USG of fuel for start, taxi, run-up and takeoff allowance
7. Increase time, fuel and distance by 10% for each 10º C above ISA conditions
8. Increase time, fuel and distance by 10% for aircraft weight of 3,100 lbs *(ref BB)*
9. Distances are based on still air (no wind)

Figure 4-10 Time, Fuel and Distance to Climb

Cruise Performance Data

14. The following data are derived from validation flights using C-FCGS and C-FTUG and are valid for flight planning purposes.

15. Data are provided for pressure altitudes of 2,000 ft, 4,000 ft, 6,000 ft, 8,000 ft and 10,000 ft ASL (reference BB).

16. The governing conditions for cruise performance data are as follows:

a. mixture leaned to 50ºF Rich of Peak (ROP);

CAUTION

Do not adjust the mixture to Lean of Peak, as significant engine damage may result.

b. standard atmospheric conditions (ISA);

c. aircraft weight of 3,100 lbs;

d. range estimates are based on full fuel tanks;

e. range estimates are based on still air; and

f. range estimates are based on a 30 minute fuel reserve.

NOTE

Maximum continuous cruise power is 75% of maximum continuous BHP.

CAUTION

Fuel flow and thus the accuracy of endurance and range data is highly dependent upon the employment of optimum engine leaning techniques.

Cruise Performance							2,000 ft MSL	
Governing Conditions 1. Mixture leaned to 50 degrees ROP 2. Standard Atmospheric Conditions 3. Tow Aircraft Weight normalized to 3,100 lbs 4. Range calculated from full tanks to 30 minute reserve in STILL AIR								
RPM	**MP**	**% BH**	**IAS MPH**	**TAS MPH**	**TAS KTS**	**GPH Leaned**	**RANGE (NM)**	**Comments**
2500	**25**	**75**	**144**	**150**	**130**	**18.2**	**470**	**Max Speed Cruise**
	24	73	142	148	129	17.3	495	
	23	71	140	146	127	16.4	515	
	22	68	134	140	121	15.8	515	
	21	65	132	138	120	15.3	530	
	20	62	130	136	118	14.5	550	
	19	59	126	132	114	13.9	560	
2400	**25**	**74**	**140**	**146**	**127**	**17.5**	**480**	**Normal Cruise**
	24	71	138	144	125	16.6	500	
	23	68	143	140	121	15.9	510	
	22	66	128	134	116	15.2	515	
	21	62	124	129	113	14.4	530	
	20	60	122	126	110	13.9	540	
	19	57	121	125	109	13.3	560	
2300	26	74	139	145	126	17.3	480	
	25	71	137	143	124	16.3	510	
	24	68	135	141	122	15.5	530	
	23	65	132	138	120	14.7	550	
	22	63	127	133	115	14.1	555	
	21	60	125	130	113	13.4	580	
	20	57	124	128	112	13.0	590	
	19	**55**	**122**	**126**	**110**	**12.3**	**615**	**Max Range Cruise**

Figure 4-11 Cruise Performance at 2,000 ft ASL

Cruise Performance							4,000 ft MSL	
Governing Conditions 1. Mixture leaned to 50 degrees ROP 2. Standard Atmospheric Conditions 3. Tow Aircraft Weight normalized to 3,100 lbs 4. Range calculated from full tanks to 30 minute reserve in STILL AIR								
RPM	**MP**	**% BH**	**IAS MPH**	**TAS MPH**	**TAS KTS**	**GPH Leaned**	**Range (NM)**	**Comments**
2500	**24**	**75**	**143**	**154**	**134**	**17.7**	**500**	**Max Speed Cruise**
	23	73	141	152	132	16.8	525	
	22	70	138	149	129	16.1	535	
	21	67	133	143	125	15.2	550	
	20	64	126	136	118	14.7	555	
	19	61	123	133	115	14.2	550	
2400	**25**	**75**	**142**	**153**	**133**	**17.8**	**495**	**Normal Cruise**
	24	73	139	150	130	16.7	520	
	23	70	136	147	127	16.0	535	
	22	68	134	145	126	15.4	550	
	21	65	130	140	122	14.6	565	
	20	62	127	137	119	14.0	580	
	19	59	123	133	115	13.4	590	
2300	26	75	142	153	133	18.2	480	
	25	73	140	151	131	16.8	520	
	24	70	137	148	128	15.7	550	
	23	67	134	145	126	15.0	565	
	22	65	131	141	123	14.4	580	
	21	62	129	139	121	13.7	600	
	20	60	126	136	118	13.1	620	
	19	**57**	**122**	**132**	**115**	**12.5**	**630**	**Max Range Cruise**

Figure 4-12 Cruise Performance at 4,000 ft ASL

Cruise Performance								6,000 ft MSL
Governing Conditions 1. Mixture leaned to 50 degrees ROP 2. Standard Atmospheric Conditions 3. Tow Aircraft Weight normalized to 3,100 lbs 4. Range calculated from full tanks to 30 minute reserve in STILL AIR								
RPM	**MP**	**% BH**	**IAS MPH**	**TAS MPH**	**TAS KTS**	**GPH Leaned**	**Range (NM)**	**Comments**
2500	Full Throttle at approximately 24" MAP							
	24	**75**	**139**	**155**	**135**	**18.0**	**495**	**Max Speed Cruise**
	23	73	135	151	131	17.0	510	
	22	70	132	148	128	16.0	535	
	21	67	129	144	125	15.2	555	
	20	63	126	141	123	14.5	575	
	19	61	124	139	121	13.8	595	
2400	Full Throttle at approximately 24" MAP							
	24	**72**	**138**	**154**	**134**	**17.6**	**505**	**Normal Cruise**
	23	70	135	151	131	16.3	540	
	22	67	131	147	127	15.6	550	
	21	64	129	144	125	14.7	570	
	20	62	126	141	123	14.1	590	
	19	59	123	138	120	13.4	610	
2300	Full Throttle at approximately 24" MAP							
	24	69	135	151	131	17.1	510	
	23	67	133	149	129	16.0	540	
	22	65	131	147	127	15.0	575	
	21	62	127	142	124	14.0	600	
	20	59	124	139	121	13.3	620	
	19	**56**	**121**	**136**	**118**	**12.5**	**650**	**Max Range Cruise**

Figure 4-13 Cruise Performance at 6,000 ft ASL

Cruise Performance								8,000 ft MSL
Governing Conditions 1. Mixture leaned to 50 degrees ROP 2. Standard Atmospheric Conditions 3. Tow Aircraft Weight normalized to 3,100 lbs 4. Range calculated from full tanks to 30 minute reserve in STILL AIR								
RPM	**MP**	**% BH**	**IAS MPH**	**TAS MPH**	**TAS KTS**	**GPH Leaned**	**Range (NM)**	**Comments**
2500	Full Throttle at approximately 22.3" MAP							
	22.3	**70**	**136**	**158**	**137**	**15.2**	**610**	**Max Speed Cruise**
	22	69	135	157	136	15.1	610	
	21	66	133	154	134	14.3	635	
	20	63	130	151	131	13.7	650	
	19	60	127	148	128	13.2	660	
2400	Full Throttle at approximately 22.5" MAP							
	22.5	**68**	**131**	**152**	**132**	**14.8**	**605**	**Normal Cruise**
	22	66	130	151	131	14.4	620	
	21	64	124	144	125	13.7	625	
	20	61	120	140	121	13.0	640	
	19	58	117	135	117	12.5	645	
2300	Full Throttle at approximately 22.6" MAP							
	22.6	65	131	152	132	14.3	625	
	22	63	127	148	128	13.8	635	
	21	61	123	143	124	13.1	650	
	20	58	121	141	122	12.6	660	
	19	**55**	**116**	**134**	**116**	**12.1**	**665**	**Max Range Cruise**

Figure 4-14 Cruise Performance at 8,000 ft ASL

Cruise Performance								10,000 ft MSL
Governing Conditions 1. Mixture leaned to 50 degrees ROP 2. Standard Atmospheric Conditions 3. Tow Aircraft Weight normalized to 3,100 lbs 4. Range calculated from full tanks to 30 minute reserve in STILL AIR								
RPM	**MP**	**% BH**	**IAS MPH**	**TAS MPH**	**TAS KTS**	**GPH Leaned**	**Range (NM)**	**Comments**
2500	Full Throttle at approximately 21.0" MAP							
	21	**66**	**130**	**157**	**136**	**15.3**	**595**	**Max Speed Cruise**
	20	63	127	153	133	14.5	620	
	19	60	122	147	128	13.8	630	
2400	Full Throttle at approximately 21.0" MAP							
	21	**64**	**127**	**153**	**133**	**14.7**	**610**	**Normal Cruise**
	20	61	125	150	131	13.9	640	
	19	58	119	143	125	13.2	645	
2300	Full Throttle at approximately 21.0" MAP							
	21	61	120	145	126	14.1	605	
	20	59	116	139	120	13.1	630	
	19	**56**	**115**	**137**	**119**	**12.4**	**665**	**Max Range Cruise**

Figure 4-15 Cruise Performance at 10,000 ft ASL

Cross Country Glider Towing

17. The following data are derived from validation flights using C-FCGS and C-FTUG and are valid for flight planning purposes. Note that MP settings are ***approximate***, and may have to be adjusted +/- 1 to achieve target IAS.

Altitude	Flap Setting	RPM	MP	IAS (MPH)	TAS (KTS)	GPH	RANGE
2,000 ft	10 ^{o}	2300	~18	90	81	12.0	450 NM
	20 ^{o}	2300	~20	80	72	13.0	360 NM
4,000 ft	10 ^{o}	2300	~18	90	84	11.8	465 NM
	20 ^{o}	2300	~20	80	75	12.8	375 NM
6,000 ft	10 ^{o}	2300	~18	90	87	11.6	485 NM
	20 ^{o}	2300	~20	80	78	12.6	395 NM
8,000 ft	10 ^{o}	2300	~18	90	90	11.4	505 NM
	20 ^{o}	2300	~20	80	80	12.4	405 NM
10,000 ft	10 ^{o}	2300	~18	90	94	11.2	525 NM
	20 ^{o}	2300	~20	80	83	12.2	420 NM

Governing Conditions

1. Mixture leaned to 50 degrees ROP
2. Standard Atmospheric Conditions
3. Tow Aircraft Weight normalized to 3,100 lbs
4. Range calculated from full tanks to 30 minute reserve in STILL AIR

Figure 4-16 Glider Cross Country Towing

Approach and Landing Speeds

18. Circuit Speeds. For easy transition to final approach speeds it is recommended that pilots slow to approximately 125 MPH upon entering the traffic pattern. Specific guidance on the traffic pattern is as follows:

a. slowing to approximately 125 MPH can be accomplished with a power setting of 2400 RPM and 20" MAP;

b. if desired, a slower airspeed of approximately 115 MPH can be achieved with power setting of 2400 RPM and 18" MAP. At this airspeed, it is recommended to select flaps to 10 degrees to prevent an excessive nose-up attitude in the circuit; and

c. if desired, a slower airspeed of approximately 115 MPH can be achieved with power setting of 2400 RPM and 18" MAP. At this airspeed, it is recommended to select flaps to 10 degrees to prevent an excessive nose-up attitude in the circuit.

19. Approach Speeds. Normal approach and landing speeds are based on the selected flap setting, and are detailed below:

Flap Setting	Approach Speed
0º	70-80 MPH IAS
20º	75-85 MPH IAS
35º	80-90 MPH IAS

Figure 4-17 Landing Approach Speeds

CAUTION

In gusty wind conditions, add half the gust spread to the final approach speed.

Landing Performance Data

20. Landing distance (ground run and total to clear a 50 foot obstacle) are provided below (reference E):

Landing Performance								
Press Alt	0^0 C		10^0 C		20^0 C		30^0 C	
	Grd Roll	Total to Clr 50 ft Obst	Grd Roll	Total to Clr 50 ft Obst	Grd Roll	Total to Clr 50 ft Obst	Grd Roll	Total to Clr 50 ft Obst
SL	550	1350	600	1400	650	1450	650	1450
2,000 ft	600	1400	650	1450	700	1500	700	1550
4,000 ft	650	1500	700	1550	700	1600	750	1600
6,000 ft	700	1600	750	1650	750	1700	800	1700

Governing Conditions

1. Flaps 35 degrees
2. Power IDLE / Propeller FULL FINE
3. Final Approach Speed 70 MPH IAS
4. Maximum Braking (after flaps raised on touchdown)
5. Paved, level, dry runway
6. Zero Wind
7. Aircraft Weight 2950 lbs (maximum landing weight)
8. Decrease both distances by 10% for every 10 kts of headwind
9. Increase both distances by 10% for every 2 kts of tailwind up to 10 kts
10. For operations from dry grass, increase distances by 40% of ground roll

Figure 4-18 Landing Performance

CAUTION

Landing performance data is extracted from the Aircraft POH and the applicable STC Flight Manual Supplements. Data is based on best possible performance under ideal conditions. They incorporate no safety margin or allowance for error.

WEIGHT AND BALANCE

Weight Limits

21. The following weight limits are applicable:

Maximum ramp weight	3,110 lbs
Maximum takeoff weight	3,100 lbs
Maximum landing weight	2,950 lbs
Full fuel weight (75 USG useable @ 15º C)	480 lbs
Max weight – Fwd Baggage Compartment	120 lbs
Max weight – Aft Baggage Compartment	80 lbs

Figure 4-19 Weight Limitations

Center of Gravity Limits

22. Figure 4-20 details the weight and centre of gravity limits:

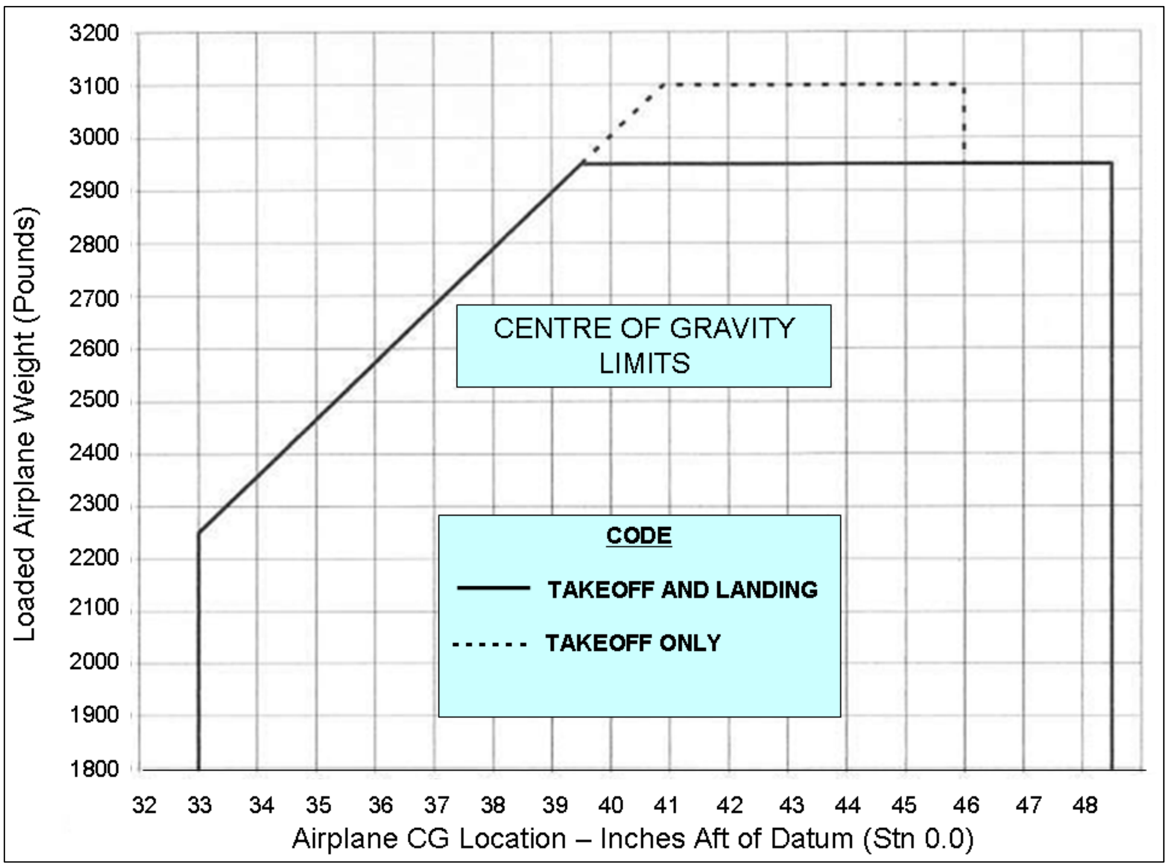

Figure 4-20 Centre of Gravity Limits

Calculation of Operational Weight and Balance

23. Pilots shall verify that the loaded aircraft is within weight and balance limits prior to flight. The weight and balance for any particular load is computed as follows:

a. enter the current basic empty weight and moment on the worksheet using data from the Aircraft Weight and Balance Certificate or the Journey Log;

b. calculate useable fuel on board, calculate the fuel weight, and then calculate the fuel moment;

c. enter weights for front and rear seat occupants and cargo in the forward and aft baggage areas, then calculate the moment for each; and

d. calculate total weight and moment for the aircraft, calculate the CG position (loaded moment divided by loaded weight), and plot centre of gravity position on Centre of Gravity Limit Chart.

WARNING

Operation of the aircraft outside of published weight and balance limits will adversely affect the stability and control characteristics of the aircraft, and will invalidate the Certificate of Airworthiness.

NOTE

Aircraft Empty Weight, as shown on the Aircraft Weight & Balance report, includes the following: 10qts Oil, 5 USG Unusable Fuel, Life Jackets, Charts, Fire Extinguisher, and First Aid Kit.

NOTE

As flights planned with full fuel and front seat occupant(s) only may result in a C of G position forward of the approved envelope, a removable glider type ballast block is normally mounted at the aft bulkhead of the baggage compartment. For improved aircraft handling, solo pilots may benefit by leaving this ballast block installed. For C of G planning, flights planned with rear seat occupants and / or cargo in the baggage compartment may not require the use of this ballast. Unless the aircraft load is planned at maximum weights, or the additional weight will adversely affect safety of flight, the removable ballast should remain installed.

	Takeoff Condition			Landing Condition		
	Weight (lbs)	**Arm (in)**	**Moment (in-lb)**	**Weight (lbs)**	**Arm (in)**	**Moment (in-lb)**
Empty Weight & Moment						
Useable Fuel (6.0 lb / USG)		48.00			48.00	
Front Seat Occupants		37.00			37.00	
Rear Seat Occupants		74.00			74.00	
Forward Baggage Area (max 120 lbs)		97.00			97.00	
Tie Down Box (20 lbs if carried)		97.00			97.00	
Step Ladder (6 lbs if carried)		97.00			97.00	
Rear Baggage Area (max 80 lbs)		115.00			115.00	
Removable Ballast (20 lbs if carried)		115.00			115.00	
Tow Bar (2 lbs if carried)		124.00			124.00	
Total Weight & Moment						

Figure 4-21 Weight and Balance Worksheet