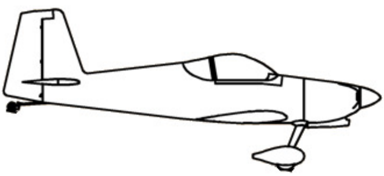
PILOT'S OPERATING HANDBOOK

TOTAL PERFORMANCE
VAN'S AIRCRAFT

RV7 - 200HP C/S



Serial No. *71334*
Registration No. *ZU-WAB*

This Handbook follows GAMA Specification No. 1, *Specification for Pilot's Operating Handbook*, issued February 15, 1975 and revised September 1, 1984.

First issue, January 29, 2019

RV7 Performance

WEIGHT	
Solo Weight	1400 lbs
Gross Weight	1800 lbs
SPEED - Solo Weight	
Top Speed	188 kt
Cruise [75% @ 8000 ft]	180 kt
Cruise [55% @ 8000 ft]	162 kt
Stall Speed	45 kt
SPEED - Gross Weight	
Top Speed	187 kt
Cruise [75% @ 8000 ft]	179 kt
Cruise [55% @ 8000 ft]	161 kt
Stall Speed	51 kt
GROUND PERFORMANCE	
Ground Performance - Solo Weight	
Takeoff Distance	250 ft
Landing Distance	350 ft
Ground Performance - Gross Weight	
Takeoff Distance	500 ft
Landing Distance	500 ft
CLIMB/CEILING	
Climb/Ceiling - Solo Weight Rate of Climb	2,550 fpm
Ceiling	25,500 ft
Climb/Ceiling - Gross Weight Rate of Climb	1,900 fpm
Ceiling	22,500 ft
RANGE	
Range [75% @ 8000 ft]	664 nm
Range [55% @ 8000 ft]	812 nm

NOTE

Numbers in this table are provided by the kit manufacturer and are not measured performance on the aircraft identified on the front page. The speeds and ranges indicated are converted from claimed numbers in mph or statute miles to knots or nautical miles.

PILOT's OPERATING HANDBOOK
LOG OF REVISIONS

Revision Number and Date	Revised Pages	Description of Revision
1: 13/07/2018	All	Initial creation of document
2: 28/11/2018	Systems	Tyre and tube detail added
3: 20/12/2018	Equipment list	Equipment list added
4: 29/01/2019	Weight & balance	Actual numbers used
	Systems	Moved Equipment list to Systems
	Systems	Added EFIS backup battery

Contents

Section 1

General description

General

This pilot's operating handbook is designed to provide information relevant to achieve maximum utilisation of the aircraft. It is not designed to be a substitute for adequate and competent flying instruction and should not be used for operational purposes unless kept up to date.

Assurance that the aircraft is airworthy is the responsibility of the owner. The pilot in command is responsible for ensuring the aircraft is safe for flight and for operating within the limits detailed in this handbook and as displayed on placards and instrument markings in the aircraft.

Three View

The RV7 is a propeller driven conventional gear aircraft with a wingspan of 7.7m, a length of 6.1m and a height of 1.6m as shown in Figure 1.1.

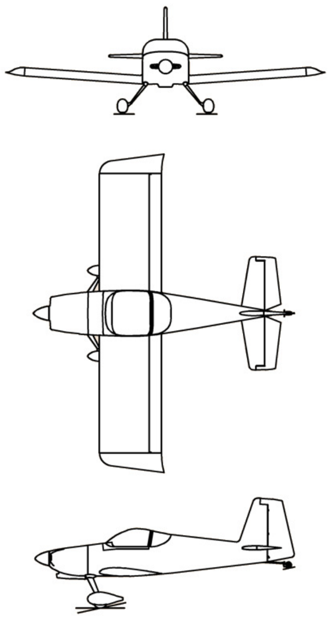


Figure 1.1: RV7 three view: Wingspan 7.7m, Length 6.1m, Height 1.6m

Descriptive Data

Engine

Number of Engines:	1
Engine manufacturer:	Avco Lycoming
Engine Type:	Normally-aspirated, air-cooled, horizontally opposed, fuel injected, four-cylinder engine
Engine Model number:	IO-360-A1B6
Rated horespower:	200 hp
Rated speed, RPM:	2700 rpm
Displacement, cu inch:	361.0
Compression ratio:	8.7:1
Firing order:	1-3-2-4
Spark plugs:	Champion REM38E or REB37E
Propeller rotation:	Clockwise
Weight:	333 lbs

Propeller

Propeller Manufacturer:	Hartzell
Propeller Model No:	HC-C2YR-1BFP/F7497-2
Number of Blades:	2
Propeller Diameter:	Maximum 72"
Propeller Type:	Variable Pitch
Weight:	51.8 lbs
Limitation:	None (Type Certificate Data sheet No. P-920)

Fuel

Approved Fuel Grades:	100/130 Aviation Fuel (Blue).
Capacity:	42 US Gal (159ℓ)
Useable fuel:	40 US Gal (151ℓ)
Max fuelpump pressure:	35psi

Oil

Oil capacity:	8 US Qt (min 2 US Qt)

Maximum Weights

Maximum weight:	1800 lbs (820 kg)
Max baggage weight:	100 lbs (45 kg)

Standard airplane weights

Standard empty weight:	1122 lbs (510 kg)
Usable load:	679 lbs (310kg)

Cabin and Entry dimensions

The cabin features side by side seating with control and brakes for both occupants. Cabin entry is made through the open canopy by stepping from the wing over the cabin side onto the seat.

Baggage space and entry dimensions

Baggage is stored behind the seatbacks of the front occupants. A maximum weight of 100 lbs and volume of 12 cubic feet is available for baggage.

Specific loadings

Wing Loading:	14.8 lb/sq ft
Power Loading:	9.0 lb/hp

Symbols

V_a	Manoeuvring speed. Speed at which full application of aerodynamic control will not overstress the aircraft.
V_{fe}	Maximum Flap Extension Speed. Highest Speed permissible with wing flaps in a prescribed extended position.
V_{ne}	Never exceed speed. Not to be exceeded at any time.
V_{no}	Maximum structural cruising speed. Not to be exceeded except in smooth air and then only with caution.
V_s	Stalling speed. The minimum steady airspeed at which the aircraft is controllable.
V_{so}	Stalling speed. The minimum steady airspeed at which the aircraft is controllable, in the landing configuration.
V_x	Best angle of climb. Airspeed that delivers greatest altitude gain in shortest horizontal movement.
V_y	Best rate of climb. Airspeed delivering greatest altitude gain in shortest possible time.
V_{gl}	Best glide speed for lowest sink rate. (propeller set to fine)

Abbreviations

CAS	Calibrated airspeed. Indicated airspeed corrected for position and instrument error. Equates to true airspeed in standard atmosphere at sea level.
GS	Groundspeed. Speed relative to the ground
IAS	Indicated Airspeed. Speed, as shown on Airspeed indicator, includes instrument and position error.
KIAS	IAS in Knots
kt	Knots
NM	Nautical Miles
TAS	True airspeed relative to undisturbed air, which is the CAS, corrected for altitude, temperature and pressure.

Terminology

Constant Speed	A propeller system which employs a governing device to maintain a selected engine RPM.
Demonstrated crosswind	Demonstrated cross wind component for which adequate control of the aircraft during take off and landing has been demonstrated.
Empty Weight	Weight of the airplane including fixed ballast, unusable fuel and oil.
Gross Weight	Sum of empty weight plus crew, passengers, fuel and baggage.
Maximum Gross Weight	The maximum allowable operating weight with all variable load items located such that the Centre of Gravity remains within prescribed limits.
Payload	Weight of passengers and baggage.
Useful Load	Weight of passengers, fuel and baggage.

Section 2

Limitations

Introduction

This section includes operating limitations, instrument markings and basic placards necessary for the safe operation of the aircraft, its engine, standard systems and equipment.

Airspeed Limitations

Table 2.1: Airspeed Limitations

	SPEEDS	KIAS	REMARKS
V_{ne}	Never exceed speed	200 kt	Do not exceed this speed in any operation
V_{no}	Maximum structural cruising speed	168 kt	Do not exceed this speed except in smooth air, and then only with caution
V_a	Manoeuvering Speed	123 kt	Do not make full or abrupt control movements above this speeds
V_{fe}	Flap Extended Speed: To 20° Flaps 20° - 40° Flaps	- 96 kt 87 kt	 Do not exceed these speeds with the given flap settings

Airspeed Indicator Markings

Table 2.2: Airspeed Indicator Markings

MARKING	KIAS VALUE or RANGE	SIGNIFICANCE
White Arc	51 kt - 87 kt	Full flap operating range. Lower limit is maximum weight V_{so} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	56 kt - 168 kt	Normal operating range. Lower limit is maximum weight V_s with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	168 kt - 200 kt	Operations must be conducted with caution and only in smooth air.
Red Line	200 kt	Maximum speed for all operations

Power plant limitations

Engine Operating Limits for Takeoff and Continuous Operations:

Engine manufacturer:	Avco Lycoming
Engine Model number:	IO-360-A1B6
Maximum Power:	200 hp
Maximum Engine Speed:	2700 RPM
Maximum Cylinder Head Temp:	500°F *(260°C)*
Maximum Oil Temperature:	245°F *(118°C)*
Oil Pressure:	125 psi
Fuel Pump Pressure:	-2 - 35 psi
Fuel Injector Pressure:	14 - 45 psi
Propeller Manufacturer:	Hartzell
Propeller Model No:	HC-C2YR-1BFP/F7497-2
Propeller Diameter:	Maximum 72"
Propeller Blade Angles:	Low: 13.6° High: 35°

Power plant instrument markings

Power plant instrument marking and their colour code significance are shown in Table 2.3. The limits tabled are based on the Lycoming engine operating manual. To maximise engine service life green arc limits should be adhered to and engine power settings of 65% or less is recommended.

Table 2.3: Power Plant Instrument Markings

Instrument	Minimum Limit	Normal Operating	Caution Range	Maximum Limit
	RED LINE	GREEN ARC	YELLOW ARC	RED LINE
Tachometer	....	1800 - 2500 RPM	....	2700RPM
Manifold Pressure	....	15 - 25 in. Hg	....	28.7 in. Hg
Oil Temperature	140°F	165 - 220°F	....	245°F
Cylinder Head Temperature	150°F	150 - 400°F	400 - 435°F	500°F
Fuel Pressure (Flow)	-2 psi	-2 - 35 psi	....	35psi
Oil Pressure	25 psi	55 - 95 psi	....	95/115psi

Weight Limits

Maximum Takeoff Weight:	1800 lbs
Maximum Landing Weight:	1800 lbs
Maximum Aerobatic Weight:	1600 lbs
Maximum Weight Baggage:	100 lbs

Centre of Gravity limits

Reference Datum: 70" forward of the leading edge of the wing.

Normal Operations

Center of Gravity range:

- Forward: 78.7" aft of datum at 1800 lbs or less
- Aft: 86.8" aft of datum at 1800 lbs or less

Aerobatic Operations

Center of Gravity range:

- Forward: 78.7" aft of datum at 1600 lbs or less
- Aft: 84.5" aft of datum at 1600 lbs or less

Manoeuvre limits

This aircraft is designed for flight in both the normal and aerobatic category.

Normal Category

The normal category is applicable to aircraft intended for non-aerobatic operations. These include manoeuvres incidental to normal flying, stalls (except whip stalls), lazy eights, chandelles and steep turns in which the angle of bank is not more than $60°$.

Aerobatic Category

The aerobatic category is applicable to the aircraft when loaded within limits. Aerobatic manoeuvres include, Loops, Horizontal Eights, Immelman Turns, Aileron Rolls, Barrel Rolls, Snap Rolls, Vertical Rolls and Split S. Tail slides and extended flight at negative G's (more than 3 seconds) are *prohibited*.

Flight load limit factor limits

Normal Category

At any weight between 1600lbs and 1800lbs or at any CG location aft of 84.5 inches, the aircraft flight load limits are +4.4 and -2.2G.

Aerobatic Category

At an Aerobatic gross weight of 1600lbs the airframe structure is designed to withstand flight load limits of +6 and -3G. Sustained flight at negative G's is probibited due to lack of an inverted oiling system. Fuel flow will be unimpeded by inverted flight due to flop tube fuel pickups and fuel injection.

Kinds of operation limits

This aircraft is approved for any operation approved in accordance with the current Authority to Fly.

Fuel limitations

Approved Fuel Grades:	100/130 Aviation Fuel (Blue).
Capacity:	42 US Gal (159ℓ)
Useable fuel:	40 US Gal (151ℓ)

Placards

The following information is displayed in the form of composite or individual placards.

(1) At fuel valve (at appropriate locations):

Fuel Total	40 US Gal (151ℓ)
Left Tank	20 US Gal
Right Tank	20 US Gal

Section 3

Emergency procedures

Introduction

This section provides checklist and amplified procedures for coping with emergencies that may occur. Emergencies caused by airplane or engine malfunctions are extremely rare if proper preflight inspection and maintenance are practised.

Airspeeds for Emergency Operations

Table 3.1: Airspeed for Emergency Operations

	Description	Airspeed
V_{ref}	Engine Failure After Take Off	70 kt
V_{glide}	Best glide	78 kt
V_a	Manoeuvring speed	123 kt

ENGINE FAILURE

Engine Failure during Takeoff Run

(1) Throttle – CLOSED

(2) Brakes – APPLY

(3) Wing Flaps – RETRACT

(4) Mixture – IDLE CUT OFF

(5) Ignition – OFF

(6) Master – OFF

Engine Failure After Take Off

(1) Airspeed – 78 KIAS

(2) Mixture – IDLE CUT OFF

(3) Fuel Selector – OFF

(4) Ignition – OFF

(5) Flaps – AS REQUIRED

(6) Master – OFF

Engine Failure During Flight

(1) Airspeed – 78 KIAS

(2) Fuel Selector – SWITCH TANKS

(3) Mixture – RICH

(4) Fuel pump – ON

(5) Ignition – ON

If power not restored

(a) Ignition – Cycle OFF then ON

(b) Alternate Air – PULL

(c) Throttle and Mixture – RESET

If power not restored perform Forced Landing.

FORCED LANDING

Emergency Landing without Engine power

(1) Airspeed – 78 KIAS

(2) Fuel Selector – OFF

(3) Mixture – IDLE CUT OFF

(4) Ignition – OFF

(5) Flaps – AS REQUIRED

(6) Master – OFF

(7) Canopy – UNLATCH

FIRES

During Start on the Ground

(1) Ignition – START continue cranking

(2) Mixture – IDLE CUT OFF

(3) Fuel Selector – OFF

(4) Ignition – OFF

(5) Master – OFF

(6) Airplane – EVACUATE

(7) Fire Extinguisher – DISCHARGE into cowl outlet

Engine Fire in Flight

(1) Mixture – IDLE CUT OFF

(2) Fuel Selector – OFF

(3) Master – OFF

(4) Cabin Heat – OFF

(5) Airspeed – SELECT glide speed to extinguish fire

Prepare for emergency landing.

Electrical Fire in Flight

(1) Master – OFF

(2) Air Vents – CLOSED

(3) Cabin Heat – CLOSED

(4) Extinguisher – DISCHARGE

After fire stopped open air vents to clear cabin. Return power to essential instruments only if safe to do so.

ELECTRICAL POWER SUPPLY FAILURES

Ammeter Shows Battery Discharge

(1) Alternator – Cycle OFF for 15s then ON

If battery discharge continues reduce electrical load and terminate flight as soon as possible.

Amplified Procedures

Engine Failure

If an engine failure occurs during take off run, the most important thing is to stop the aircraft on the remaining runway.

The first response to an engine failure after takeoff is the prompt lowering of the nose to maintain airspeed in the glide. The checklist procedures assume that adequate time exists to secure fuel and ignition systems before touchdown.

After an in flight engine failure establish best glide speed first. Should an engine restart fail a forced landing without power must be completed.

Spins

Van's Aircraft does not consider spins to be a recreational aerobatic manoeuvre. Accidental spins can result from a variety of conditions in which asymmetric wing lift is induced. Spins normally are caused by improper rudder usage coupled with a stall.

Should a spin occur, the following recovery procedure is suggested:

(1) Throttle – IDLE

(2) Rudder – OPPOSITE to rotation

(3) Ailerons – NEUTRAL

(4) Control – FORWARD enough to break stall
Hold these controls until rotation stops.

(5) Rudder – NEUTRALISE then gently recover from dive

Section 4

Normal operations

Airspeed Normal Operations

Table 4.1: Airspeed for Normal Operations

Symbol	Description	Airspeed
V_r	Take off rotate speed	70 kt
$V_{x'}$	Best angle of climb	74 kt
V_y	Best rate of climb	104 kt
V_{fe}	Maximum full flap speed	87 kt
V_{fe20}	Maximum 20° flap speed	96 kt
V_a	Turbulent air operating speed	123 kt
V_{no}	Turbulent air operating speed	168 kt
V_{ne}	Never exceed speed	200 kt
V_{ref}	Landing final approach full flap	70 kt
V_{gl}	Best glide	78 kt
V_s	Stall flapless	56 kt
V_{so}	Stall full flap	51 kt

Before Entering the Airplane

1

(1) Master and EFIS – ON

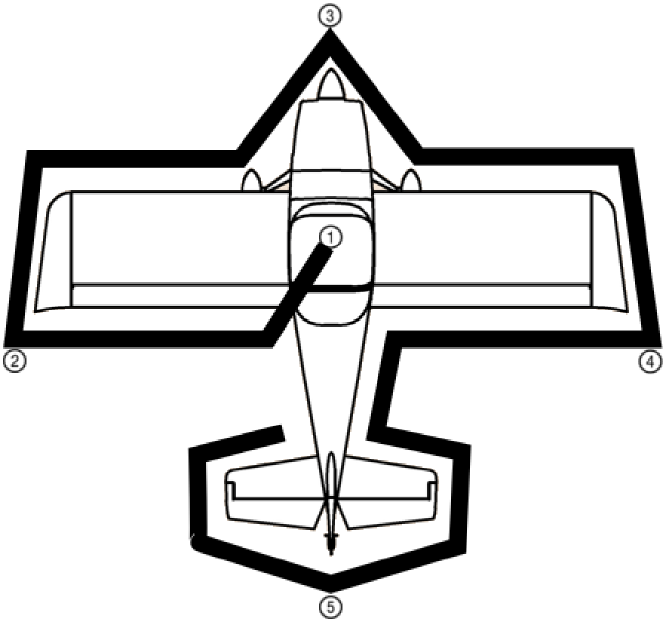


Figure 4.1: Walkaround

(2) Fuel gauges – CHECK

(3) Flaps – EXTEND FULLY

(4) Master and EFIS – OFF

2

(1) Left wing control surfaces – CHECK

(2) AoA port – CLEAR

(3) Pitot tube – CLEAR

(4) Left tank – CHECK LEVEL and CAP SECURE

(5) Left strainer – DRAIN and CHECK

(6) Left wheel – CHECK

3

(1) Fuel vents – CLEAR

(2) Windshield – CLEAN and SECURE

(3) Air inlets – CLEAR

(4) Prop and Spinner – CHECK

(5) Oil – Check level (6 Qt)

(6) Cowls – SECURE

4

(1) Right tank – CHECK LEVEL and CAP SECURE

(2) Right strainer – DRAIN and CHECK

(3) Right wing control surfaces – CHECK

(4) Right wheel – CHECK

5

(1) Static port – CLEAR

(2) Rear Empennage Fairing – CHECK

(3) Elevator – CHECK

(4) Rudder – CHECK

(5) Tail wheel – CHECK

Before Starting the Engine

(1) Seats and Seat Belts – Adjust and Lock

(2) Alternate air – OFF (Emergency use only)

(3) Brakes – Test

(4) Avionics – OFF

(5) Flaps – RETRACT IN STAGES $(20^\circ, 10^\circ, 0^\circ)$

Priming the Engine (Cold Engines Only)

(1) Propellor – FINE

(2) Fuel valve – SELECT

(3) Master – ON

(4) EFIS – ON

(5) Fuel pump – ON

(6) Throttle – OPEN FULL

(7) Mixture – ADVANCE TO FULL RICH (Until slow but steady fuel flow achieved for 3-5s)

(8) Throttle – CLOSED

(9) Mixture – IDLE CUT OFF

(10) Fuel pump – OFF

Starting Engine (Cold)

(1) Prime – AS REQUIRED

(2) Throttle – OPEN 1/4 TRAVEL

(3) Ignition Switch – START (release when engine starts)

(4) Mixture – FULL RICH (slowly and smoothly)

(5) Throttle – SET 1000 RPM

(6) Oil Pressure – CHECK (stop if not green in 30s)

(7) Ammeter – ON AND CHARGING

(8) Mixture – LEAN (for taxi)

(9) Avionics – ON

Starting Engine (Hot)

1. Mixture – FULL LEAN
2. Throttle – FULL OPEN
3. Inition – ON
4. Ignition Switch – START (release when engine starts)
5. Mixture – FULL RICH (slowly and smoothly)
6. Throttle – CLOSE AND SET 1000 RPM
7. Ammeter – ON AND CHARGING
8. Mixture – LEAN (for taxi)
9. Avionics – ON

Ground Running and Warm-up

(1) Aircraft – Into Wind

(2) Mixture – RICH

(3) Propellor – FINE

(4) Throttle – SET 1000-1200 RPM (less than 2200 RPM on ground)

Power Check

(1) Brakes – ON

(2) Fuel selector – SWITCH

(3) Oil Temperature – GREEN

(4) Oil Pressure – GREEN

(5) Mixture – RICH

(6) Throttle – 1000 - 1500 RPM

(7) Propellor – CYCLE x 3 (Avoid more than 500 RPM drop)

(8) Throttle – SET 1800 RPM (50-65% power)

(9) Magneto – CHECK (175 drop 50 RPM difference)

(10) Alternate air – Check for RPM drop on activation

(11) Engine instruments and Ammeter – CHECK

(12) Flights Instruments and Radios – SET

(13) Beacon, Navigation lights – ON (as required)

(14) Wing Flaps - CHECK

NOTE
Any ground check that requires full throttle operation must be limited to three minutes, or less if the cylinder head temperature should exceed the maximum as stated in this manual.

Take Off

Normal Take Off

(1) Flaps – UP

(2) Throttle – OPEN

(3) Mixture – RICH (lean for field elevation)

(4) Rotate – 70 KIAS

(5) Climb Speed – V_y 104 KIAS

Maximum Performance Take Off

(1) Flaps – 15°

(2) Brakes – APPLY

(3) Throttle – FULL THROTTLE

(4) Mixture – RICH (lean for field elevation)

(5) Brakes – RELEASE

(6) Rotate – 55 KIAS

(7) Climb Speed – V_x 74 KIAS

(8) Wing Flaps – RETRACT after reaching 74 KIAS

NOTE
Do not reduce power until wing flaps have been retracted.

Enroute Climb

(1) Airspeed – V_y 104 KIAS or higher

(2) Power – 25 INCHES or FULL THROTTLE and 2500rpm

(3) Mixture – LEAN as required

Cruise

(1) Power – 15-25 INCHES, 2100 - 2500 RPM (no more than 75%)
Performance (75% Power): RPM 2450, Fuel Flow 12.3 Gal (47l/h)
Economy (65% Power): RPM 2350, Fuel Flow 9.5 Gal (36l/h)

(2) Mixture – LEAN as required

Before Landing

(1) Mixture – RICH

(2) Propeller – HIGH RPM

(3) Airspeed – 70-80 KIAS (flaps UP)

(4) Wing Flaps – As Required (20°below 96 KIAS 20°-40° below 87 KIAS)

(5) Aisrpeed – 60-70 KIAS (flaps DOWN)

Balked Landing (Go-around)

(1) Power – FULL THROTTLE and 2700rpm

(2) Wing Flaps – RETRACT to 20°

(3) Airspeed – 70 KIAS

(4) Wing Flaps – RETRACT slowly

Engine Shutdown

(1) Propellor – FINE

(2) Throttle – IDLE until CHT drop

(3) Mixture – IDLE CUT OFF

(4) Master – OFF when engine stops

Amplified Procedures

Before starting engine

When testing the brakes both brake pedals should have a similar feel and a firm resistance after 1/2" of pedal travel.

Throttle operation

Throttle movements from full power to idle or from idle to full power are full range movements. Full range throttle movements must be performed over a minimum time duration of 2 to 3 seconds. Performing a full range throttle movement at a rate of less than 2 seconds is considered a rapid or instant movement. Performing rapid movements may result in detuned counterweights which may lead to failure of the counterweight lobes and subsequent engine damage.

Take off

The auxiliary fuel pump is normally off during take offs. If there is evidence of fuel vapour or rough engine operation the pump should be turned on.

Full throttle runups over loose gravel are harmful to propeller tips. Rolling take offs where the throttle is advance gently is suggested.

Use full-rich mixture during takeoff or climb. Careful observation of engine temperature instruments should be practiced to ensure the limits specified are never exceeded. Prior to take off from fields above 3000 ft elevation the mixture should be leaned.

Wing flap settings

Check that the flaps are retracted evenly. When flap is needed to shorten take off runs, no more than 15° is suggested.

Enroute climb

Normal climbs are performed with the flaps retracted and the airspeed 5 to 15 kt faster than best rate of climb speed. Power selected should not be less than 25" MAP and 2500 rpm. Full throttle climb at 2400 RPM and higher is allowed.

Cruise

Normal cruising is perfromed between 55% and 75% power. For reduced noise levels the lowest RPM in the green arc for the desired power setting is suggested.

For maximum service life, maintain the following limits are recommended for continuous cruise operation:

- Engine power setting - 65% of rated or less.
- Cylinder head temperatures - 400°F or below.
- Oil temperature 165°F to 220°F.

NOTE

After engine rework cruising should be done at 65% to 75% power for 50 hours or until oil consumption stabilise.

Mixture leaning in flight

The relationship between Mixture setting and engine power is indicated in Figure 4.2.

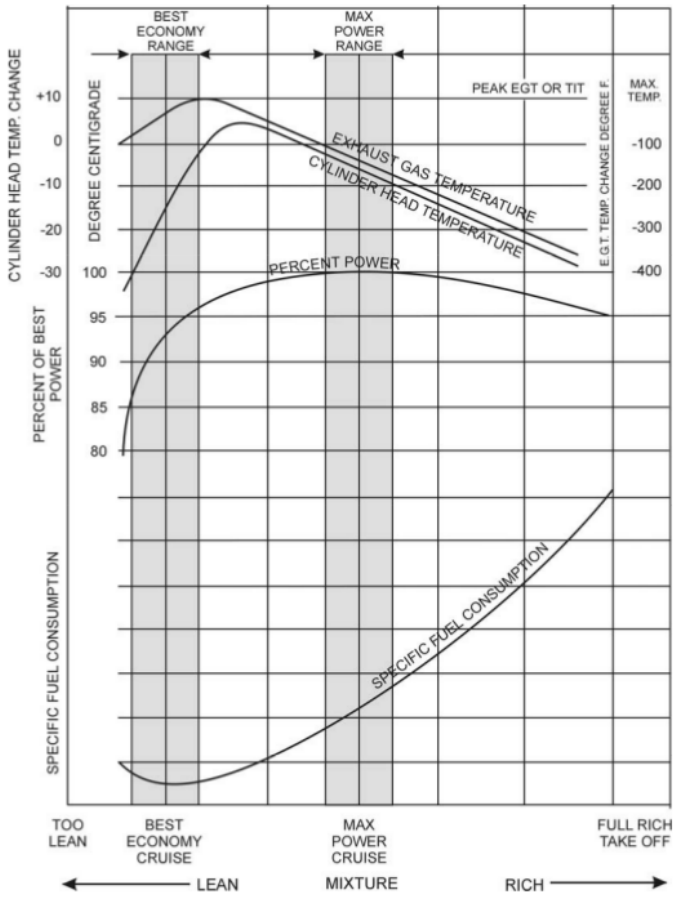


Figure 4.2: Lycoming power leaning curve

Leaning with Exhaust Gas Temperature (EGT) Gauge

Maximum Power Cruise

(1) Approximately 75% Power.

(2) Never lean beyond 150° on RICH side of peak EGT.

(3) Monitor cylinder head temperatures.

Best Economy Cruise

(1) Approximately 75% Power and BELOW.

(2) Operate at PEAK EGT.

Leaning with Manual Mixture Control

Economy cruise, 75% power or less, without flowmeter or EGT guage

(1) Slowly move mixture control from FULL RICH position toward lean position.

(2) Continue leaning until slight loss of power is noted
(loss of power may or may not be accompanied by roughness.)

(3) Enrich until engine runs moothly and power is regained.

Let down

Sudden cooling is detrimental to the good health of the aircraft engine. Lycoming Service Instruction 1094D recommends a maximum temperature change of 50°F per minute to avoid shock cooling of the cylinders.

Pilots must avoid fast letdowns with very low power (high-cruise RPM and low manifold pressure), along with rich mixtures that contribute to sudden cooling. It is recommended that pilots maintain at least 15" MAP or higher, and set the RPM at the lowest cruise position.

Letdown speed should not exceed high cruise speed or approximately 1,000 feet per minute of descent. Keeping descent and airspeed within these limits will help to prevent the sudden cooling that may result in cracked cylinder heads, warped exhaust valves, and bent pushrods.

The mixture setting also has an effect on engine cooling. To reduce spark plug fouling and keep the cylinder cooling within the recommended

50°F per-minute limit, the mixture should be left at the lean setting used for cruise and then richened gradually during the descent from altitude. The lean mixture, maintaining some power and using a sensible airspeed should achieve the most efficient engine temperatures possible.

Crosswind Landing

When landing in a crosswind, use the minimum flap setting required for the field length available.

Go-around

In a go-aroud, apply full throttle and 2700 RPM smoothly using fine pitch. Reduce wing flaps promptly to climb setting. Upon reaching a safe airspeed with positive rate of climb flaps should be retracted fully.

Cold Weather Operation

Prior to starting in cold temperatures it is advisable to pull the propeller through several times.

NOTE
When pulling through the propeller treat it as if the ignition is on. A loose or broken ground wire to either magento could cause the engine to fire.

Aerobatic Flight

Aerobatic Flight

The aircraft is capable of easily performing basic aerobatic manoeuvres. This capability is due to its relatively high power loading and aerodynamic cleanliness which produces the speed or energy needed. Excessive speed build-up can occur very quickly and should be of primary concern when attempting and practicing aerobatics. Elevator stick forces are relatively light, over stressing could easily occur. Pilots should received formal aerobatic training before attempting aerobatic flight.

Airspeed Aerobatic Manoeuvres

The aircraft is capable of performing the aerobatic manoeuvres listed in Table 4.2.

Table 4.2: Aerobatic Entry Speeds

Manoeuvre:	Speed Minimum	Speed Maximum
Loops, Horizontal eights:	122 kt	165 kt
Immelman Turns:	130 kt	165 kt
Aileron Rolls, Barrel Rolls:	104 kt	165 kt
Snap rolls	70 kt	96 kt
Vertical Rolls:	156 kt	165 kt
Split-S:	87 kt	96 kt

Section 5

Performance

Introduction

Performance data charts on the following pages are presented in order to know what to expect from the aircraft under various coniditions. Values in this section are factory numbers and must be verified on your aircraft.

Use of Performance Information

The performance information should allow the pilot to plan all stages of a flight including take off, climb out, cruise and landing. Particular attention should be paid to fuel required and monitored against fuel used during actual flight conditions.

Stall speeds

Stall speeds are presented for 0° angle of bank only. Stall speeds increase with increasing angle of bank.

Table 5.1: Stall speeds

Weight	Flap Deflection	Airspeed
1800 lbs	UP	56 kt
1800 lbs	40°	51 kt

Takeoff Distance

Takeoff distance given below are in standard conditions and optimum pilot technique.

Table 5.2: Takeoff Distance

Description	Weight	Distance
Solo Weight	1400 lbs	250 ft
Gross Weight	1800 lbs	500 ft

Rate of Climb

Rate of Climb values given below are in standard conditions and optimum pilot technique.

Table 5.3: Rate of Climb

Description	Weight	Rate
Solo Weight	1400 lbs	2550 fpm
Gross Weight	1800 lbs	1900 fpm

Cruise performance

Cruise performance values given below is based on engine power settings alone. Actual power settings depends on environment and altitude of operation.

Table 5.4: Operating conditions

	RPM	Fuel Flow Gal/Hr.	Oil Use Qts./Hr.
Normal Rated 200 HP	2700	—	.89
Performance Cruise (75% Rated) 150 HP	2450 (23")	12.3 (47ℓ/h)	.50
Economy Cruise (65% Rated) 130 HP	2350 (21")	9.5 (36 ℓ/h)	.44

Range Profile

Range profile for different power settings at a typical cruise pressure altitude of 8000 ft is given below.

Table 5.5: Range Profile

Setting	Altitude	Range
75% Power	Pressure Altitude 8000 ft	*664 nm*
55% Power	Pressure Altitude 8000 ft	*812 nm*

The fuel consumption for either best power or best economy settings are provided in the engine operating manual and reproduced in Figure 5.1.

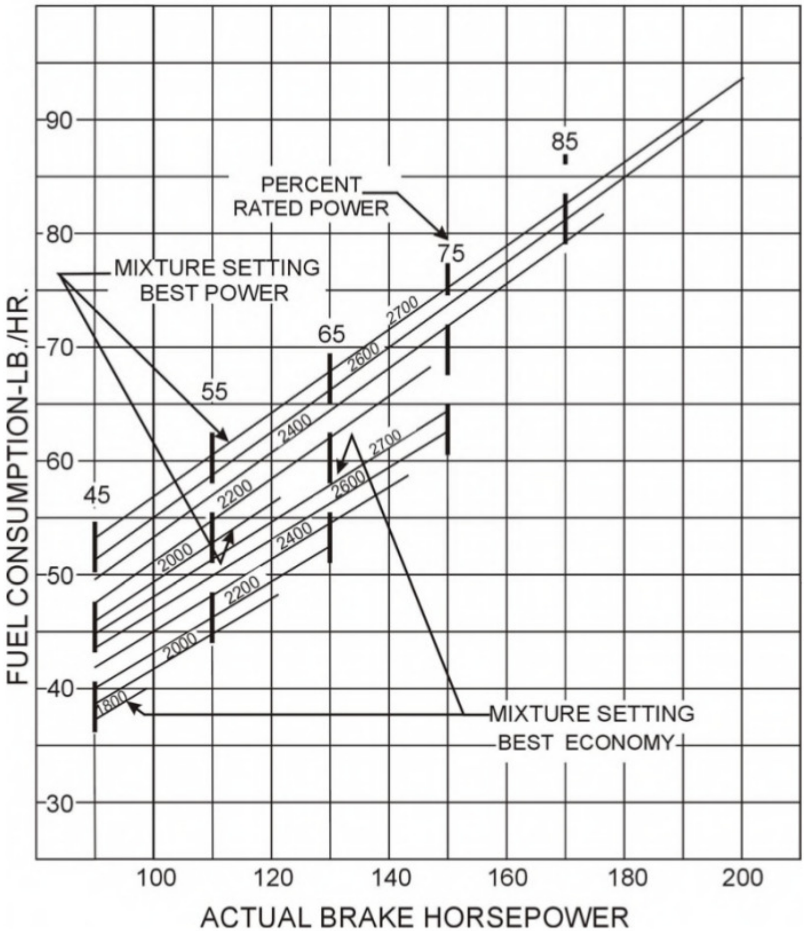


Figure 5.1: Fuel consumption for Best Power and Best Economy setting

Landing Distance

Landing distance given below are in standard conditions and optimum pilot technique.

Table 5.6: Landing Distance

Description	Weight	Distance
Solo Weight	1400 lbs	350 ft
Gross Weight	1800 lbs	500 ft

Section 6

Weight and Balance

Introduction

This section describes the procedure for establishing the basic empty weight and moment of the airplane.

It should be noted that specific information regarding the weight, arm, moment and installed equipment list for this airplane can only be found in the appropriate weight and balance records.

Airplane weighing procedures

The airplane should be weighed in the empty condition and in a level attitude. Scales should be placed simultaneously under both main wheels and the tail wheel as shown in Figure 6.1.

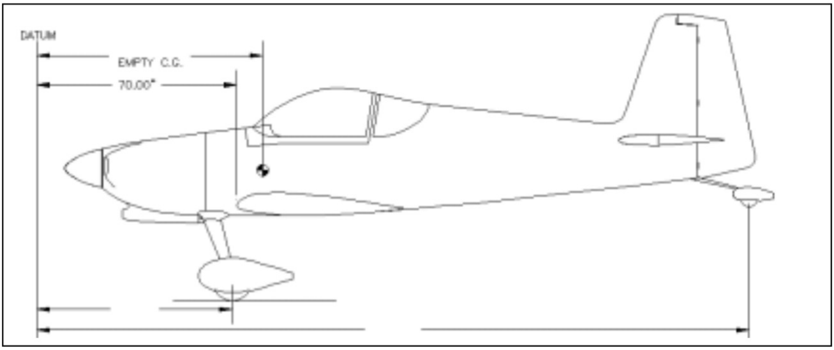


Figure 6.1: Aircraft weighing orientation

Preparation

Inflate tyres to recommended operating pressures. Drain all fuel. Drain all engine oil. Move all seats to the most forward position. Raise flaps to fully retracted position. Place all control surfaces in neutral position.

Levelling

Place scales under each wheel. Level attitude is established at the datum line which is the cockpit rails.

Weighing

With the airplane level, record the weight shown on each scale.

Measuring

To keep all moments positive, a datum has been selected at a point forward of the prop spinner. This point is 70 inches in front of the wing leading edge. Measure the distance from both the main wheels to the aircraft datum. Measure the distance from the tail wheel to the aircraft datum.

Calculation

Calculate the moment for both main wheels and the tail wheel by multiplying the distance to the datum with the measured weight for each. Sum all the Moments and the Weights. To obtain the empty Centre of Gravity divide the total moment by the total weight.

Weight and Balance

The following information will enable the pilot to operate within the prescibed weight and center of gravity limitations.

Centre of Gravity limits

The maximum weight and Centre of Gravity limits for both the Aerobatic and Normal Category operations are summarised in Table 6.1.

Table 6.1: Centre of gravity limits

Category	Weight Maximum	C of G Minimum	C of G Maximum
Aerobatic	1600	78.7"	84.5"
Normal	1800	78.7"	86.8"

Sample loading problems

The following example in Table 6.2 shows the aircraft loaded to the maximum weight of 1800 lbs. This is achieved by loading full fuel and 85lbs of the full 100 lbs baggage allowance. A standard 170 lbs pilot and 170 lbs passenger occupy the seats.

Table 6.2: Gross weight Sample loading problem

Item	Weight [lbs]	Arm [inch]	Moment [inch-.lbs]
Aircraft	1122	79.14	88799.05
Fuel (42Us Gal)	252	80	20160.00
Pilot	170	97.48	16571.60
Passenger	170	97.48	16571.60
Baggage (100 lbs max)	85	126.78	10766.30
Total (1800 lbs)	1799	85.45	152878.55

The second example in Table 6.3 shows the aircraft loaded within the aerobatic limits. The same standard 170 lbs pilot and his 170 lbs passenger can only take half tanks and little or no baggage.

Table 6.3: Aerobatic weight Sample loading problem

Item	Weight [lbs]	Arm [inch]	Moment [inch-.lbs]
Aircraft	1122	79.14	88799.05
Fuel (21 Us Gal)	126	80	10080.00
Pilot	170	97.48	16571.60
Passenger	170	97.48	16571.60
Baggage (100 lbs)	—	126.78	—
Total (1800 lbs)	1588	83.14	132022.25

Figure 6.2 shows the centre of gravity limits plotted graphically. The Normal category operation envelope is plotted with a solid blue line. The Aerobatic operation envelope is plotted with a dashed blue line. The gross weight sample is plotted as a solid dot and the aerobatic weight sample is plotted as a plus sign.

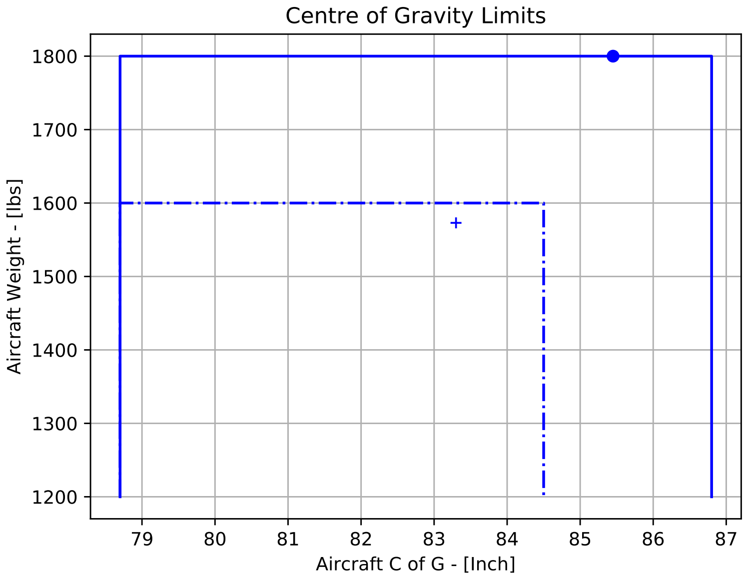


Figure 6.2: Aircraft weighing orientation

A blank table is provided in Table 6.4 to calculate the specific weight and balance for your aircraft.

Table 6.4: Weight and Balance worksheet

Item	Weight [lbs]	Arm [inch]	Moment [inch-.lbs]
Aircraft	1122	79.14	88799.05
Fuel (42Us Gal)	...	80	...
Pilot	...	97.48	...
Passenger	...	97.48	...
Baggage (100 lbs)	...	126.78	...
Total (1800 lbs)	...	...	...

Section 7

Systems

Introduction

Airframe

The airframe is aluminium alloy construction except for steel components comprising the engine mount, main landing gear mounts, control bellcranks and other miscellaneous items. Fibreglass mouldings are used for the tips of wings and tail surface as well as for the engine cowls, wheel spats and empennage fairings. The aircraft is conventionally configured with a non laminar flow aerofoil; the effect of surface irregularities is relatively minor compared to a laminar flow aerofoil.

Engine and propeller

The aircraft is powered by a LYCOMING IO-360-A1B6 four cylinder, direct drive, horizontally opposed, air cooled, fuel injected engine rated at 200 HP at 2700 rpm.

The engine is fitted with a 60-amp 14-volt alternator, Sky Tec starter, high-pressure fuel pump and dual magneto ignition system.

The induction air filter is mounted in a ram air snorkel in the left air intake. An alternate air door is mounted to the side of the air snorkel for emergency use should the induction intake or filter be blocked.

The exhaust system is all-stainless Vetterman four into two configuration and no mufflers. A heat shroud provides cabin heat as required being ducted to the centre section of the firewall.

Please refer to the Lycoming Operators Handbook for detailed information on maintenance, care and operation of the engine.

Landing gear

In conventional configuration the landing gear legs are of spring steel (6150).The tail wheel is steerable and additional steering is possible through differential braking.

The main gear wheels are fitted with Cleveland wheels and disc brakes. The braking system consists of toe brakes attached to the rudder pedals operating individual Cleveland brake cylinders to each of the main landing wheels. These share a common reservoir installed on the top right front face of the fire wall. The brake fluid used is MIL- H-5606 and is red in colour.

Tyres and synthetic tubes are used. The tyres are 6-ply and 5.00x5 in size. Typical tyre pressure of 2.4 bar or 35 psi is used.

Flying controls

Flight control integrity is essential for safe flight. At installation or after maintenance it should be confirmed that ALL controls are connected, secured and safe tied and that they all operate within the specified ranges smoothly and in the correct direction. Full travel should be confirmed prior to each flight. NO play should be permitted in the control hinges; sloppiness may induce flutter. Similarly trim tabs must be free of play.

Dual controls are provided. Elevator and Ailerons are operated through a system of adjustable pushrods. The rudder is operated through a cable system to the rudder pedals.

An electric elevator and aileron trim system enables operation of the elevator trim tab and aileron spring bias system. The elevator and aileron trims can be operated from a rocker switch on the instrument panel.

Engine controls

Engine controls consist of a throttle control, pitch control, mixture control, cabin heat and an alternate air control, mounted at centre beneath the avionics panel.

The throttle (black) is used to adjust engine power output, forward being full throttle and rearward for idle. A throttle friction nut is located at the base of the control.

The propeller pitch control (blue) is located between the throttle and mixture control. Forward is full fine and rearwards coarse. The control is of the vernier type and can be operated by rotating the blue knob clockwise or anti clockwise for small adjustments or by pressing the centre knob in and pushing or pulling the control in or out.

The mixture control (red) is used to adjust the fuel to air ratio. The engine is shut down by placing the mixture control in the idle cut-off, or rearward position. The control is of the vernier type and can be operated by rotating the red knob clockwise or anti clockwise for small adjustments or by pressing the centre knob in and pushing or pulling the control in or out.

The alternate air is used to operate a sliding door on the side of the induction box. To activate, the ratchet cable and knob must be pulled to open the door. This allows the engine to obtain warm unfiltered air from within the cowling area. This control should only be used when an induction filter or intake blockage is suspected. Once operated the control should be manually reset following rectification of the induction system blockage.

Fuel System

Fuel is stored in two 21 US gal (20 US gal usable) tanks secured to the leading edge structure with screws and plate nuts. Fuel drains are fitted to the lowest point of each tank (and of the fuel system) and should be drained prior to the first flight of the day to check for sediment and water.

Two fuel tank vents are located under the main fuselage on the left and rights side just forward of the main landing gear attachments. These should be checked for any blockages.

The fuel selector valve is located in the centre column. It has four selectable positions - left or right tank and two fuel shut-off positions.

An auxiliary electric fuel boost pump is fitted forward of the fuel selector on the cabin side of the fire wall and is used in case of engine driven pump failure and is also used when changing fuel tanks in flight. A switch marked FUEL PUMP is located on the instrument panel.

Two fuel quantity indicators form part of the EFIS display and receive a signal from capacitive type fuel probes mounted in the fuel tanks. Both are marked to indicate the appropriate fuel tank. These indicators only register from a set quantity and NOT from full. As with all fuel gauges, these will tend to be inaccurate when flight attitude is not coordinated or level and during turbulence.

A FUEL FLOW indicator and TOTAL FUEL QTY readout form part of the EFIS display and obtains fuel flow information from a sender unit mounted in the main fuel line between the fuel selector and the engine driven fuel pump. This should be used as a more accurate way of determining fuel consumption and fuel remaining. This system relies on the pilot accurately loading the current fuel quantity into the EFIS whenever fuel is added.

Electrical System

A block diagram of the aircraft electrical system is provided in Figure 7.1.

The electrical system includes a 14 volt 60 amp alternator with an internal regulator and overvoltage protection.

The alternator is protected from overload by a 60A fuse mounted on the engine firewall. The main aircraft battery is a 12-volt sealed Odyssey battery,

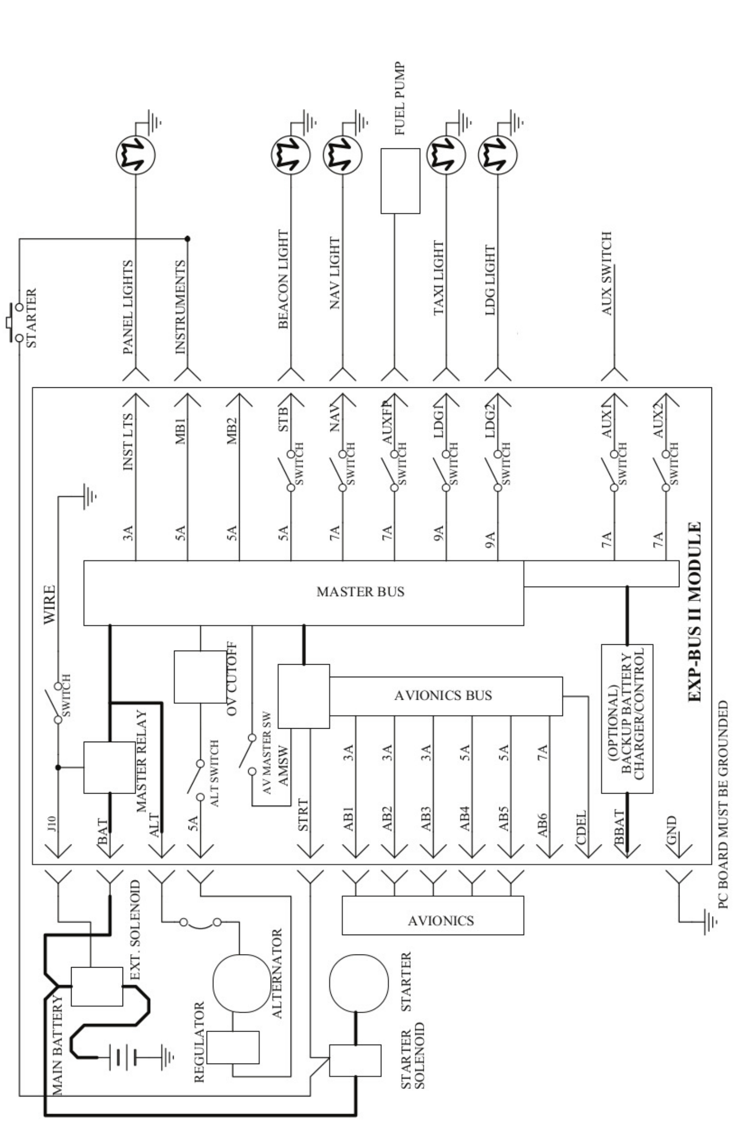


Figure 7.1: Electrical system block diagram

which is mounted on the right side of the forward firewall just above the main battery and starter relays.

The aircraft has no conventional circuit breakers but is instead fitted with an EXP BUS DC load centre which makes use of solid state current limiting devices known as PTC current limiters. These devices have unique advantages over fuses and circuit breakers.

Like a fuse, the PTC device 'blows' when too much current is drawn by an offending circuit, however, like a circuit breaker, the PTC can be reset and in fact does this automatically once the load is COMPLETELY removed.

To reset a circuit simply switch the item off and wait about ten to fifteen seconds for the PTC to reset. Should the fault have cleared, the circuit will be restored when the switch is turned back on.

The alternator field switch is located next to the master switch. This switch will be disabled should the bus voltage exceed 18V.

Electrical accessories include starter, electric fuel pump, flap actuator, exterior lights, trim motors and avionics as listed in the equipment section.

Instruments

The aircraft is fitted with a MGL Odyssey EFIS system as its Primary Flight Display and Engine Management System.

The EFIS unit is powered from the main bus with a dedicated power switch on the instrument panel. In addition a standalone EFIS backup battery is installed powered by a separate power switch on the instrument panel. Standard procedure would be to power the EFIS via the EFIS backup battery to verify its state of charge before turning on the unit via the main bus. The EFIS Backup Battery should be left on during flight to allow charging via the main bus.

A system memory backup battery is mounted behind the EFIS display and is able to hold configuration data only. Configuration data is not stored when this battery is removed.

The MGL RDAC engine module is mounted forward of the firewall under the engine cowl and provides the interface between the EFIS and the engine.

The MGL ADAHRS is mounted in front of the fuel selector switch on top of the fuel pump cover. The MGL magnetometer is mounted behind the baggage area bulkhead.

Outside Air Temperature is obtained from a sensor mounted on the left bottom cockpit behind the pilot rudder pedals.

A standby analogue airspeed indicator and altimeter are fitted for redundancy. An Airpath magnetic compass is fitted to the windscreen support bar in full view from pilot or co-pilot position.

The MGL EFIS provides the following engine and flight instruments:

Engine monitoring

Left tank level:	Fuel quantity [liters]
Right tank level:	Fuel quanitity [liters]
Total fuel level:	Calculated [liters]
Fuel pressure:	Output of engine pump [psi]
Cylinder Heat Temperature:	CHT1-4 [F]
Exhaust Gas Temperature:	EGT1-4 [F]
Oil temperature:	[F]
Oil pressure:	[psi]
Manifold pressure:	MAP ["Hg]
Engine speed:	RPM
Fuel flow:	Liters/hour [l/h]

Flight monitoring

Airspeed:	Knots
Attitude indicator:	Roll, Pitch
Altitude:	feet
Turn and slip indicator:	
Heading indicator:	Magnetic heading
Vertical speed indicator:	ft/min
Angle of attack:	

Avionics

The following aircraft avionics is fitted and powered once the avionics switch is on:

- The GARMIN GX 327 is a mode C transponder.
- MGL V6 COM radio
- Microair COM radio
- Flightcom 403mc Intercom

- MGL V6 COM radio 1
- Microair M760 COM radio 2
- MGL N16 NAV radio 1
- GARMIN GTX327 transponder

A GPS antenna is mounted on top of the engine mount underneath the top engine cowl.

Equipment list

A summary of the installed equipment is provided in Table 7.1.

Table 7.1: Equipment list

Item no.	Item	Build
1	Magnetic compass	
2	UMA Airspeed indicator	
3	UMA Altitude indicator	
4	MGL Odyssey EFIS G2	A3007
	MGL SP-2 Magnetometer	
	MGL SP-7 AHRS	
5	Flightcom 403mc Intercom	
6	MGL V6 COM radio 1	
7	Microair M760 COM radio 2	
8	GARMIN GTX327 transponder	
9	MGL N16 NAV radio 1	

Heating and Ventilation

Cabin heat is provided via a heat muff attached to the exhaust system and fed with high-pressure air from the front right engine baffle plate. Flow of hot air enters through a valve on the lower centre and is controlled with a ratchet cable and knob marked CABIN HEAT. Flow is off in the forward position. When in the OFF position, air passing through the muff and ducts is dumped into the low-pressure section of the cowl.

Fresh air from naca ducts on the forward side of the fuselage is fed into vents on either side of the instrument panel for front occupants.

Canopy and cabin features

The canopy is unlatched using the handle on the top middle of the canopy. To open the canopy should be rolled back while lifting the back slightly to ease it up on the guide rail.

Entry into the cabin is made by first stepping on the wing, taking care not to step onto the flaps. The area on the wing where it is safe to stand is covered in black non-slip *wingwalk* material. From the wing step onto the seat over the cabin side and then slide down into a seated position.

The pilot and passenger backrest may be adjusted forward and aft by means of a piano hinge style system. The backrest may also be angled to more than one position.

Both seats are fitted with a four-point harness, which should be carefully fitted and adjusted prior to take off. In single person operations the unused straps should be used to secure the seat cushions and to prevent the straps flying about. Straps should be checked regularly for damage.

Baggage space and entry dimensions

The baggage area is located behind the passenger seat backrests. The baggage area has a maximum load capacity of 100 lbs and volume of 12 cubic feet.

Baggage needs to be lifted over the seatbacks and fit under the rolled back canopy. This will constrain the maximum dimension of any item in the baggage area.

Section 8

Service and Maintenance

General

This section provides information on handling, service and maintenance of the aircraft.

The owner can obtain up-to-date service bulletins from the VanâĂŹs web site at www.vansaircraft.com. Service bulletins on the Lycoming Kit engine can be obtained from www.lycoming.com and any information relating to the installed propeller from the Hartzell manufacturer at www.hartzellprop.com.

The South African CAA or the Aero Club of South Africa may also issue information and directives. These directives could be advisory or mandatory. As failure to implement such a directive could contravene the issued Permit to Fly (as well as risking safety) It is essential the owner keep up to date on all such relevant information relating to the aircraft, and its installed systems equipment.

Ground Handling

Ground towing/non-taxi movement can be accomplished by manoeuvring with the castoring tail wheel. When taxiing the aircraft ensure that the taxi path and propeller back blast areas are clear. In the first few feet of taxi apply the brakes to ensure effectiveness. Do not operate the engine at high rpm, taxi with care When parking, ensure aircraft is protected from adverse weather and that it presents no danger to others. Park the aircraft into wind if possible and tie down securely.

Maintenance and Service

Refer to the Reference section for 50/100hr/annual maintenance requirements and overhaul time periods.

All work should be entered in the appropriate log book indicating:-

- Date work was done
- Description of work
- Number of hours recorded on the aircraft at that time.
- Name and signature of individual doing the work.

25 Hour Inspection

The following 25-hour check is in essence a detailed pre-flight developed from relevant sources and based on best practice.

Engine compartment

Remove engine cowls for general inspection including the following:

1. Oil hoses and filter. Check for leaks and security.
2. Oil cooler. General check of installation
3. Oil. Check level and review top up frequency
4. Induction filter. Check filter visually
5. Fuel injection servo/Carburettor. General exterior check including control cables.

6. Magneto. General exterior inspection and security
7. Plug leads. Inspect for condition
8. Fuel hoses. Check for leaks and signs of loosening
9. Fuel pump. Check body joins for leaks
10. Exhaust system. Check for blowing manifold gaskets
11. Check heat muffs and ducting
12. Check joints for wear/damage. Check mounting points
13. Check general integrity of system
14. Engine mount. Check for damage
15. Brake fluid. Check level, note change since last service.
16. Compartment wiring. Check for damage and security.
17. Cooling system. Check for damage/wear/security.
18. Check baffles and flexible sealing strips.
19. General. Review/inspection of engine compartment
20. Cowls. Inspect for damage.
21. Replace cowls

Propeller inspection

1. Propeller. Check for nicks, scratches, leaks or corrosion.
2. Spinner. Check spinner and back plate for condition.

External inspection

1. Remove all wheel spats:
2. Tyres. Check pressures, mains 30-35 psi. (Cold)
3. Inspect tyres for wear and slip on hub.
4. Brake system. Inspect brake pads, replace if appropriate.
5. Inspect hydraulic lines, joints and bleed points.
6. Wheels. Check bearings for play. Check split pins and bolts for security, including the split-hub bolts.
7. Spats. Inspect for damage, replace wheel spats.
8. General airframe and control surfaces review including, but not limited to:
9. Control surfaces. Individual inspection of each surface for free movement, satisfactory mounting/hinge condition and actuating system integrity, particular attention should be given to flap actuating rods as the rod end is not safe tied.
10. Fibreglass components. General inspection for integrity.
11. Fuel tanks. Inspect for leaks and security.

Propeller Maintenance

Lubrication Intervals

1. The propeller must be lubricated at intervals not to exceed 100 hours or at 12 calendar months, whichever occurs first.

   If annual operation is significantly less than 100 hours, calendar lubrication intervals should be reduced to six months.

   If the aircraft is operated or stored under adverse atmospheric conditions, e.g., high humidity, salt air, calendar lubrication intervals should be reduced to six months.

2. Owners of high use aircraft may wish to extend their lubrication interval. Lubrication interval may be gradually extended after evaluation of previous propeller overhauls with regard to bearing wear and internal corrosion.

3. Hartzell Propeller Inc. recommends that new or newly overhauled propellers be lubricated after the first one or two hours of operation because centrifugal loads will pack and redistribute grease, which may result in a propeller imbalance. Redistribution of grease may also result in voids in the blade bearing area where moisture can collect.

Battery Maintenance

The State of Charge of the battery can be determined from Figure 8.1.

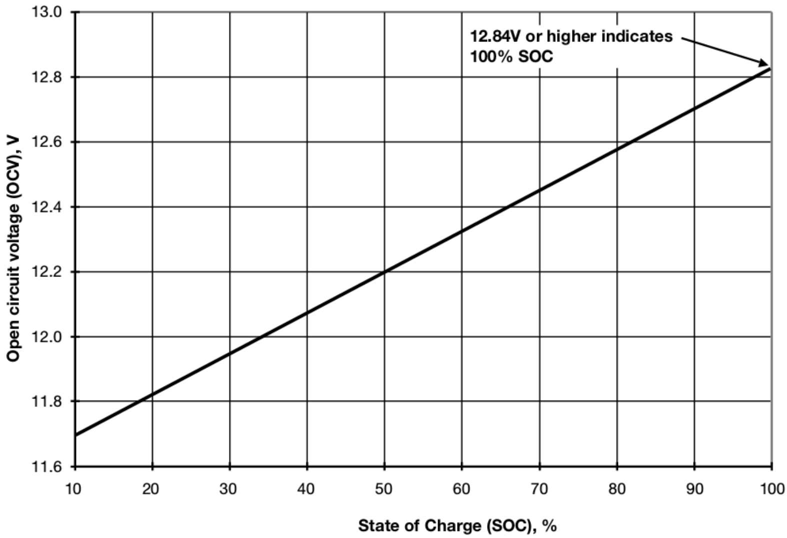


Figure 8.1: State of Charge

To get long life from the battery, it is important that the battery is kept near full charge, approximately 12.8V. If there are electrical loads during storage, then the negative battery cable should be disconnected OR an independent float charger used.