PILOT'S OPERATING HANDBOOK Version 4.0

Model: BRUMBY 610 High Wing Rotax Engine
Model No: Brumby R610
Publication No.: BAA F2746-12H

Aircraft Registration Number

Aircraft Serial Number

Approved _________________________ **Date**

For Brumby Aircraft Australia

LOG OF EFFECTIVE PAGES

Section	Pages	Amendment
1	ALL	4
2	ALL	4
3	ALL	4
4	ALL	4
5	ALL	4
6	ALL	4
7	ALL	4
8	ALL	4
9	ALL	4
10	ALL	4
11	ALL	4

Record of Manual Revisions

AMENDMENT No.	DATE	DATE INSERTED	PAGES
V2.0	11/4/14	11/4/14	various
V3.0	16/5/14	16/5/14	ALL
V4.0	4/9/14	4/9/14	ALL

FOREWORD

This Pilot's Operating Handbook contains the airworthiness limitations and essential operating data for this aircraft.

Special operations requiring additional limitations and instructions are listed in Section 10 - "SUPPLEMENTS". These supplements and instructions are included in Section 10 of this Handbook and shall be consulted before undertaking such operations.

This Handbook shall be carried in the aircraft on all flights. The pilot in command shall comply with all requirements, procedures and limitations in this handbook with respect to the operation of the aircraft.

Amendments will be approved by the manufacturer and will take the form of replacement pages, identified by the appropriate amendment number at the bottom of each page. It is the owner's responsibility to incorporate in the Handbook all such amendments, and to enter the date of incorporation in the Amendment Record Sheet.

No entries or amendments may be made to this Handbook except in the manner and by persons authorized by the manufacturer.

A copy of the pilot operating handbook and maintenance manual is supplied with each aircraft on delivery. Amendments will be sent if and when required.

Brumby Aircraft Australia

FEEDBACK FORM

This form is for the owner / operator to provide notification to Brumby Aircraft Australia about issues and anomalies that are identified during the operation or maintenance of the aircraft.
Return this form to:
Quality Assurance Manager Brumby Aircraft Australia, 112 Airport Road Cowra Australia 2794 or email to info@brumbyaircraft.com.au attention Quality Assurance Manager

Table 1. Feedback Form

Aircraft Serial No.	
Registration No.	
Date of Maintenance	
Name of authorised maintenance person	
Location of maintenance	
Type of maintenance	
Comments	

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1. INTRODUCTION

1.1 ASTM Standards

This operating Handbook consists of an introductory section and 9 additional numbered sections. It includes material required to be furnished to the pilot by Section 9 of ASTM International Designation F 2245-13b – Standard Specification for Design and Performance of a Light Sport Aircraft. Other standards required for the construction and safety monitoring of aircraft are:

- ASTM F2279-10 - Standard Practice for Quality Assurance in the Manufacture of LSA.
- ASTM F2295-10- Continued Operational Safety Monitoring of Fixed Wing LSA
- ASTM F2483-12 - Standard Practice for Maintenance & Development of Maintenance Manuals
- ASTM F2930-14 - Standard Guide for Compliance with LSA standards
- ASTM F2746-12 - Standard Specification for Pilot's Operating Handbook (POH) for LSA

1.2 Manufacturer and contact information

- **Manufactured by Brumby Aircraft Australia**
- **112 Airport Road Cowra NSW 2794**
- **Phone +61 2 63411635**
- **Email; info@brumbyaircraft.com.au**

1.3 Data Location and Contact Information

- Data location and contact information for the recovery of certification documents should Brumby Aircraft Australia lose the ability to support the make and model will be
- **PG Aviation Pty Ltd**
- **112 Airport Road Cowra NSW 2794**

2. GENERAL INFORMATION

2.1 Summary of Performance

Gross weight -	600 Kg
Top speed S/L -	120 Kts
Cruise speed at 5,000ft	110Kts at 5300rpm
Range –	6 hours plus 1 hour reserve
VX (best angle of climb) –	60 Kts
VY (best rate of climb)	70 Kts
Stall speed, flaps up	44 Kts
Stall speed, 30o flap	39 Kts
Fuel capacity	132litres
Fuel useable –	130 litres
Fuel type –	RON 95 Min (ethanol free)
Max power –	100 hp at 5800 rpm (5 minutes)

The operating procedures presented herein are the result of Brumby Aircraft's knowledge and experience gained in the certification of the aircraft. The Handbook is not intended to be a guide for basic flight instruction or as a training manual. It may be used for operational purposes only if kept in a fully amended state. It contains the information considered necessary to safely operate the aircraft.

The operator must thoroughly familiarise himself with the aircraft and the contents of this Handbook before initial operation. Thereafter the Handbook should be reviewed periodically to enable the operator to maintain the highest level of familiarity with the aircraft, its controls and recommended operating procedures.

6775

2011

Figure 1. Plan view of Brumby 610 Rotax

Overall length 6775
Tail height from ground 2600

Figure 2. Side view of Brumby 610 Rotax

Wing span 8640
Wheel track (outside) 2011

Figure 3. Head on view of Brumby 610 Rotax

2.1 Handbook Explanation

This Handbook, unless subsequently amended, refers to the aircraft as originally delivered from the factory. The basic Pilots Operating Handbook (POH) provides all required details of the standard aircraft and the procedures required to operate in the recreational role. For other role operations, refer to the Supplements in Section 10 to provide details and procedures associated with the fitment of special optional and special purpose equipment that the aircraft may be approved for.

Any amendments to any section of the POH are to have an amendment number and show the date of issue of the amendment. Amendments will be issued by the manufacturer and are to be incorporated as soon as possible after their receipt and details entered in the appropriate amendment record sheet.

2.1.1 Definitions

Definitions used in the POH such as WARNING, CAUTION, NOTE are employed in the following context:

WARNING
Operating procedures, techniques, etc. which if not followed correctly, may result in personal injury or death.

CAUTION
Operating procedures, techniques, etc. which if not strictly observed, may result in damage to the aircraft or to its installed equipment.

NOTE
Operating procedure, techniques etc. which it is considered appropriate to highlight.

2.2 General Description

2.2.1 Aircraft

This Aircraft has been constructed under the Light Sport Aircraft (LSA) category in accordance with ASTM standards. The fuselage is of all metal semi-monocoque construction, with removable composite engine cowlings. The cockpit area is reinforced with a tubular frame. The cockpit is designed to accommodate two persons. Each person has access their own set of flight controls and has access to all engine and system controls. The left hand seat is designated as the command pilot station. A baggage compartment is provided aft of the pilots' seats. Maximum baggage behind the seats on the floor is 20kgs. Only soft and very light weight items should be stored on the upper shelf. The wings are of all metal construction, with aluminium fuel tanks. The ailerons and flaps are also of all metal construction.

2.2.2 Engine

A four cylinder, horizontally opposed, water cooled, normally aspirated Rotax 912 ULS engine is installed with a nominal rating of 100 BHP. The engine drives a three bladed ground adjustable composite propeller.

2.3 Symbols, Abbreviations and Terminology

2.3.1 General Symbols and Abbreviations

AGL	Above Ground Level
AMSL	Above Mean Sea Level
AVGAS	Aviation Gasoline
BHP	Brake Horse Power
CASA	Civil Aviation Safety Authority (Australia)
^{o}C	degrees Celsius
CHT	Cylinder Head Temperature
EMERG	Emergency
ft	Foot
ft/min	Feet per minute
g	Acceleration due to gravity
hPa	Hectopascal(s)
ISA	International Standard Atmosphere
Kg	Kilogram(s)
KIAS	Knots Indicated Airspeed
kPa	Kilopascal(s)
l	Litre(s)
m	Metre(s)
MAC	Mean Aerodynamic Chord
max	Maximum
MCP	Maximum Continuous Power
mm	Millimetre(s)
min	Minimum
nm	Nautical mile(s)
PAX	Passenger
POH	Pilot's Operating Handbook
psi	Pounds per Square Inch
RPM	Revolutions per Minute
T/O	Take-off
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

2.3.2 General Airspeed Terminology and Symbols

CAS *Calibrated Airspeed*: the indicated speed of an aircraft corrected for position and instrument error. CAS is equal to true airspeed in a standard atmosphere at sea level.

KCAS CAS expressed in knots.

IAS *Indicated Airspeed*: the speed of the aircraft as shown on the airspeed indicator. IAS values shown in the POH assume zero instrument error.

KIAS IAS expressed in knots.

TAS *True airspeed*: The airspeed of the aircraft relative to the undisturbed air through which it passes.

V_{TOSS} *Take-off Safety Speed*: The airspeed chosen to ensure that adequate control will exist under all conditions, including turbulence and sudden and complete engine failure, during the climb after take-off. It is the speed to be achieved by 50 ft. After lift off the aircraft should not be allowed to climb away until VTOSS is attained.

V_A *Max Manoeuvring Design Speed*: The maximum speed at which application of full available aerodynamic control will not damage or overstress the aircraft.

V_{FE} *Maximum Flap Extension Speed*: The highest speed permissible with wing flaps in a prescribed extended condition.

V_{NE} *Never Exceed Speed*: The limiting airspeed that may not be exceeded at any time.

V_S *Stalling Speed*: <u>or</u> minimum steady flight speed at which the aircraft is controllable.

V_{S0} *Stalling Speed*: <u>or</u> minimum steady flight speed at which the aircraft is controllable in the landing configuration.

V_X *Best Angle of Climb Speed*: The airspeed which delivers the greatest gain in altitude in the shortest possible horizontal distance.

V_Y *Best Rate of Climb Speed*: The airspeed that delivers the greatest gain in altitude in the shortest possible time.

$V_{APP} = V_{REF}$ *Approach Speed*: The airspeed chosen to ensure that adequate control will exist under all conditions, including turbulence, to carry out a normal flare and touchdown. It is the speed required at 50 ft.

Vo *Operating Manoeuvre Speed.* **An airspeed such that at airspeeds slower than Vo the aircraft will stall before the structure is subjected to its limiting aerodynamic load**

2.3.3 Meteorological Terminology

ISA International Standard Atmosphere in which:
The air is a perfect dry gas
The temperature at sea level is 15^{0}C
The pressure at sea level is 1013 hPa (29.92 inches Hg)
The temperature gradient from sea level is 1.98^{0}C/1000 feet

OAT *Outside Air Temperature:* The outside free air static temperature.

Pressure Altitude: The altitude read on the altimeter when the barometric sub-scale has been set to 1013 hPa.

2.3.4 Aircraft Performance Terminology

Climb Gradient: The ratio of change in height during a climb, to the horizontal distance travelled.

Demonstrated Crosswind Component: The crosswind component during take-off and landing for which adequate control of the aircraft was demonstrated during manufacturer's flight tests.

2.3.5 Weight and Balance Terminology

Reference Datum: An imaginary vertical plane from which all horizontal distances are measured for balance purposes.

Station: A location along the aircraft fuselage usually given in terms of distance from the reference datum.

Arm: The horizontal distance from the reference datum to the centre of gravity (CG) of an item.

Moment: The product of the weight of an item multiplied by its arm.

Centre of Gravity (CG): The point at which the aircraft would balance if suspended. The distance from the CG to the reference datum can be found by dividing the total moment by the total weight of the aircraft.

CG Arm: The arm obtained by adding the aircraft's individual moments by the sum of the total weight.

CG Limits: The extreme CG locations within which the aircraft must be operated at a given weight.
Useable Fuel: Fuel available that may be used in flight.

Unusable Fuel: Fuel that cannot be used to maintain engine operation.

Empty Weight: Weight of the aircraft with unusable fuel and undrainable oil.

Basic Empty Weight: Usually defined as empty weight plus full oil.

Useful Load: Difference between take-off weight and basic empty weight.

Maximum Take-off Weight (MTOW): Maximum weight approved for take-off.

3 Limitations

3.1 General

This section of the POH presents the various operating limitations, instrument markings, colour coding and basic placards necessary for safe operation of the aircraft, its engine and systems. For specific operations covered by a supplement in Section 9 of this POH, limitations applicable will be found in the relevant supplement.

The maximum service ceiling for the Brumby 610 R is 12,500 AMSL.

The load factor limits are 4G positive and 2.0G negative.

3.2 Airspeed Limitations (V Speeds)

SPEED	KIAS	REMARKS
Max Design Manoeuvring Speed (V_A)	90	Do not make full or abrupt control movements above this speed
Max Flap Extend Speed (V_{FE})	80	Do not exceed this speed with any flap extended
Never Exceed Speed (V_{NE})	140	Do not exceed this speed in any operation
Max Structural Cruise Speed (V_{NO})	100	Do not exceed this speed except in smooth air and then with caution

3.3 Airspeed Indicator Speed Range Markings

MARKING	KIAS	SIGNIFICANCE
White Arc	39 80	Flap operating range. Lower limit is max weight stalling speed in landing configuration Vso Upper limit is V_{FE}
Green Arc	44 100	Normal operating range. Lower limit is max weight stalling speed with flaps up. Vs Upper limit is V_{NO}
Yellow Arc	100 140	Operations must only be conducted with caution in smooth air
Red Line	140	Maximum speed for all operations (V_{NE})

Stall Speeds At Maximum Take Off Weight

Stall Type MTOW	KIAS	Significance
Vso	39	Stall speed MTOW full flaps
Vs	44	Stall speed MTOW zero flaps

Flap Extended Speed Range

Flap Extended	KIAS	Significance
Vso	39	Minimum flight speed flap extended
Vfe	80	Maximum flight speed flap extended

Operating Manoeuvre Speed

The Maximum Operating Manoeuvre Speed (Vo) is an airspeed such that at airspeeds slower than Vo the aircraft will stall before the structure is subjected to its limiting aerodynamic load. The table below shows Vo at maximum and minimum weights as well as a practical weight approximating a pilot and 20 litres of fuel.
Vso at particular weights

Weight Kgs	KIAS	Significance
600	88	Max weight, aircraft fully loaded
470	79	Practical weight,Pilot + 20 litres of fuel
370	70	Minimum weight, basic empty aircraft

3.4 Engine Limitations

3.4.1 Engine limitations

Engine manufacturer: Rotax Aircraft Engines. Refer to Rotax Operators Manual.
For Rotax Engine Type 912 Series

Performance Performance data relate to ISA conditions without Governor, external generator etc.

Take-off performance	73.5 kw @ 5800 rpm (max 5 min)
Max. Continuous performance	69 kw @ 5500 rpm

Engine Power Output

Take-off power	5800 rpm (max. 5 min)
Max. continuous power	5500 rpm
Max continuous torque	5000 rpm
Min Idle power	Min. 1400 rpm

Acceleration limit of engine operation at zero gravity and in negative "g" condition

Max.	5 seconds at max. -0.5 g

Oil Pressure

Max.	7 bar (102 psi)
NOTE	for a short period admissible at cold start
Min.	0.8 bar (12 psi) (below 3500 rpm)

Normal	2.0 to 5.0 bar (29-73 psi) (above 3500 rpm)

Oil Temperature

Max.	130 ° (266 °F)
Min.	50 ° (120 ° F)
Normal operating temperature	Approx. 90 to 110° C (190-230 ° F)

EGT

Max.	880 °C (1616°F)
Normal	800 850°C (1472°F)

CHT

Min.	50°C (122 °F)
Max.	135°C (275°F)

3.4.1 Fuel grade

Premium (RON 95 Min) Unleaded (Ethanol free). If Unleaded fuel is not available then AVGAS 100LL can be used.

NOTE For fuel tank capacities refer to para. 2.10 "Fuel Limitations"

3.4.2 Engine coolant

The engine coolant is 50/50 mixed glycol and water and engine is filled to radiator cap on top of engine when cold. The operating level is indicated by max/min marks on the overflow bottle fitted to the firewall. Max. coolant temperature is 120°C (248°F)

NOTE Refer to Rotax Operators Manual for Type 912 SeriesLubricating oil

1. *Specification* – AeroShell Oil Sport Plus 4 Aviation Oil 10W.40
2. *Capacity* - Max: 3 litres
   Min safe: 2.51 litres

3.4.3 Propeller

Number of blades: 3
Type: Composite, Ground Adjustable
Manufacturer: Whirlwind
Designation: 3 Blade

3.5 Engine Instrument Markings

INSTRUMENT	Green Arc Normal Operating	Yellow Arc Precautionary Range	Red Line
Tachometer (RPM)	1400-5500	5500-5800	5800
Oil Pressure	2-5 bar 29-73 psi	0.8 - 2 bar 12-29psi 5-7 bar.73-102psi	0 - 0.8 bar 0-12psi 7 bar 102psi
Oil Temperature (°C)	90 - 110	50-90° 110-130°	130
CHT (°C)	75-110	50-75° 110-135°	135

MAXIMUM EGT (^{0}C)			880^o

3.6 Weight and Centre of Gravity Limits

3.6.1 Weight Limits

Maximum Take-off Weight: 600 kg
Maximum Landing Weight: 600 kg

3.6.2 Centre of Gravity Limits

Datum:	Wing leading edge
Forward Limit 16% MAC:	208 mm aft of the datum up to 520 kg
Forward Limit 16% MAC	208 mm aft of the datum at 600 kg
Aft Limit 28% MAC:	365 mm aft of the datum up to 600 kg

3.7 Manoeuvre Limits

All aerobatic manoeuvres including spins are prohibited.

3.8 Limits to the Kinds of Operations

The aircraft is approved for private operations, flying training operations and glider towing operations. The aircraft is approved for Day VFR operations. It is also approved for Night VFR operations when fitted out in accordance with NVFR requirements. If Night VFR approved this must be stated in Section 10.

3.9 Placards

The following placards are required and are to be located as follows:

Interior

- LSA Warning placard – instrument panel
- Switch and circuit breaker ID – instrument panel
- Open / Close /– adjacent to door handles
- Fuel on/off – cockpit – fuel valves located above each door
- Trim – nose up / down – adjacent to trim wheel
- Maximum luggage weight 20 kg – aft of pilot attached to parcel tray. As described in Section 6 Weight and Balance but in any case should not exceed 20Kg.
- MTOW 600Kgs – cockpit instrument panel
- Aircraft registration – cockpit instrument panel

Exterior

- Door open closed adjacent to door handles
- Earth on exhaust – earth to exhaust by attaching the earth clamp to the lip of the exhaust pipe.
- Minimum fuel octane 95 RON (ethanol free) or 100LL adjacent to filler cap
- Capacity 65 litres on each wing adjacent to the filler cap.
- Fuel Vent – port and starboard wing tips
- Fuel Drain – lower left firewall, under port & starboard wings
- Oil – (10W/40 Aeroshell Oilsport Plus 4) outside cowl inspection cover

- Water – Outside cowl inspection cover

3.10 3.13 Fuel Limitations

Two wing tanks: 65 litres each
Total fuel: 130 litres usable
Un-useable fuel: 2 litres
Fuel Type: Premium (RON 95 Min) Unleaded (Ethanol free). If Unleaded fuel is not available then AVGAS 100LL can be used. Refer to Rotax 912 Engine Operating handbook for more information.

3.11 Range

Assuming the following:

- 20 litres / hour consumption
- Cruise speed at 4,000ft - xxxKts at 5000rpm (75% power setting)
- 130 litres
- Total 6 hours and 30 minutes endurance
- Subtract 45 minutes fixed reserve fuel leaves 5 hrs and 45 mins (i.e. 5.75 hrs)
- In still air in ISA @xxx knots for 5.45 hrs= xxx nm (xxxx km)

Caution:
Range and endurance vary with power settings and weather conditions.

3.12 Cross Wind Limits

Maximum cross wind component 12 knots

4. Emergency Procedures

4.1 General Information

This section of the POH describes the procedures to be adopted in the event of an emergency or abnormal situation occurring in the Brumby aircraft. The procedures are arranged in the sequence considered to be the most desirable in the majority of cases. Steps should be performed in the order listed unless good reasons for deviations exist.

It should be remembered however, that not all conceivable eventualities can be foreseen by the manufacturer. Particular circumstances such as multiple or unanticipated emergencies, adverse weather etc. may require modification to these procedures. A thorough knowledge of the aircraft and it's systems is essential to analyse the situation correctly and determine the best course of action in any particular circumstance.

Emergency procedures should be practiced at regular intervals and be checked by a qualified flying instructor bi-annually to retain minimum required piloting skills.

The following basic rules apply to all aircraft emergencies:

1. Maintain aircraft control.
2. Analyse the situation and take appropriate action.
3. Land as soon as practical.

4.2 Airspeeds for Emergency Operations

4.2.1Engine Failure After Takeoff

Best Glide Speed	65 KIAS
Wing Flaps 10 deg	60 KIAS

4.2.2Maximum Operating Manoeuvring Speed Vo

600 Kg	88 KIAS
470 Kg	79 KIAS
372 Kg	70 KIAS

4.2.3Maximum Design Manoeuvre Speed V_A

VA	90 KIAS

4.2.4Precautionary Landing with Engine Power

Min Speed with flaps	60 KIAS

4.2.5Precautionary Landing without Engine Power

Min Speed	65 KIAS

4.3 Emergency Procedures Checklist

4.3.1Engine Failures

4.3.1.1 ENGINE FAILURE DURING TAKE-OFF RUN

1. Throttle ....IDLE
2. Brakes…………………………..........APPLY
3. Fuel………………………… ....OFF
4. Ignition………………………. ....OFF
5. Master switch…………………..……OFF

4.3.1.2 ENGINE FAILURE IMMEDIATELY AFTER TAKE-OFF

1. Airspeed………………………. ....65 KIAS
2. Fuel……………………………...........OFF
3. Ignition………………………. ....OFF
4. Flaps………………………….. ....FULL RECOMMENDED
5. Master switch…………………..……OFF
6. Brakes………………………….. ....AS REQUIRED

4.3.1.3 ENGINE FAILURE DURING FLIGHT

1. Throttle ....CLOSE
2. Fuel ....CHANGE FUEL TANKS
3. Carburettor ....HEAT ON
4. Magnetos ....CHECK

Notes:

(a) If engine does not restart, commence forced landing procedure.

(b) If clear symptoms of a mechanical failure exist, or if engine has seized due to loss of oil pressure, do not attempt restart

4.3.2 Forced Landings

Emergency Landing Without Engine Power

- Reduce speed to 65 knots, flaps up, converting excess speed to height or maintaining altitude whilst turning.
- Establish best glide attitude and speed (65 knots), trim and hold.
- Select suitable field and plan landing pattern.
- Radio alert, transmit MAYDAY and activate ELT. (Give location and intention and squawk 7700)
- Attempt to resolve emergency with trouble shooting checklist if time allows.
- Brief passengers for landing (check seatbelts and to unlatch door and remind them of egress route.)

  Note. Both cabin doors are equipped with gas struts and should open automatically when unlatched. Delay opening until just prior to touchdown, this will reduce cabin buffet and wind noise.
- Touchdown and stop as quickly and safely as possible.
- Exit aircraft when fully stopped.

4.3.3 Precautionary Landings with engine power

- Once a suitable landing site has been selected, carry out a closer inspection by flying overhead at right angles to the chosen landing site to determine if a left or right hand circuit is the best option. Also confirm the wind assessment through judging the drift of your aircraft.
- Confirm approaches are clear and identify any features such as trees or power lines that may be a risk in the event a go around is necessary.
- Make a distress radio call, transmit MAYDAY and activate ELT if required.
- Brief the passenger for the landing (brace position and unlock the door or remind them of emergency egress routes)
- **Note.** Both cabin doors are equipped with gas struts and should open automatically when unlatched. Delay opening until just prior to touchdown, this will reduce cabin buffet and wind noise.
- Carry out a safety check before landing, and

- Carry out a short field landing (55-60 Kts approach) and brake as necessary after landing.

4.3.4 Inadvertent icing encounter (airframe icing)

- Should airframe icing be experienced, turn back or immediately descend clear of the icing level to allow the warmer temperature to dislodge any ice build-up.
- Descent should occur in a cautious manner as icing can affect lift and CofG performance.
- Do not engage the Auto Pilot or if the Auto Pilot is engaged, disengage the Auto Pilot
- Watch for signs of induction or Carburettor Icing and apply CARB HEAT if necessary
- Failure to act quickly may result in an unrecoverable icing encounter
- If the icing persists plan a landing at the nearest airport. If the ice build up intensifies or starts building up rapidly select a suitable off airport landing site.
- Be prepared for significantly higher power requirements, higher approach speeds and higher stall speeds and a longer landing roll. Gently pitch and yaw the aircraft periodically to keep ice bridging on the controls to a minimum.
- Approach at a higher than normal speed (70 to 80 KIAS) depending on the amount of ice accumulated.
- Perform the landing in a level attitude.
- Go rounds should be avoided whenever possible because of the likelihood of severely reduce climbing performance.

4.3.5 Fires

4.3.5.1 During Start on Ground

1. Throttle………………………….. ....CLOSED
2. Ignition………………………….. ....OFF
3. Fuel ....OFF
4. Master switch……………………. ......OFF
5. Aircraft………………………….. ....ABANDON
6. ....Extinguish fire using best available means

4.3.5.2 Engine Fire in flight or on take off

1. Throttle………………………….. ....CLOSED
2. Ignition………………………….. ....OFF
3. Fuel……………………………. ....OFF
4. Master switch…………………. ....OFF
5. Airspeed………………………. ....INCREASE UP TO VNE *(to try to blow fire out)*
6. Forced Landing………………… ....EXECUTE As soon as practical

4.3.5.3 Electrical fire in flight

1. Master switch…………………….. .....OFF

If fire goes out

2. Land……………………………… AS SOON AS PRACTICAL

If fire does not go out

3. Smoke………………………….. ....EVACUATE if required
4. Precautionary Landing……………. EXECUTE IMMEDIATELY

4.3.5.4 Smoke/Fume Evacuation

1. Power……………………………….........REDUCE
2. Airspeed………………………….. ....65 KIAS
3. Power……………………………….........ADJUST to maintain safe flight

4.3.6 Landing with a Flat Main Tyre

1. Approach……………………. ....NORMAL
2. Wing flaps…………………….................FULL DOWN
3. Touchdown…………………... ....GOOD TYRE FIRST

Note: Hold aircraft off flat tyre as long as possible with aileron and rudder control.

4.4 Amplified Emergency Procedures

This section is provided to supply the pilot with additional information concerning emergency procedures in general, and an elaboration of the EMERGENCY PROCEDURES CHECKLISTS.

4.4.1 Engine Failures

If the engine failure occurs during the take-off run, the most important action is to stop on the remaining runway. The extra items in the checklist will provide additional safety after the failure.
If the engine fails shortly after take-off the initial response must be prompt lowering of the nose to maintain safe airspeed. In most cases, the landing should be executed straight ahead with only small changes in direction to avoid obstacles. The checklist procedures assume adequate time exists to secure fuel and ignition prior to touchdown.
After an engine failure in flight, the glide speed of 65 KIAS should be established as quickly as possible. When gliding towards a suitable landing area, an effort should be made to identify the cause of the failure and, if time permits, an engine restart should be attempted. If the engine cannot be restarted a forced landing must be executed. As outlined in Emergency Landing Without Engine Power in Section 3.2.2 Forced Landings

4.4.2 Forced Landings

If all attempts to restart the engine fail and a forced landing is imminent, a suitable landing should be established and the EMERGENCY LANDING WITHOUT ENGINE POWER procedure (3.2.2 Forced Landings) should be completed if at all possible.

4.4.3 Ditching

The Brumby has not been flight tested by carrying out an actual water ditching; therefore the recommended procedure is based entirely on the best judgment of the manufacturer.

If available, life jackets should be donned **but not inflated** until after evacuating the aircraft. Inflating lifejackets prematurely increases the risk of damage to them when exiting the aircraft and their bulkiness adds to the difficulty in evacuation.

Plan the approach into wind if winds are high and seas are heavy. With heavy swells and light winds, land parallel to the swell. If possible maintain a constant rate of descent of 300 ft/min almost until touchdown, but reducing speed to the minimum possible immediately prior to touchdown. Evacuate the aircraft as soon as possible before the aircraft hull sinks.

4.4.4 Fires

Although engine fires are extremely rare in flight, the checklist procedure should be followed if one is encountered. Completion of the Engine Fire in Flight procedure, execute a forced landing. Do not restart the engine after an engine fire. The initial indication of an electrical fire is usually the smell of burning insulation. Turning off the master switch should result in the elimination of the cause of the fire.

4.4.5 Rough Engine Operation / Loss of Power

4.4.5.1 IGNITION SYSTEM MALFUNCTION - A sudden engine roughness or misfiring is usually evidence of ignition problems. Switching each system OFF in turn should identify which system is malfunctioning. Select a different power setting to determine if continued operation with both systems ON is practical. If not, switch the offending system OFF and proceed to the nearest practical airfield to have the problem rectified.

4.4.5.2 LOSS OF OIL PRESSURE OR LOW OIL PRESSURE - If low oil pressure is accompanied by normal oil temperature, there is the possibility that the oil pressure gauge or the relief valve is malfunctioning. However, a landing at the closest practical airfield is advisable so that the source of the trouble can be investigated. If total loss of oil pressure is accompanied by a rise in oil temperature, an engine failure is imminent. Reduce engine power immediately and select a suitable forced landing area. Use only the minimum power required to reach the touchdown point.

4.4.5.3 HIGH OIL PRESSURE - If high oil pressure is indicated proceed at cruise power settings, fly to the nearest airport and investigate the cause. A possible cause is a faulty oil pressure sender unit.

4.4.5.4 CARBURETTOR ICING - Slight engine roughness and/or reducing power available are symptoms of carburettor icing. Icing is most likely to occur at low power settings, but can happen at any time if temperature and relative humidity are conducive. At the first sign of carburettor icing apply FULL CARB HEAT. This should clear the icing and the engine should return to normal operation. If carburettor icing is detected before take-off, apply CARB HEAT until engine operation is normal and then select CARB HEAT OFF to ensure full power is available for take-off. After take-off CARB HEAT may be selected ON again if icing conditions are likely. CARB HEAT should be selected ON for descent and landing. Use of CARB HEAT will result in a slight reduction in power available, and a slight increase in fuel consumption, but will not harm the engine.

4.5 Electrical System Malfunctions

The electrical system in this aircraft is very simple. Apart from the occurrence of an electrical fire, which may be dealt with by turning off the MASTER switch (see 3.2.3 and 3.3.4 above), the only other likely problem is insufficient charge rate or generator failure.

4.5.1 Overvoltage

If an overvoltage situation occurs the circuit breaker will disconnect the generator from the electrical system and a landing should be made as soon as possible to investigate the cause.

4.5.2 Undervoltage and Alternator Failure

If the voltmeter indicates less than 12 volts, there is insufficient alternator output to charge the battery, or alternator might have failed. Provided the eventual total loss of electrical services will not affect the safety of flight and, no other symptoms exist, the flight may continue. It is preferable to turn OFF the MASTER switch so that the battery is not flattened unnecessarily, but if limited electrical services are required, the MASTER switch may be left ON.

NOTE - it is not possible to hand start the Rotax engine. Once the engine is operating battery failure will not affect the engine operation. Ignition is supplied by the internal magnetos.

4.6 Loss of Primary Instruments

Maintain current power and attitude settings.
Check circuit breakers to see if the Master, Instrument or Avionics circuit breaker has popped. If so reset.
If resetting the circuit breaker or the circuit breakers are all ok then proceed to closest airport and land using visual navigation.

4.6.1 Loss of flight controls

- Attempt control of aircraft using co-pilot controls.
- Maintain pitch control using elevator trim.
- Maintain lateral control using rudder.

4.6.2 Fuel System Malfunctions

The fuel system has been designed to be as simple to operate as possible. Fuel tank selection will normally be dictated by lateral balance considerations. The selection of the tank not in use should be considered if feed appears restricted or contamination of the tank in use is suspected.

In the event that the fuel filter becomes blocked or restricted, usually as a consequence of contaminated fuel, this may cause the operate incorrectly particularly at high power. This in turn may result in leaning of the mixture, and subsequent increase in CHT, and in extreme cases starve the engine of sufficient fuel to maintain the selected power setting.
ACTION Reduce power and/or speed, as sufficient fuel flow may be available to operate the engine at reduced power settings, and monitor engine instruments to ensure correct operating parameters. Select the other tank and see if this rectifies the situation. Irrespective of the outcome of changing tanks, it would be imprudent to continue beyond the first suitable landing area.

4.6.3 Spins

Intentional spins are prohibited in this aircraft. Should an inadvertent spin occur, the following recovery procedure should be used:

1. Throttle to idle
2. Place ailerons in a neutral position
3. Apply **<u>and hold</u>** full rudder opposite to the direction of rotation
4. Move the elevator control forward far enough to break stall
5. Hold these control positions until rotation stops

4. As rotation stops, neutralise rudder and ailerons, retract flaps if deployed and maintain wings level

5. Make a smooth recovery from the resulting dive avoid over speeding the aircraft.

WARNING

If flaps are extended, do not retract them until rotation ceases as this may delay or prevent recovery.

5 Normal Procedures

5.1 General

Section 4 of this handbook describes the procedures to be adopted for normal operations of the Brumby aircraft. The procedures are arranged in the sequence considered to be the most desirable and therefore should be performed in the order listed unless good reasons for deviation exist.

5.2 Speeds for Normal Operation

Unless otherwise noted, the following speeds are based on a maximum weight of 600 kg and may be used for any lesser weight.

V_{TOSS} (Take-off Safety Speed @ 50 ft)		60 KIAS
Normal climb out		70 KIAS
V_X (best angle of climb)		60 KIAS
V_Y (best rate of climb)		70 KIAS
Stall Speeds		42 KIAS flaps up / 39 Flaps at 30^o
V_{APP} (approach speed @ 50 ft)		60 KIAS
Baulked landing		60 KIAS
Max recommended in turbulence	Va	90 KIAS
Max demonstrated crosswind velocity		12 knots

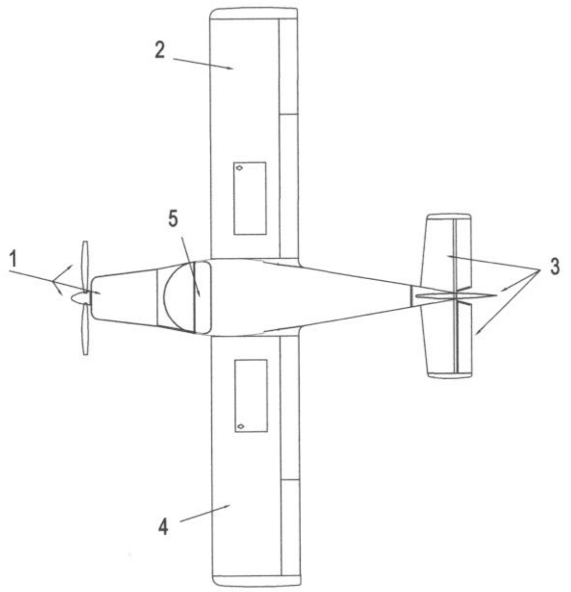
5.3 Normal Procedures Checklists

This section provides procedures and amplified instructions for normal operations using standard equipment. Normal procedures using optional equipment can be found in the operating manuals that are supplied with that optional equipment.

5.3.1 Preflight

Before flight a careful visual inspection should be carried out to ensure that the aircraft and its systems are serviceable. The aircraft should be parked in a normal ground attitude to make sure that fuel drain valves allow for the accurate sampling of the fuel tanks and Gascolator. In cold weather even small accumulations of frost, ice or snow should be removed from the wing, tail and control surfaces. Also make sure that the control surfaces do not contain any internal accumulations of ice or debris. Figure 4 below is to be used in conjunction with the preflight inspection checklist:

Figure 4 – Preflight checklist points



1. Engine / Propeller / Nose
2. Right Wing
3. Empennage
4. Left Wing
5. Cockpit

1. Initial Cockpit Check

Control Locks Removed	**CHECK**
Magnetos to off position	**CHECK**
Master Switch to off position	**CHECK**
Keys removed from ignition	**CHECK**
Wing Flaps	**AS REQUIRED**

Engine/Propeller/Nose

Engine air inlets/outlets	CHECK FOR OBSTRUCTIONS
Exhaust	CONDITION/SECURITY/OBSTRUCTION
Nose undercarriage	CONDITION/SECURITY
Tyre	CONDITION/INFLATION
Propeller	CONDITION/SECURITY
Cowling	CONDITION/SECURITY
Coolant	LEVEL
Oil	CHECK QUANTITY –

NOTE: Check the oil and if it is between the Min and Max marks it is ok. If it is not more than 1cm below the min mark, start the engine and check the oil pressure. Stop the engine and check the oil level. If it has risen to lie between the Min and Max mark the oil level is ok. If it is still below the Min mark add oil. Ideally the oil level should be half way between the Min and Max mark. The difference between the Min and Max mark is 450 ml. Avoid oil levels exceeding the Max mark.

FUEL DRAIN – NOTE: THE FUEL DRAIN FOR THE AIRCRAFT SYSTEM IS THE GASCOLATOR MOUNTED ON THE FIREWALL. THIS FILTER SHOULD BE SAMPLED BEFORE EACH FLIGHT TO

ENSURE THERE IS NO WATER OR CONTAMINATES IN THE SYSTEM. Drains are also under each wing

2. Right Wing

Undercarriage	CONDITION/SECURITY
Brakes	CONDITION
Tyre	CONDITION/INFLATION
Fuel tank vent	ENSURE IT IS NOT BLOCKED.
Fuel contents	NOTED
Fuel cap	SECURE
Wing leading edge	CONDITION
Wing tip	CONDITION
Aileron and flap	CONDITION/HINGES

3. Empennage

Aft fuselage	CONDITION
Tail plane	CONDITION
Elevators	CONDITION/SECURITY
Trim tab	CONDITION/SECURITY
Rudder	CONDITION/SECURITY

4. Left Wing

Flap and aileron	CONDITION/HINGES
Wing tip	CONDITION
Leading edge	CONDITION
Pitot and static sources	CONDITION/CLEAR
Fuel tank vent	ENSURE IT IS NOT BLOCKED
Fuel contents	VISUAL INSPECTION
Fuel cap	SECURE
Fuel tank sump drain	DRAIN (until clear)
Undercarriage	CONDITION/SECURITY
Brakes	CONDITION
Tyre	CONDITION/INFLATION

5.Final Cockpit Check

Ignition switches	OFF
Master switch	ON
Fuel contents	CHECK
Voltage	CHECK 12 volts
Harnesses and seats	CONDITION
Door/latches	CLEAN/CONDITION
Cockpit area	CONDITION
Loose objects/baggage	SECURE
Flaps Fully Retracted	CHECK
Master switch	OFF

Pilots Operating Handbook	**AVAILABLE/CONDITION**
Other Optional Equipment Handbooks	**AVAILABLE/CONDITION**

5.3.2 Before starting Engine

Preflight inspection	COMPLETE
Passenger briefing	COMPLETE
Harnesses	ADJUST/SECURE
Circuit Breakers	CHECK IN
Avionics/Electrical Equipment	OFF
Brakes	ON/PARK
Fuel selector	FULLEST TANK

5.3.3 Starting Engine

Avionics Master Switch	OFF
Master switch	ON
Voltage	CHECK >12
Ignition switches	ON

Cold engine

Throttle	CLOSED
Choke	APPLY

Hot engine

Throttle	¼" OPEN
Choke	OFF

Start Engine

Check Prop is clear	**CLEAR PROP**
Starter	ENGAGE
Throttle	IDLE @ 1400 RPM for 10 secs
Avionics Master Switch	ON
Throttle	AFTER 10 SECS IDLE AT 2100RPM
Choke (if used)	OFF
Oil pressure	CHECK AFTER 10 SECONDS
Voltage	13+
Avionics	ON

5.3.4 Ground Check and Run-up

Brake	ON
Warm up	2000 – 2500 RPM
Oil temperature and pressure	WITHIN LIMITS
Idle check	1400 – 1500 RPM
Throttle	3500 RPM
Ignition systems check	WITHIN LIMITS - Max drop (300RPM)
CARB HEAT check	SMALL RPM DROP OBSERVED

Throttle	1400 RPM THEN TO 2100 RPM

5.3.5 Pre Take-off actions

Trim	SET (for take-off)
Frictions	ADJUST THROTTLE
Flaps	SET – TAKE-OFF
Fuel	ON/QUANTITY
Ignition switches	BOTH ON
Instruments	SET and CHECK
Switches	SELECTED as required
Nav Light (if installed)	ON/AS REQUIRED
Strobe Light (if installed)	ON/AS REQUIRED
Transponder (if installed)	ON/AS REQUIRED
Controls	FULL/FREE/CORRECT SENSE
Cabin Doors	SECURE
Harnesses	SECURE

5.3.5.1Taxiing

When taxiing, the combination of differential braking and steerable nosewheel provide excellent ground manoeuvring in tight spaces as well as control during normal taxiing. Excess speed and "riding a brake" should be avoided since this can cause brake heating, brake fade, or loss of braking effectiveness resulting in loss of control or stopping ability. It is important that taxi speed be held to that of a brisk walk and all flight controls be utilized up to their maximum deflection (refer to Figure 4-2, Taxiing Diagram) to aid in maintaining directional control. This is particularly important in windy conditions.

CAUTION

- Due to lower weights and slower stall speeds than larger airplanes, proper taxi techniques should be used in windy conditions.
- Exercise caution when taxiing in wind above 20 knots

NOTE

Flaps should be retracted when turning away from the tailwind condition and the BEFORE TAKEOFF Checklist should be used to insure flaps are properly reset before takeoff.

Taxiing over loose gravel should be done at the lowest engine RPM possible to avoid abrasion and stone damage to the propeller tips.

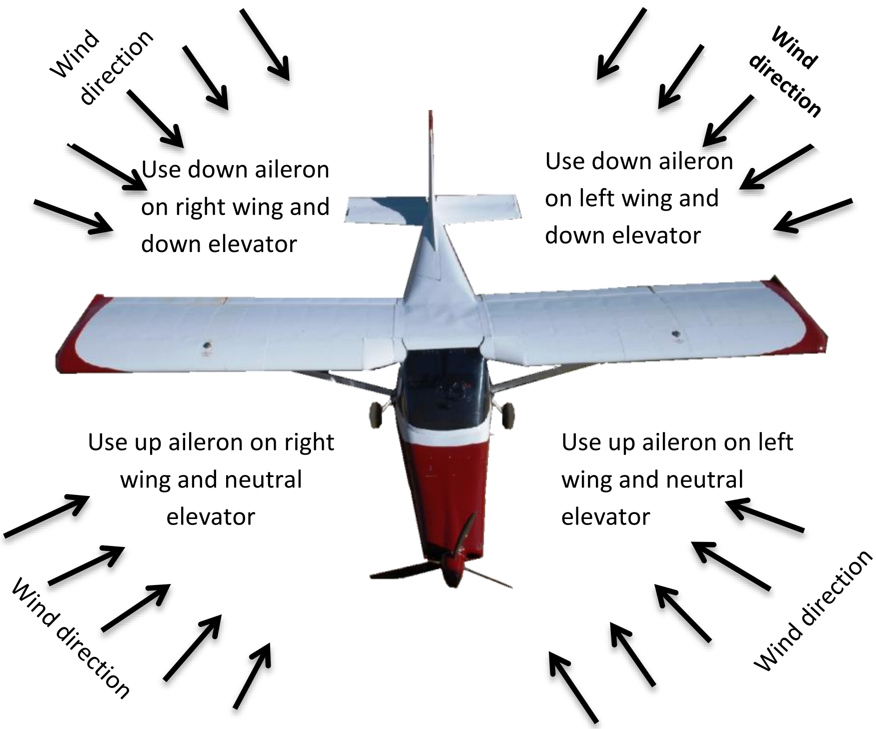


Figure 5. Taxiing in Wind

5.3.6 Normal Take-off

Throttle	FULL
Elevator	NEUTRAL
Directional control	RUDDER as required
Rotate	50 KIAS
VTOSS	60 KIAS
Initial climb speed	70 KIAS

5.3.7 Climb

Throttle	FULL
Airspeed Vy	70 KIAS
Temperatures and pressures	MONITOR

NOTE

Recommended climb speed will enhance engine cooling.

For max performance climb

Best Angle Of Climb Speed Vx	60 KIAS
Best Rate OF Climb Speed Vy	70 KIAS.

5.3.8 Cruise

Cruise power	AS REQUIRED
RPM	AS PER ROTAX TABLE BELOW

Max Continuous	5500 RPM
94%	5300
75%	5000
65%	4800
55%	4300

5.3.9 Descent

Power	REDUCE (as required)
CARB HEAT	ON (if appropriate)

5.3.10 Before Landing (Downwind Leg of Circuit)

Brakes	OFF
Fuel	SELECT FULLEST TANK
Cabin Doors	SECURE
Harnesses	SECURE

5.3.11Approach & Normal Landing

Airspeed	60 KIAS on final
Flaps	AS REQUIRED (normally full)
Directional control	RUDDER
Braking	AS REQUIRED

5.3.12 Baulked Landing

Throttle	FULL
Airspeed	ESTABLISH CLIMB AT 60KIAS
Flaps	UP WHEN CLEAR OF OBSTACLES
Airspeed	ACCELERATE TO 70 KIAS

5.3.13 After Landing/Securing

Flaps	UP
Brakes	ON/AS REQUIRED
Avionics	OFF
Throttle	CLOSE
Ignition switches	BOTH OFF
Master switch	OFF

5.4 Amplified Procedures

This section is provided to supply the pilot with additional information concerning normal procedures in general. Elaboration of the procedures specified in the NORMAL PROCEDURES CHECKLISTS, as well as the inclusion of some more generalised procedures that can be better covered by a general descriptive procedure rather than a formal checklist, are included in this section. This will give the pilot a more complete understanding of these procedures.

5.4.1 Pre-flight Inspection

The Pre-flight inspection as covered by the PREFLIGHT INSPECTION CHECKLIST is recommended prior to the first flight of the day. Inspection procedures for subsequent flights can be abbreviated provided essential items such as fuel and oil quantities, security of fuel and oil filler caps are satisfactory. After each fuelling fuel samples must be taken from all drain points.

NOTE: THE FUEL DRAIN FOR THE AIRCRAFT SYSTEM IS THE FILTER MOUNTED ON THE FIREWALL. THIS FILTER SHOULD BE SAMPLED BEFORE EACH FLIGHT TO ENSURE THERE IS NO WATER OR CONTAMINATES IN THE SYSTEM. Drains are also under each wing

5.4.2 Starting Engine

Due to the geared propeller drive, it is not recommended to start the engine by hand swinging, and the engine will not start if the battery state is low.

Starting a cold engine will require use of the choke. Once the engine is running, the throttle can be advanced and the choke selected OFF. If the engine is hot, choke is not required, and a small amount of throttle may be applied to assist the start.

After start, oil pressure should rise almost immediately. If no pressure is evident within 30 seconds of start, shut down and have the problem investigated.

5.4.3 Taxiing

The rudder pedal circuit is connected to the steerable nose-wheel. Differential braking can be used to tighten turns, but most steering requirements can be achieved with rudder application alone.

Taxiing over loose gravel and stones should be done at the lowest power possible to minimise propeller damage.

5.4.4 Before Take-off

WARM UP

Most of the warm up will have occurred during taxiing. The engine is warm enough for full power when the cylinder head and oil temperatures are indication above the minimum graduations, and the throttle can be opened without the engine faltering.

IGNITION CHECK
Ignition system check should be performed at 3500 RPM as follows:
Select LEFT ignition OFF and observe RPM drop. Select LEFT ignition on until engine regains speed and then RIGHT ignition OFF and observe RPM drop. Drop in RPM should not exceed 300 RPM, and the difference between the systems should not exceed 115 RPM. Return both ignition switches to ON after completing this check.

CARB HEAT CHECK
When the engine has warmed, and at 3500 RPM, apply CARB HEAT. There should be a slight RPM drop (usually less than 50) and no evidence of rough running. Return CARB HEAT knob to OFF.
RPM increase indicates ice presence and ice melting.

5.4.5 Take-off

Full throttle application over loose gravel is especially harmful to the propeller and should be avoided. When take-offs are made from gravel surfaces, the throttle should be advanced slowly and a rolling start take-off technique used to minimise propeller damage. It is important to check full throttle engine performance early in the take-off run. Any sign of rough engine operation, or less than expected RPM, is good cause to abort the take-off.

Normal take-offs are made with zero^0 flap selected.

5.4.6 Short Field Take Off

- Breaks held on
- Wing Flaps 10 degrees
- Carb Heat Off
- Apply Full Throttle
- Release Breaks
- Elevator control to slightly tail low
- Maintain directional control using differential breaking until rudder authority is established
- Lift off at 55 KIAS and maintain until obstacles are cleared

5.4.7 Wet/Soft Field Take Off

The same as a normal take off but at 55 to 60 KIAS off lift off should be achieved as soon as practicable and then allow the aircraft to fly parallel to the ground at about 3 feet above the ground until normal climb speed is reached. When taking off on a wet short field the same procedures as a normal short field take off should be used except lift off should occur as soon as practicable and then allow the aircraft to fly parallel to the ground at about 3 feet above the ground until 55 KIAS is achieved and maintained until obstacles are cleared.

5.4.8 Climb and Cruise

Normal climbs are made with full throttle and at 70 KIAS.

En-route climbs are made with full throttle and at 80 KIAS. This provides better engine cooling and improved view ahead with very little loss of climb performance.

Cruise power settings and speed are at the pilot's discretion, provided that limitations, particularly RPM limitations, are observed. In turbulent conditions speed should be reduced to below V_A of 90 KIAS.

5.4.9 Stalls

In any attitude or under any loading condition the stall is preceded by a slight airframe buffet. All controls are effective up to and throughout the stall and recovery. Stall recovery is carried out by lowering the nose and correcting any wing drop with rudder.

5.4.10 Approach and Landing

Landings are normally conducted with full flap. The landing is conventional for a nose-wheel configured aeroplane.
Landings can be made with power on or power off. Surface winds and air turbulence are usually the primary factor in determining the most appropriate approach speeds
Landing*:* select an appropriate descent speed generally 70 to 75 KIAS (base and final), flaps to full, 60 KIAS approach speed on late final. Shut throttle and apply brakes at touchdown as required

5.4.11 Cross Wind Landing

When landing in a strong cross wind use a wing low, crab, or a combination method of drift correction and preferably land on the main wheels first. Flap retraction just after landing will assist in maintaining lateral and directional control, particularly in gusting conditions. The pilot may elect to approach and land without flap as the slightly higher speeds will ease drift control problems.

5.4.12 Baulked Landing

Throttle Control to full power
Carb Heat off
Climb Speed 55 KIAS until clear of obstacles
Increase Climb Speed to 65 KIAS after obstacles are cleared
When established in climb at 65 KIAS slowly retract flaps whilst maintain climb
Establish normal climb

After reaching a safe airspeed, and when clear of obstacles, retract the flaps to the full up position and establish a normal climb.

5.4.13 Short Field Landing

For a short field landing in smooth air conditions -

- Flaps fully down, power set to maintain 55 KIAS
- After Obstacles are cleared and as approaching the landing field, gradually and smoothly reduce power, lowering the nose to maintain 55 KIAS
- Prior to touch down, round out to ensure the main wheels touch the ground before the nosewheel
- Carefully lower the nosewheel and apply breaking as required
- Maintain directional control with differential braking assisted by rudder authority.

5.4.14 Wet/Soft Field Landings.

The same procedure as a short field landing with the added caution that muddy, slippery or soft ground should be avoided at touch down and throughout the landing roll. Also braking should be used cautiously to avoid losing control of the aircraft through slipping, skidding, sliding or ground looping or in the case of sand letting the tyres dig in through undue heavy breaking.

6 Performance

6.1 General

The performance data on the following pages is presented so that you may know what to expect from the aircraft under various conditions, and also to facilitate flight planning with reasonable accuracy. The data has been computed from actual flight tests with the aircraft and engine in good condition and using average piloting techniques.

6.2 Take-off Distance

The take-off distance is based on measurements made at MTOW (600 Kg) from rest to a height of 50 ft with the engine operating at full power. The technique used in establishing take-off distance is such that the aircraft is held on or close to the ground until VTOSS (60 KIAS) is approached, and the climb away then commenced so that VTOSS is achieved by 50 ft.

Take-off distance under ISA sea level conditions is 420m, consisting of 120m ground roll and 300m to achieve 50 ft.

Each 10^{o}C rise in temperature above ISA conditions, or 1000 ft increase in pressure altitude above sea level, increases take-off distance by approximately 40 m.

CAUTION

The above distance assumes a strip with a firm level surface.

Note: Soft ground an up slope, tail winds and unusually long and/or wet grass will each increase take-off distance.

6.2 1 Take off total Distance Over a Fixed Height Obstacle (15m/50')

Using normal take off procedures the total distance required to clear an obstacle of 15m or 50 feet is 420 m. This consists of a take-off roll of 120 m and a climb distance to the obstacle of 300m. These figures are for a flat runway with a hard surface in still air at Standard ISA Day conditions.

6.3 Rate of Climb

Rate of climb at V_Y (70 KIAS) and full power in ISA sea level conditions is 710 feet per minute (fpm). This performance is applicable to a MTOW of 600 kg, and will be conservative for all lesser weights at the same atmospheric conditions.
Each 10°C rise in temperature above ISA conditions will reduce rate of climb by approximately 60 fpm.
Each 1000 ft increase in pressure altitude above sea level will reduce rate of climb by approximately 90 fpm.

6.4 Cruise

The following data is applicable to a MTOW of 600 kg, and will be conservative for all lesser weights.

RPM	Fuel flow (L/hr)
5000 (75%)	18.5
5500 (max continuous)	25

6.5 Service Ceiling

The maximum service ceiling for the Brumby 610 R is 12,500 AMSL

6.6 Landing Distance

The total landing distance depends on approach speed winds and runaway condition. For a normal landing on a hard runway in zero wind conditions at a touchdown speed of 60 KIAS a landing roll of 180 to 200 m is normal.

6.6.1Landing Total Distance Over a Fixed Height Object (15m/50')

In normal landing configuration in zero wind conditions from and altitude of 15 m / 50 feet in ISA sea level conditions a landing distance of at least 400m to touch can be expected. After touchdown a ground roll of at least 180m can also be expected.

6.7 Airspeed Calibration

CONDITION: Power as required for level flight or maximum RPM as appropriate

KIAS	40	50	60	70	80	90	100	110	120	130	140
KCAS	42	53	60	68	78	88	96	108	118	125	135

6.8 Stall Speeds

CONDITION: Power idle, CG forward limit, MTOW (600 Kg)

NOTES:

1. KIAS values are approximate and based on level flight airspeed calibration data
2. Stalling speed will reduce as weight is reduced and CG is moved aft.

Flaps	KIAS
UP	44
30^0	39

7. Weight & Balance and Equipment List

7.1 Introduction

This section describes the procedure for establishing the basic weight and moment for the aircraft. A list of all equipment available from the manufacturer is included in the equipment list. Each item of equipment fitted to the aircraft when originally delivered from the factory is included in the equipment list. These items are all included in the Basic Empty Weight of the aircraft as delivered. Any subsequent changes to the equipment fit must be recorded and the Empty Basic Weight and moment data amended. It is the responsibility of the pilot to ensure the aircraft is correctly loaded.

NOTE – The procedures for determining the weight and balance details can be found in FAA Publication AC 43-13-2B

7.2 Aircraft Weight and Balance Calculation

Brumby 610 Weight and Balance, Centre of Gravity (CofG) Example Calculation

Example Only. Do not use for operational purposes. For operational purposes use the Weight and Balance Table and CofG Envelope Chart on page 44 of this manual.

Maximium Take off Weight	Wt=	600	Kg
Empty Weight	We=	373	Kg
Max Payload	Wu=	227	Kg
Max aft CofG @ 600Kg	D600aft=	243	Kgmm/1000
Max fwd CofG @ 600Kg	D600fwd	129	Kgmm/1000

Aircraft Mean Aerodynamic Chord (MAC) = 1306mm

Max Aft CofG limit 28% MAC = 366 mm

Max Fwd CofG limit 16% Mac = 206 mm

Figure 6. EXAMPLE WEIGHT AND BALANCE CALCULATIONS

	Weight Kg	Arm mm	Moment Kg mm	Momen /1000
Empty Weight	372.00	178.52	66411	66
Pilot	80.00	720.00	57600	57
Passenger	80.00	720.00	57600	58
Baggage	10.00	1280.00	12800	6
Zero Fuel Weight	**542.00**	**358.69**	194411	**192**
Fuel	58.00	240.00	13920	15
Take Off Weight	**600.00**	**347.22**	208331	**207**

% Cof G	26.59

Figure 6. Example Weight and Balance Calculations
Three checks of this table can be employed to ensure the Take Off Weight and Zero Fuel Weight of the Aircraft in the example above lays within the permissible CofG envelope.

Example Check 1. Arm Limits
The Take Off Weight Arm of **347.22** mm lies between the Max Forward and Aft CofG limits i.e. **206mm<347.22<366**. Similarly the Zero Fuel Weight Arm of **358.69** mm lies between the Max Forward and Aft CofG limits i.e. 206<**358.69**<366. The CofG of the aircraft will be within the acceptable limits throughout the full fuel burn

Max Fwd CofG Arm	Max Take off Weight Arm	Max Aft CofG Arm	Yes/No
206 is less than	**347.22**	Is less than 366	**Yes**
	Zero Fuel Weight Arm		Yes/No
206 is less than	**358.69**	Is less than 366	**Yes**

Note: If the Yes/No box contains a No then the loading of the aircraft must be reviewed and changed to bring the aircraft back into the range of weight and balance constraints.
In this case both the values lie between the acceptable limits.

Example Check 2 Centre of Gravity Graphical Representation

Example Weight and Balance Calculations

	Weight Kg	Arm mm	Moment Kg mm	Momen /1000
Empty Weight	372.00	178.52	66411	66
Pilot	80.00	720.00	57600	57
Passenger	80.00	720.00	57600	58
Baggage	10.00	1280.00	12800	6
Zero Fuel Weight	**542.00**	**358.69**	194411	192
Fuel	58.00	240.00	13920	15
Take Off Weight	**600.00**	**347.22**	208331	**207**

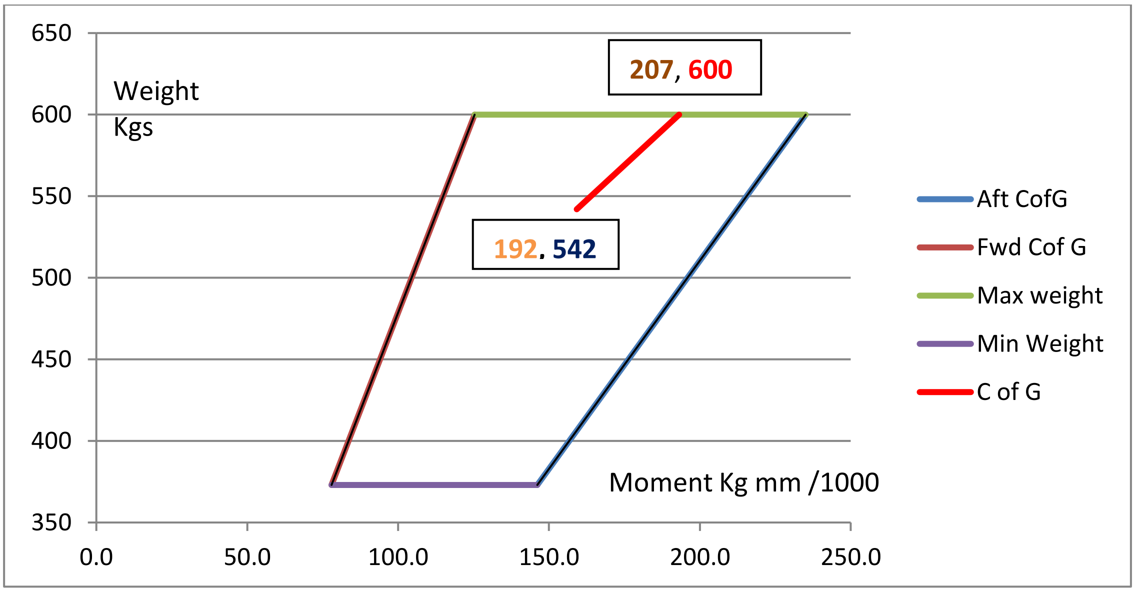
% Cof G	26.59

Fig 6 Example Weight and Balance Calculations

With this method the process involves plotting **Moment/1000** and corresponding **Weight Points** for the Max T/off Weight and Zero Fuel T/off Weight on the graphical drawn envelope supplied for the aircraft.

In this example the Max T/off Weight Moment/1000 (**207**) and Weight Points (**600**) (are taken from the table above and plotted on the graph fig 7 below. Similarly plotted is the Zero Fuel Weight Moment/1000 (**207)** and Weight Point (**542**) Joining the two points i.e. (**207**,**600**) to (**192** **542)** and observing that the line stays within the weight and balance envelop. **Note**: At the maximum weight of 600Kg the line on the graph below should be level and equal to the top line on the graph, but should not exceed it. If the line falls outside the envelope weights must be adjusted to bring it back inside the envelope. This can occur if the baggage weight limit is exceeded even if the all up weight is less than 600Kg. Please pay strict attention to the baggage weight limit.

Figure 7. EXAMPLE WEIGHT AND BALANCE CHART



Brumby 24-8681 Weight and Balance Calculations

Empty Weight	We=	373.00		
Empty Weight Moment	M=	77643.7		
Empty C of G	D=	208.16		
MAC Length (mm)	MAC=	1300.00		
Empty C of G as % MAC	D%=	16.01%		
Maximium Take Off Weight (Kg)	Wt=	600.00	Kg	
Empty Weight	We=	373.00	Kg	
Max Payload	Wu=	227.00	Kg	
Max Aft Cof G @ 600 Kg	D600aft=	390.00	30	%MAC
Max Fwd C of G @ 600 Kg	D600fwd=	208.00	16	%MAC
Max Aft C of G @ 439 Kg	D367aft=	390	30	%MAC
Max Fwd C of G @ 439 Kg	D367fwd=	208.00	16	%MAC

Weight and Balance Calculations

	Weight Kg	Arm mm	Moment Kg mm
Empty Weight	373.00	208.16	77644
Pilot	85.00	720.00	61200
Passenger	75.00	720.00	54000
Baggage	10.00	1280.00	12800
Zero Fuel Weight	543.00	378.72	205644
Fuel	58.60	240.00	14064
Take Off Weight	601.60	365.21	219708

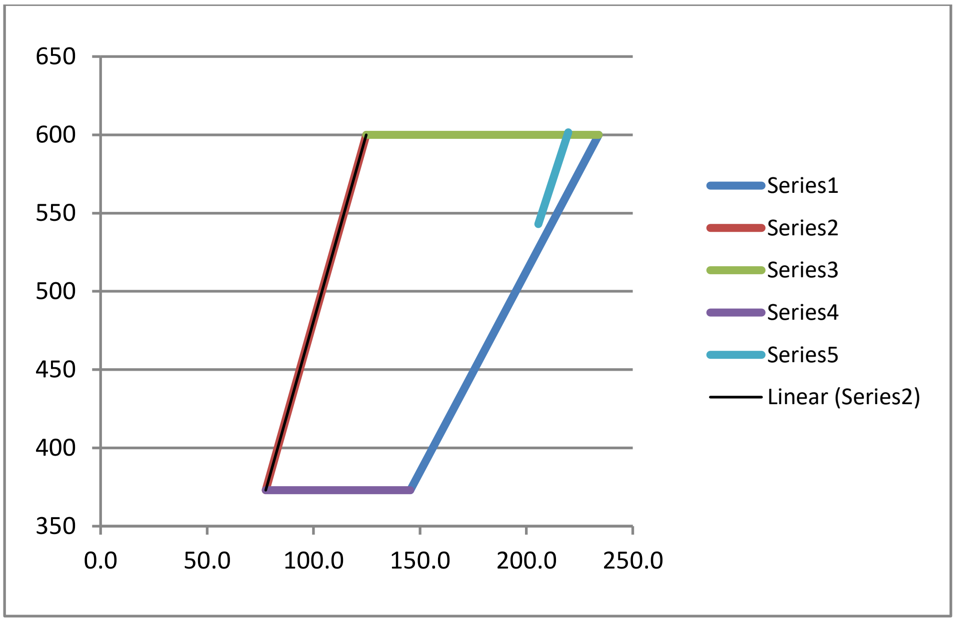
% Cof G	28.09

Check 1 Arm Limits

Max Fwd CofG Arm	Max Take off Weight Arm	Max Aft CofG Arm	Yes/No
206 is less than		Is less than 366	
	Zero Fuel Weight Arm		Yes/No
206 is less than		Is less than 366	

Note: If the Yes/No box contains a No then the loading of the aircraft must be reviewed and changed to bring the aircraft back into the range of weight and balance constraints.

Check 2 Centre of Gravity Graphical Representation -Weight and Balance Chart



Note: If the line falls outside the envelope then the loading of the aircraft must be reviewed and changed to bring the aircraft back inside the weight and balance envelope.

7.3 Equipment List

NOTE: The following list is of equipment supplied with the standard configuration Brumby aircraft. Installation of additional equipment (e.g. Extra GPS) or alternate systems (e.g. EFIS) will change the Basic Empty Weight condition.

Item Description
Engine. Rotax 912 ULS
Propeller. Whirlwind ground adjustable
Main Wheel Assy with Brakes
Main Wheel Tyre. 500x5
Nose Wheel Tyre 500x5
Battery. River
Altimeter. Gauge
Airspeed Indicator Gauge
Trig Transponder Mode S
Airspeed
Altimeter
Rotax tacho
Vertical speed indicator
Icom radio
MGL 8.5" Glass Cockpit Incorporating
Compass
Heading Indicator
Altitude Indicator
Vertical Speed Indicator
Turn Coordinator Ball
Cylinder Head Temperature
Exhaust Gas Temperature
Oil Pressure
Oil Temperature
Voltmeter
Fuel Level Indicator
Hobbs Meter

Figure 8. Equipment List

8. Description of Aircraft Systems

8.1 General

This section provides a brief description of the aircraft and its systems. Greater detail is available in the Brumby Servicing Manual, and the Brumby Parts Catalogue.

8.2 Airframe

The airframe is constructed of welded steel truss. The engine cowlings and some lightly stressed areas are made from fibre glass. The fuselage is based on fabricated truss to which the skin is riveted. The wings are based on forward and rear spars to which pressed ribs are riveted, and covered with aluminium skin.

8.3 Flight Controls

The aircraft's flight controls consist of conventional aileron, rudder and elevator control surfaces. These are manually operated by conventional rod and cable linkages. The control column actuates the ailerons and elevator in the conventional manner while the rudder pedals operate the rudder.
Trailing edge wing flaps are provided. They are actuated by an electric motor controlled by a switch on the centre of the instrument panel. Holding the switch in the DOWN position extends the flaps to the required position. Selecting the switch to the UP position will retract the flaps.
The elevator trim control is located on the centre console, and consists of a bias spring connected to the elevator control. Rotating the control wheel forward causes the nose to pitch down and rotating aft causes the nose to pitch up.

8.4 Instrument Panel

Figure 9. Instrument Panel

8.5 Flight Instruments

The instrument panel consists of a MGL 8.5" glass cockpit which provides the Flight Instruments It provides the following functions. Airspeed, Altimeter, Vertical Airspeed, Heading, Turn and Balance Indicator, Artificial Horizon. In addition two analogue instruments are present, an Altimeter and an Airspeed Indicator.

8.6 Engine

The aircraft is fitted with a horizontally opposed, four cylinder, water cooled, carburetted engine with a dry sump system. The engine is a Rotax 912 ULS rated at 100 BHP at 5800 RPM (Max 5 min duration). Engine ignition is provided by two independent solid state units and two spark plugs per cylinder. Normal operation is conducted with both ignition systems ON. Individual ignition systems are selected by using the individual toggle switches on the instrument panel. The electrically driven starter motor is mounted on the upper rear area of the engine.

A key activated two stage switch, located on the instrument panel, energises the Master Battery Solenoid and the Starter Solenoid. The rotary switch is activated by rotating the key in a clockwise direction. The first position energises the Master Solenoid and the second spring loaded position energises the Starter Solenoid. After the engine has fired and the rotational force on the key is released the spring automatically returns the switch to the master on position.

Engine induction air normally enters through an air filter on an intake manifold at the rear of the engine and then to the dual carburettors. Heated induction air supply or "CARB HEAT"is drawn from a shroud around the exhaust muffler. This air is unfiltered and ducted directly to the plenum chamber and thence to the carburettor. The control for selecting CARB HEAT is on the instrument panel. The mechanism is arranged so that CARB HEAT is either full on or off.

8.7 Propeller

The propeller is a Whirlwind Three Bladed Composite Ground Adjustable composite construction with metal leading edge type designed for fitting to the Rotax 912 Engine. It conforms to the ASTM F2506-13 Standard.

CAUTION

Flight in rain may damage the propeller fibreglass coating and should be avoided where practical.

8.8 Undercarriage and Brake Systems

The aircraft has a single disc, hydraulically actuated brake on each main undercarriage wheel. A brake fluid reservoir is mounted on the forward face of the firewall. Each brake is connected by a hydraulic line to a master cylinder attached to the respective rudder pedal. Each brake is thus independently operated by pushing the top part of the corresponding rudder pedal. The nose undercarriage gear sits on an air over oil oleo strut and has is steerable using rudder pedals. The main undercarriage gear is a steel spring assembly.

8.9 Seats and Restraints

Each seat has fore and aft adjustment to cater for pilots of different dimensions. Three point lap and shoulder restraints are provided for both seats.

8.10 Cabin

Cabin entry is provided through an upwardly and outwardly opening door on each side of the aircraft and has a moving pin latch to lock each door. **Do not open door(s) in normal flight.** See also emergency procedures for ditching.

8.11 Baggage

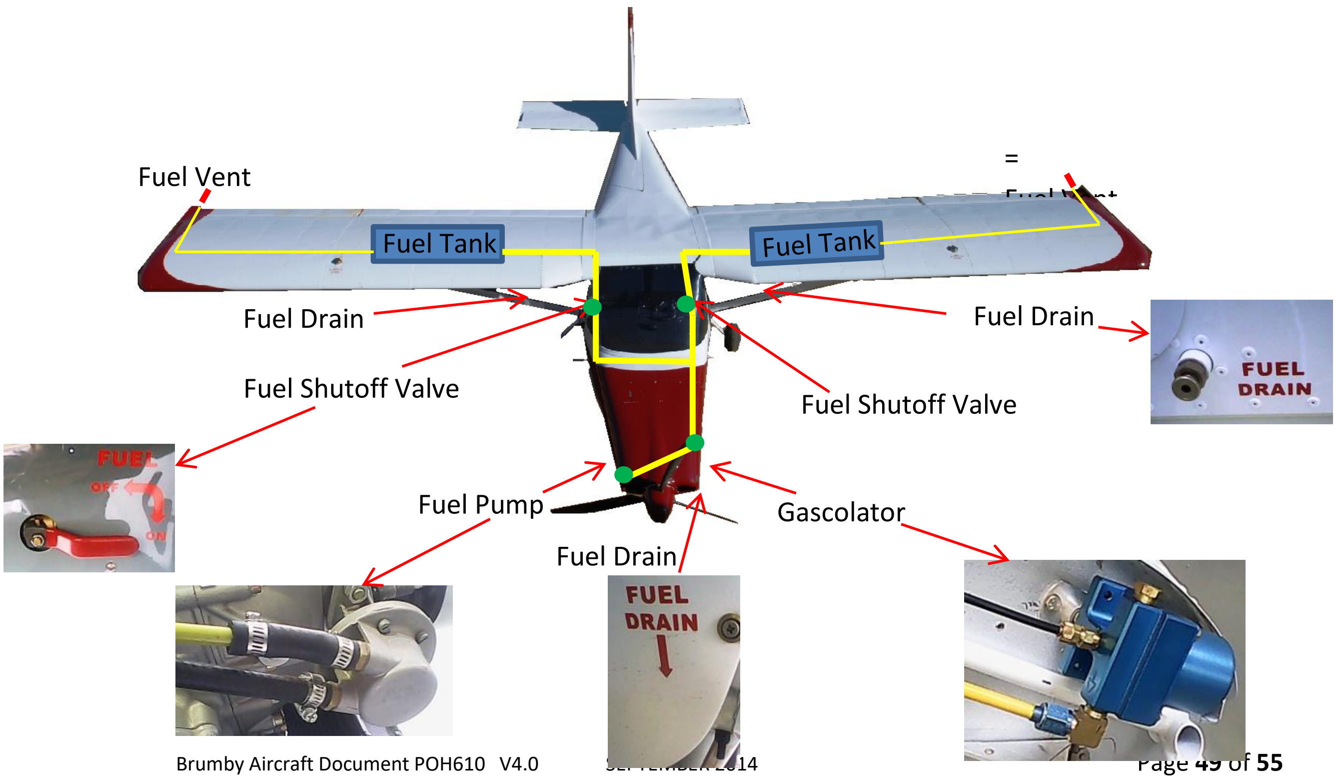
A baggage compartment is provided aft of the pilots’ seats. Maximum baggage behind the seats on the floor is 10kgs. Only soft and very light weight items should be stored on the upper shelf and should be considered as part of the 10 Kg of Baggage weight.

8.12 Fuel System

The fuel system consists of a self-contained fabricated aluminium tank installed between the main spar and rear spar of the wing. A fuel valve is mounted on each side of the cockpit above the door windows. Each tank is provided with a filler cap which is secured by chain on the wing upper surface. Earth tabs are located adjacent to the fuel fill holes. The exhaust pipe is used as the main earthing point. The earth clamp should be attached to the lip of the exhaust pipe protruding from the lower cowl.

The following figure shows the layout of the fuel system components.

Figure 10. Fuel System Diagram



FUEL DRAIN – **NOTE**: the fuel drain for the aircraft system is the Gascolator mounted on the firewall. Access is underneath the left side of the bottom cowl. Drains are also found under each wing for each fuel tank. All three fuel drains should be sampled before each flight to ensure there is no water or contaminates in the system.

8.13 Electrical System

The Brumby has a 12/14 volt electrical system consisting of a 12 volt battery, starter motor, self-regulating generator with a nominal 14 volt output, a master solenoid, a starter solenoid, circuit breakers, and associated wiring. A volt meter is incorporated in the Dynon 180.

The master switch, mounted on the instrument panel, switches both the generator field and battery to the main bus bar simultaneously. The feed from the battery to the bus bar is protected by a 25 amp circuit breaker. The health of the electrical system is monitored by reference to the voltmeter (normal operation is between 12 and 14 volts).

The self-regulating generator is mounted on and driven by the engine and delivers a nominal 14 volts to the aircraft electrical system. An over-volt relay is fitted which will trip the generator off line if the output exceeds approximately 16 volts. This system is designed to protect avionics from damage due to excessive voltage, as well as protecting the battery from over-charge. The over-volt relay can be reset by momentarily turning the master to OFF then ON again. If the relay trips a second time it can be assumed a fault definitely exists. The generator can be taken off line at any time by turning off the master switch. The aircraft's battery is located in the engine compartment.

8.14 Cockpit Ventilation

Ventilation air is provided by two ventilators located on the Perspex side windows of the door frame. The volume of air supply can be regulated by rotating the aperture of the ventilator inlet, and the direction of the airflow by directing the outlet in the desired direction.

8.15 Pitot-static System and Instruments

The pitot-static system supplies ram air pressure to the airspeed indicator and static pressure to the altimeter and airspeed indicator. The system is composed of unheated pitot and static tube mounted on the lower surface of the left wing, and associated plumbing connecting the sources to the respective instruments.

The airspeed indicator is calibrated in knots. Limitations and range markings (in KIAS) are incorporated on the instrument

The altimeter is calibrated in feet and the sub-scale in hectopascals (hPa).

The Pitot and Static tubes should be covered when not in use to avoid blockage by insects.

The fuel vents should be covered to prevent blockage by insects which can lead to the fuel tank being crushed.
NOTE: Static, Pitot and both Fuel vents should be checked daily as outline in the Daily Inspection Checklist.

9. Aircraft Handling, Servicing and Maintenance

9.1 Introduction

This section contains factory recommended procedures for proper ground handling and routine care and servicing of your Brumby aircraft. All inspections and repairs must be conducted in accordance with the regulations pertaining to the national airworthiness authority of the country of registration. I.E. for Australia this is CASA, for NZ it is the CAA and, for the USA it is the FAA.

Regulations usually require that all mandatory and inspection requirements be carried out and certified for only by appropriately trained and licensed personnel, whereas, to the extent limited by regulations, factory recommended preventative maintenance may be carried out by a suitably qualified pilot on an aircraft they own and operate.

9.2 Aircraft Documents

The following documents are supplied with the aircraft when delivered from the factory:

- Pilot's Operating Handbook
- Airframe Log Book
- Engine Log Book
- Brumby Aircraft maintenance manual

The following additional documents are available online;

- Rotax Operator's Manual for 912ULS series engine
- MGL Pilots User Guide

The following additional documents are available from the factory:

- Brumby Parts Catalogue

9.3 Aircraft Inspection and Maintenance

9.3.1 Mandatory Inspection and Maintenance

Although regulations applicable to registration may vary requirements somewhat, the aircraft will normally be required to undergo a mandatory 50 hourly and annual/100 hourly inspection in accordance with approved maintenance schedules. In addition some components, in particular the engine and its accessories, will be subject to complete overhaul based on time in service.

Brumby Aircraft recommends that all mandatory inspection and maintenance requirements for airframes be conducted in accordance with the Brumby Aircraft Maintenance Schedules using the procedures and techniques specified in the Brumby Maintenance Manual. The Rotax

912 ULS engine must be maintained in accordance with the appropriate Rotax manual. Refer to Whirlwind Propeller manual for maintenance of the propeller.
From time to time other mandatory inspections may be required in the light of service experience. In this event airworthiness directives relating to the airframe, engine, propeller or other components/equipment as appropriate will be issued. It is the responsibility of the owner/operator to ensure compliance with all applicable airworthiness directives and, when the inspections are repetitive, to take appropriate action to prevent inadvertent non-compliance.

All maintenance carried out must be correctly recorded and certified in the relevant log books.

9.3.2 Recommended Preventative Maintenance

Depending on applicable regulation, limited maintenance may be carried out by a suitably licensed pilot on an aircraft he owns or operates. Reference should be made to the relevant regulations to determine the specific maintenance operations which are authorised. Although the remainder of this section provides the majority of information that should be required for pilot maintenance, it is recommended that a copy of the Brumby Service Manual be available to ensure proper procedures are followed at all times, and to provide additional details where required.
Where permitted by regulations, Brumby Aircraft recommend the following preventative daily maintenance:

1. Clean windscreen
2. Check flap, aileron, elevator and rudder hinges for stiffness, and lubricate as necessary.
3. Clean mud and debris from the wheel spats and brake assemblies.

9.4 Alterations or Repairs

Alterations and modifications are not permitted without the written permission of the manufacturer. It is essential that the relevant airworthiness authorities are contacted prior to any alterations or modifications to the aircraft to ensure that continued airworthiness of the aircraft is not violated.

Alterations, if approved, and repairs to the aircraft structure shall be carried out in accordance with the Brumby Service Manual or in accordance with the FAA publication AC 43.13-1A&2A or subsequent issues. Assistance and advice can be obtained by contacting the customer service department at Brumby Aircraft Australia.

9.5 Ground Handling

The aircraft is easily manoeuvred by hand on the ground by having one person pulling or pushing on each wing strut.
For manoeuvring in confined spaces, a towing bar should be fitted to the nose wheel using the two holes in the nose wheel tow bar attachment point. A towbar is supplied with each aircraft.

CAUTION

Do not apply any force or weight to the flaps, ailerons, stabiliser, elevator or rudder and wing tips during ground handling. Do not move the elevator by hand using the balance arm. This may cause serious elevator damage as it is connected to the trim bias system.

9.6 Towing Instructions

The aircraft can be towed by the nose wheel tow bar attachment point using the aircraft tow bar supplied.

9.7 Parking and Tying Down

When possible, park the aircraft into the anticipated wind. Lock controls using the locking pin through the control column. When severe weather conditions or high winds are anticipated, the best precaution is to hangar the aircraft. In less severe conditions, or when hangarage is not available proceed as follows:

1. Lock the ailerons and elevator as described above or by using suitable locally manufactured external control surface locks.
2. Chock the wheels.
3. Attach a suitably strong tie down rope to the two mooring lugs under each wing and the lug under the rear fuselage. Leave sufficient slack to avoid rope shrinkage that may occur as wet rope dries out.

9.8 Fluid Servicing

9.8.1 Approved Fuel Grade and Specifications

Fuel System

Filling fuel tanks – Observe all required safety precautions for handling fuel and filling tanks. Ensure the aircraft is bonded to Earth and prior to opening fuel caps, the fuel nozzle earth strap should be attached to the earth point adjacent to each cap. Fuel should be a minimum of 95 RON (ethanol free) or if mogas is unavailable the 100 LL Avgas can be used..

FUEL DRAIN – **NOTE:** The fuel drain for the aircraft system is the filter mounted on the firewall. This filter should be sampled before each flight to ensure there is no water or contaminates in the system. Drains are also under each wing and should also be sampled prior to each flight.

9.8.2 Approved Oil Grades and Specifications

Engine Lubrication System

The engine oil reservoir should be filled to the operating level with lubricating oil specified in Section 2.4.3 (Aeroshell Oil Sport Plus 4 Aviation Oil 10W.40). This may be accomplished by using a suitable funnel inserted in the oil filler tube located on top of the oil reservoir. An access cover in the engine cowl is provided for this purpose.

The engine sump is drained by removing the lower engine cowl and removing the engine oil reservoir drain plug, or using the quick drain valve if fitted. Whilst the drain plug is removed rotate the propeller blade and "gurgle" the engine to purge additions oil from the lines and lower galleries. Ensure that the drain plug is correctly replaced with the washer and lock wired prior to refilling the sump.

The engine coolant is 50/50 mixed glycol and water**.** The engine coolant overflow container should be topped up to ensure that the fluid level is maintained between the maximum and minimum marks. During servicing when the engine is **COLD** the engine coolant reservoir cap can be removed and the level of coolant checked.

CAUTION The coolant in a hot engine is under pressure and removing the reservoir cap can allow hot fluid to erupt causing severe scalding.

9.9 Cleaning and Care

9.9.1 Fuselage

Generally, the painted surfaces can be kept clean and lusterful by washing with waters and a mild soap or a mild automotive detergent. Removal of oil and grease can be done with a cloth and a standard automotive oil and grease removing solvent.

NOTE: Harsh or abrasive soaps or detergents that are corrosive or cause scratches should never be used on the painted aluminium surfaces.

To seal any minor surface chips or scratches the aircraft should be waxed regularly with a good automotive wax in accordance with the manufacturer's instructions. If the aircraft is operated on the coast or in a salt-water environment, it should be washed and waxed more frequently to provide adequate protection. A heavier application of wax on the leading edges of the wings and tail, on the cowl leading surface and the propeller spinner will help reduce the additional abrasion encountered in these areas.

The composite propeller should be cleaned using a mild automotive detergent. Check the surfaces for chips, cracks, missing material, exposed fibres, delamination, bubbled areas or other visually evident damage.

9.9.2 Engine Care

The engine may be cleaned using a suitable solvent in accordance with the instructions in the Rotax Maintenance Manual.

9.10 Wheel Brake System

The brake system utilises two foot operated brake cylinders. The brakes do not require adjustment for pad clearance. If the pads show signs of excessive wear, they should be replaced. The brake cylinders are supplied with fluid from a reservoir in the engine bay. When toping up the reservoir use fluid to specification MIL-H-5606, and ensure no contaminants are allowed to enter the reservoir, particularly when removing and replacing the cap.

9.11 Tyres

The tyres should be carefully checked for correct inflation, cuts and abrasions, wear, slippage and other obvious defects and replaced if necessary. The tyres may be demounted from the wheels by deflating the tubes, then removing the wheel through-bolts, and allowing the wheel halves to be separated.

The recommended tyre inflation pressure is 175 kPa / 20 psi

Caution: deflate tube prior to removing wheel through bolts. Refer to Brumby Aircraft Maintenance Manual

10. Supplements

List of Approved Optional Installed Equipment – NIL

11. References

- Maintenance Manual (Line Maintenance) for Rotax Engine Type 912 Series
- Operators Manual for Rotax Engine Type 912 Series
- Installation Manual for Rotax Engine Type 912 Series
- Whirlwind three blade composite aircraft propeller installation and operation instructions for Rotax engines DOC#: 3B0R5 Installation Instructions rev-a6.doc 6-30-11
- MGL – installation manual