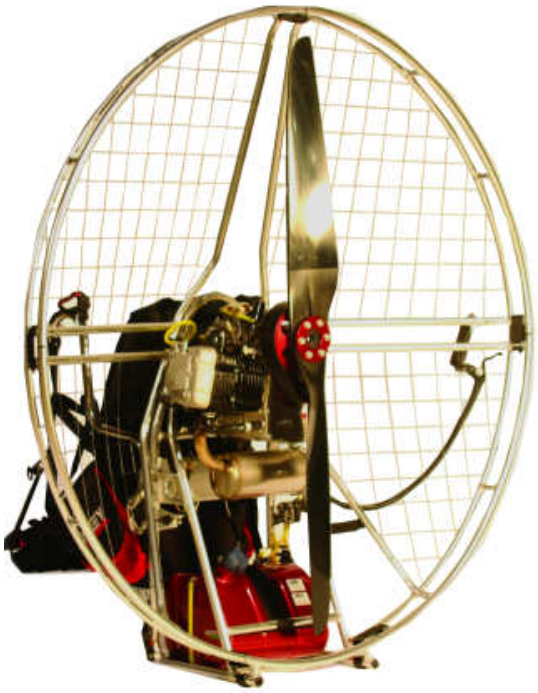
PPG OPERATION
AND
MAINTENANCE MANUAL

BAILEY 4-STROKE



BAILEY AVIATION

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Engine No: ……..

Purchase Date: ……../……./…….

BAILEY 4-STROKE

PPG OPERATION AND MAINTENANCE MANUAL

INDEX

BAILEY AVIATION

INTRODUCTION

Congratulations on the purchase of your Bailey 4Stroke paramotor.

This is the first production 4 stroke paramotor in the world and has already proved to be a great success, winning countless UK and International Paramotor Championships and completing several amazing long distance endurance trips.

The concept of building the 4 stroke started in 2003, when Bailey Aviation began testing small capacity 4 Stroke engines, looking deeply at the fundamental design of the engines assessing their attributes and downfalls. When exhibited early on in its development stage, many fellow paramotor manufacturers were in disbelief that Bailey Aviation had designed such a lightweight, powerful 4 stroke design. This is a testament to the state-of-the-art engine design and exhaustive research and development process, which has lead to the birth of a new generation of paramotor… the Bailey 4Stroke.

The Bailey 4Stroke paramotor is available in either 150 (149cc) or 175 (178cc) versions and with a choice of two different propeller sizes, a 1.10mØ version and a 1.30mØ version. The choice of two engine sizes and two propeller sizes means there is a paramotor suitable for all pilot weights. Your choice of propeller and engine type should be chosen based on your weight and its desired purpose (i.e. Competitions, fun-flying etc). The engine is only available with an electric start system for ease of use and health and safety reasons.

The Bailey 4Stroke has many advantages over its 2 stroke counterparts. The engine is much smoother than a 2 stroke and power delivery is very progressive and linear, providing one of the sweetest engines *ever* designed for paramotoring. The 4Stroke design also returns fuel consumption[1] figures simply not possible with a 2 stroke, with around 4-6 hours range with our 10 litre fuel tank.

Should you have any questions relating to the Bailey 4Stroke engine, please call the Bailey Aviation sales line on 01763 246660 or e-mail us at sales@baileyaviation.com.

We trust you will have many pleasurable hours of flight with your Bailey 4Stroke and hope that you find the rest of the operator's manual both informative and easy to understand.

Bailey Aviation… The Ultimate High….

Notes
[1] Fuel consumption will differ greatly due to many variables, such as pilot weight, propeller size, wing type, altitude, weather conditions, temperature, pilot flying style etc. Only shown as a guide to the potential of the 4 Stroke design.

ENGINE TECHNICAL DESCRIPTION

The Bailey 4Stroke 150/175 is a 4 Stroke, air/oil-cooled, single cylinder, SOHC design available in either 149cc or 178cc displacements with electric start, designed and manufactured in England by Bailey Aviation.

- Billet CNC machined aircraft grade alloy crankcases
- High pressure lubrication system with internal oil pump and stainless steel gauze filter
- Pressure compensating carburettor with automatic choke (electric capsule)
- Dellorto fuel pump
- K&N air filter (cotton gauze mesh)
- Stainless steel exhaust system
- Lightweight anodised alloy Poly-V reduction drive with eccentric adjustment
- High energy CDI ignition system
- 4 Engine mountings, spaced to reduce noise, vibration and harshness
- Permanently engaged starter motor with uni-directional clutch
- Built-in alternator – Output 6A @ 5000RPM

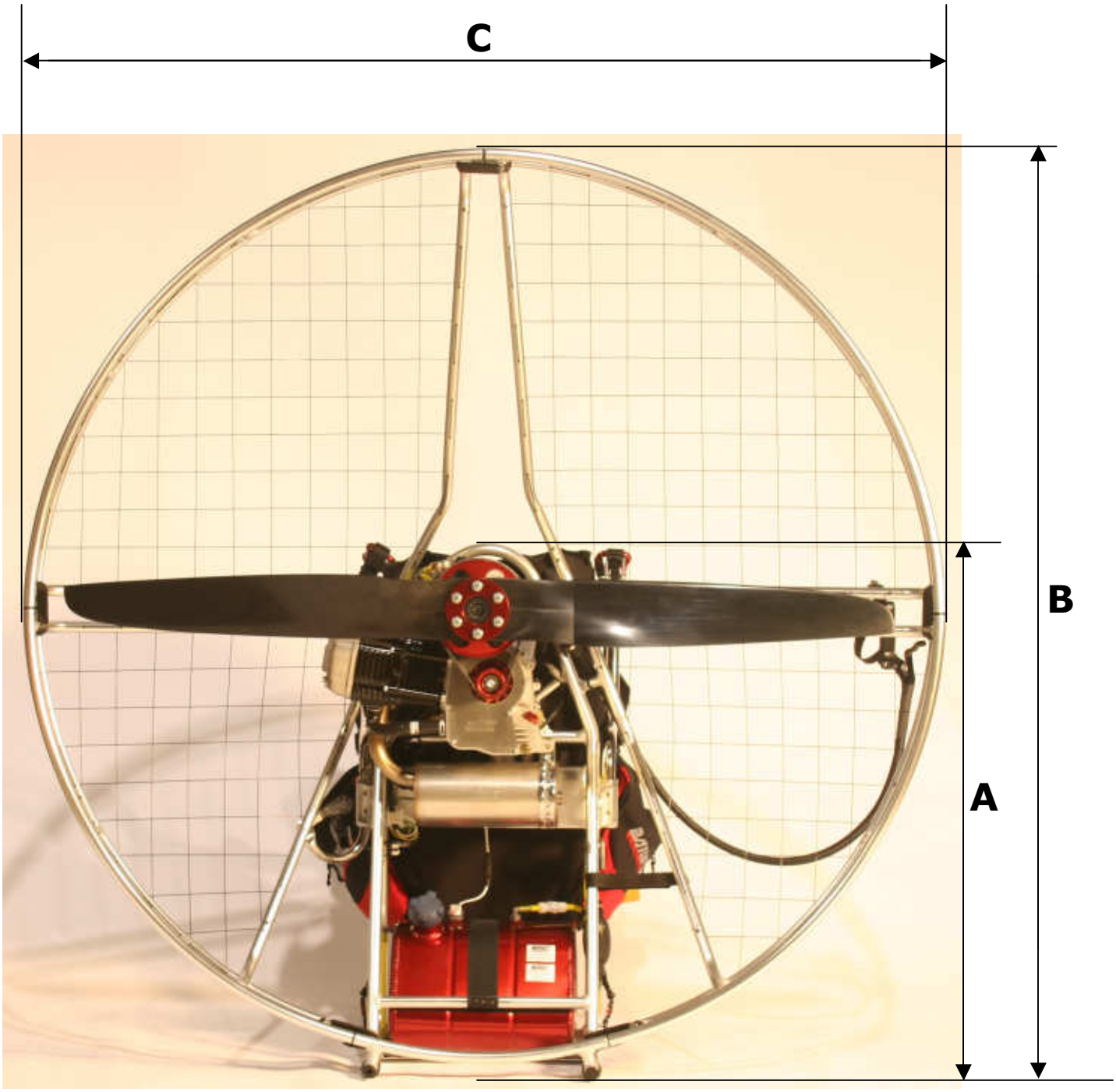
ENGINE TECHNICAL SPECIFICATION

Engine Type	Bailey 4Stroke150	Bailey 4Stroke175
Engine Capacity	149cc	178cc
Valve clearances	In: 0.05mm (0.002in)	In: 0.10mm (0.004in)
	Ex: 0.07mm (0.003in)	Ex: 0.10mm (0.004in)
Power	14.5 BHP at 7700 RPM	18 BHP at 8000 RPM
	(Maximum normal static RPM 7600 ± 100 RPM)	(Maximum normal static RPM 7800 ± 100 RPM)
Spark Plug Type	NGK C7HSA *or* Champion Z10YC	
Spark Plug Gap	0.60mm (0.24in)	
Oil Type	SAE 5W/40 Fully synthetic 4 stroke Motorcycle oil (Castrol R4 or Power 1 Racing 4T recommended)	
Oil Capacity	500cc	
Fuel Type	Leaded or Unleaded minimum 98 Octane or Avgas 100LL	
Choke	Automatic (Electronic capsule)	
Battery	12volt 2.5ah Lead Gel type	
Drive Belt Tension	5-8mm Deflection at mid span point with 10kg force	
Ignition System	Capacitive Discharge Ignition (CDI) Timing Factory Preset.	
Propeller sizes	1.10m or 1.30m diameter available	

ENGINE LIMITATIONS

Engine Type	Bailey 4Stroke150	Bailey 4Stroke175
Max Oil Temperature	130ºC / 266ºF	
Max Cyl. Head Temperature	220ºC / 428ºF	
Max Continuous RPM	7700	8000
Min Oil Quantity	450cc or 10mm below oil filler plug threads	

Paramotor Dimensions

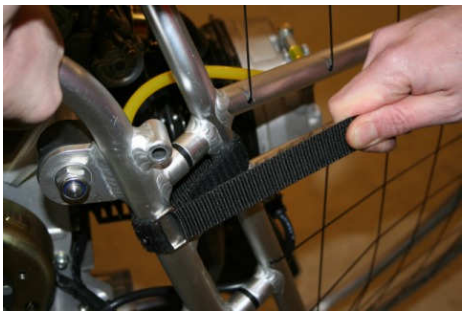


	1.30m prop	1.10m prop
A	840mm	740mm
B	1470mm	1270mm
C	1450mm	1250mm

ASSEMBLY

Cage Sections

The cage is supplied in four quarters and locates on the chassis with integral nylon joiners.
The cage quarters need first to be assembled as left and right hand vertical units. To do this put the single fittings together first, then the doubles ones. Attach the left and right hand sections to the chassis, bottom fittings first, then middle and lastly the top fittings. It is quite normal for there to be tension on the middle fittings to the chassis, intentionally designed so that the cage gives increased rigidity to the cage/chassis assembly.



All 7 Velcro straps need to be as taut as possible (tensioned like you would a guitar string). Failure to tension the Velcro straps sufficiently could result in propeller to cage contact.

There is one extra Velcro strap on the cage, fitted to the throttle side; this is designed to prevent the flexible throttle trunking making contact with the propeller. If you need to use a hand, use the **NON-THROTTLE** hand to get yourself into the seat after take-off.

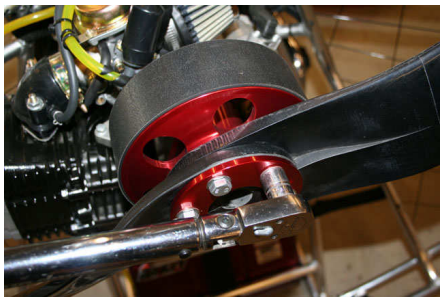
Propeller Assembly

Carefully slide the two halves of the propeller together as shown.
There are two propeller mounting systems, dependant on when the engine was manufactured:-

1) ***Engines produced before February 2008***, the propeller mounts directly onto the reduction pulley, with the six provided washers and M8 bolts, making sure the prop clamp plate goes on the front of the propeller – Tighten bolts to 15lbs/ft (20nm)

2) ***Engines produced after February 2008***, the propeller is sandwiched between two rubber gaskets before mounting to the reduction pulley and the prop clamp plate goes on the front of the propeller. This mounting system has 6 threaded studs protruding from the reduction pulley and uses Nyloc nuts, which must be tightened to 7lbs/ft (10nm)

Propeller halves slide together



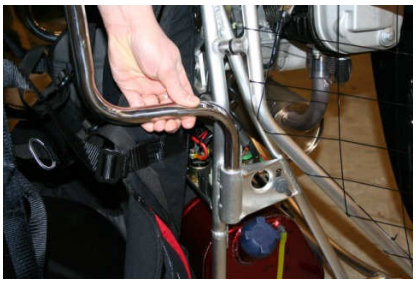
Engines ***before*** February 2008
No rubber gaskets
Secured with 6 x M8 Bolts/washers

Engines ***after*** February 2008
Two rubber gaskets
Secured with 6 x M8 Nuts

ASSEMBLY

Harness

Insert the two stainless steel pins on the top of the harness into the two sockets on the top of the chassis and secure with the two supplied 'R' clips. Next, making sure the harness risers are not twisted, insert the stainless steel hang bars into the sockets on the chassis and secure with the quick release pip pins provided. Lastly fit the lower harness buckles to the quick release fittings located at the front base of the chassis.



Fuel Tank

Ensure the fuel tank is positioned centrally in the chassis. Tighten the Velcro strap while pushing down on the tank to compress the foam pad below, thus ensuring maximum Velcro tension. Connect the dry-break fuel coupling, taking care not to damage the small 'O' ring, the coupling secures into place with a small 'click'.

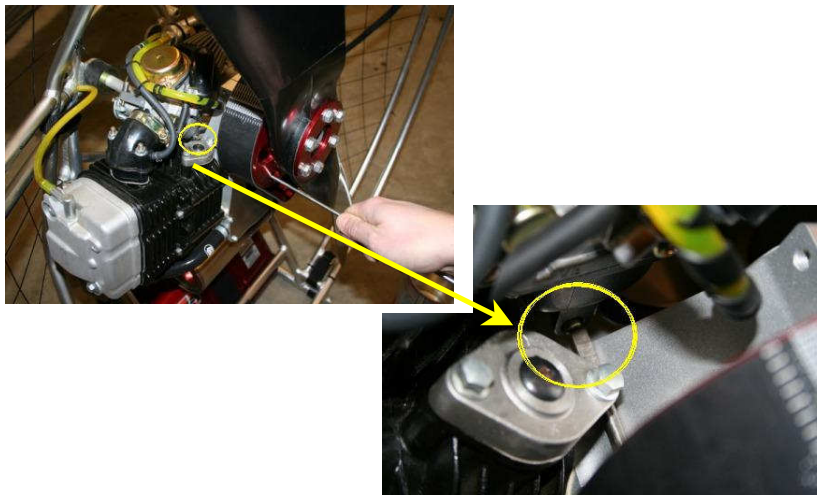
GENERAL OPERATING NOTES

Running-In

During the running-in period (first 5 hours) full power can be used for take-off. Once airborne power should be reduced to a maximum of 75%. Varying the engine RPM during this period is recommended. Running-in on the ground is strongly discouraged.

Transportation

It is good practice to drain the carburettor and disconnect the dry-break fuel coupling after flight; this will prevent fuel tank pressurization (caused by temperature change or agitation), which can force fuel through the carburettor into the engine. Draining the carburettor allows the machine to be laid down flat. The carburettor is drained by loosening the drain screw on the bottom of the float chamber. This is accessed with a long flat screwdriver through one of the holes in the large reduction pulley.

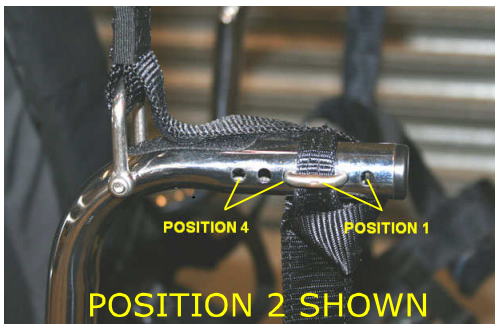


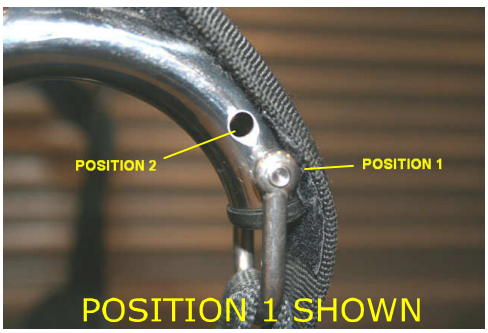
Harness Adjustment

Leg straps – These should be fairly tight, but not excessively so and most importantly both adjusted to the same length.

Thin shoulder straps (these connect to the base of the chassis) – The purpose of these straps is to keep the machine fixed tightly to the pilots back. They should be sufficiently tight so that in the standing position there is no gap between the pilot's shoulders and the machine. Correct adjustment of these straps will make the engine *feel* much lighter than it actually is.

Harness riser position – The hang position can be adjusted to suit different weight pilots, the original type Bailey Aviation hang bars (mid) have two holes, the forward most hole for lighter pilots (up to 90Kg/198lbs) and the rear most hole for heavier pilots (over 90Kg/198lbs)
The latest spec (low) hang bars have four positions of adjustment to not only cater for varying pilot weights, but also allow the pilot to change the thrust line (a very useful feature for competition flying).





Low hang bars – 4 adjustment positions	
Position No	**Weight Range**
1	Up to 70Kg (154lbs)
2	70-85Kg (154-187lbs)
3	85-100Kg (187-220lbs)
4	100+Kg (220+lbs)

Mid hang bars – 2 adjustment positions	
Position No	**Weight Range**
1	up to 90Kg (198lbs)
2	over 90Kg (198lbs)

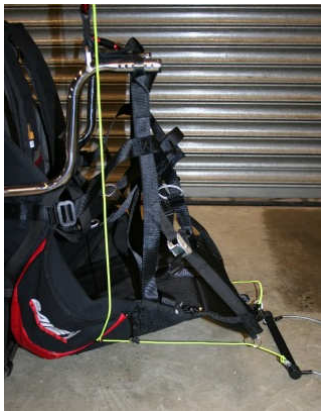
GENERAL OPERATING NOTES

Reserve Parachute Fitment

The Bailey Aviation harness is equipped with reserve attachment points and Velcro tubes for bridle routing. Please contact Bailey Aviation for details on available reserve systems

Speed System Attachment

Development fuelled by competition has resulted in our unique speed bar geometry system allowing full speed bar travel with all the latest Reflex section wings that require greater speed system travel.



Hot Stop

Due to the very short exhaust system, when the engine is stopped, the flywheel effect of the propeller continues to turn the engine for a few revolutions. This draws fuel into the engine and expels it into the hot exhaust causing a distinctive 'pop'. Although this has not shown to cause any damage, allowing the engine to idle for 10 seconds before pressing the kill button will stop this and is recommended.

Re-fuelling

Always use a filter funnel, preferably one capable of separating water. Draining the carburettor periodically is good practice to prevent any water collecting in the float chamber.

Fuel Type

Recommended fuel types are:-
Leaded or Unleaded (Minimum 98 octane)
Avgas 100LL

The use of Avgas 100LL does not make the engine produce more power, but increases the fuel *range* slightly, giving a slight advantage in competition.

The engine is capable of running on lower than 98 octane fuel, but requires modification to the ignition timing (there will be a slight reduction in power). Please contact Bailey Aviation for details.

Landing

If the engine has been stopped prior to landing (recommended) ensure that the master switch is switched to the 'off' position before dismantling the machine.

GENERAL OPERATING NOTES

Disassembly of the cage

First undo the bottom, centre and top straps (leaving the two outer middle straps connected), then starting from the top carefully prise apart the two halves using thumb pressure only (see picture). Try to prevent the two cage parts from springing apart. Next remove the half cage from the chassis (top first, then bottom), undo the Velcro strap holding the two cage quarters together and with great care separate the double joint first, then the single joint.

Care of your machine / Storage

- Do not clean the machine with water; the electrical connections are ***not*** waterproof. Clean with a damp cloth only.
- Never use any cleaning agent whatsoever on any part of the machine.
- If the machine is stored in damp conditions (i.e. garage) wiping over the engine with a cloth soaked in WD40 (or similar) will prevent any external corrosion.
- Do not store the harness in damp conditions it can cause mildew and will make the harness heavier
- Remove any dried mud from the bottom of the chassis / fuel tank area as this can dislodge In-flight and damage the propeller.
- The engine breather is routed through the chassis and vents through the bottom rearmost chassis tube; it is quite normal to see some emulsified oil residue present at the vent point. **Do not under any circumstance block this vent, engine damage will occur.**
- Dried-on insects on the propeller leading edge will considerably reduce its performance. During summer, clean the propeller regularly with a damp cloth.

PRE-FLIGHT CHECKS

Engine Oil Level

With paramotor placed on a flat surface the oil level should be up to the top of the threads of the oil filler plug hole (see picture)

Fuel System
Ensure you have sufficient fuel for the planned flight and if the carburettor was previously drained, make sure it has been re-filled using fuel primer bulb (**CAUTION**: The primer bulb is used **ONLY** to refill the carburettor float chamber when empty, over-priming (i.e. more than 2 or 3 depressions) is likely to flood the engine. Also check that the dry-break fuel coupling is locked and the fuel cap is tight.

Exhaust System
Ensure exhaust system is secure and check securing springs at cylinder head.

Air Filter
Ensure that air filter is in good condition, tightened securely and is not soiled or blocked.

Throttle Assembly
Visually check for full throttle travel on the carburettor and ensure throttle closes fully.

Cage Netting
Visually check nylon netting for damage and tightness.

Cage Straps
Ensure that all seven Velcro Cage straps are in good condition and very tight and that the throttle safety strap is secured.

Propeller
Ensure the master switch is off. Check that propeller is free from cracks and chips. On engines without rubber gaskets (before February 2008) check the six securing bolts are tightened to the specific torque setting (15lbs/ft [20nm]) on engines with rubber gaskets (after February 2008) check the six securing nuts are tightened to the specific torque setting (7lbs/ft [10nm]). Turn propeller by hand in either direction through a full 360º rotation and check for sufficient clearance of all components. Minimum clearance from propeller tip to cage should be 50mm.

Harness
Visually check all harness connections and examine harness for signs of damage/fraying etc.

Hang Bars
Check tightness of all hang bar to harness connections and make sure all four hang bar pip pins are fully inserted through the chassis sockets.

Ground Running
Bailey Aviation recommend that you **DO NOT** 'Ground run' the engine. Experience has proven that the **ONLY** safe place to run a paramotor engine is with it firmly strapped on your back. All pre-flight power checks are best performed whilst wearing the paramotor on your back. This is very much safer and prevents stones or debris being drawn into the propeller

ENGINE STARTING PROCEDURE

General Starting Notes

We recommend you strap the machine on and fasten all buckles on the harness whilst sitting on the floor. Next lift yourself ***and*** the machine from the floor ***without*** leaning excessively forward. Tipping the engine forward for more than a few seconds will cause fuel in the carburettor to enter the engine, in this ***flooded*** state the engine will be impossible to start.

If you believe the engine may be flooded or if the engine has been laid flat in a car (without draining the carburettor), you must first place the machine on a level surface; turn the master switch off, tip the whole machine so that the cylinder head points downwards (see picture) and rotate the propeller slowly by hand through compression 10 times and start following the 'Starting from hot' procedure

	ELECTRIC START
STARTING FROM COLD	1. Turn master switch to 'ON' position 2. Depress red start button for a maximum of 5 seconds *with throttle closed* (Do not operate starter for more than 5 seconds. Likely causes for non-starting are excess fuel in the cylinder [flooding] or lack of fuel).
STARTING WHEN HOT	1. Turn master switch to 'ON' position 2. Open throttle ¼ and depress red start button for a maximum of 5 seconds

After starting – Warm Up

Once the engine is started, increase the RPM slightly above idle for 30 seconds. The Bailey 4Stroke engine has an electric-automatic choke; this means that when cold the choke is always on. After Start-up the choke takes approx. 30 seconds to switch off, thus in hot weather (when the engine doesn't require choke) a slightly un-even idle will be experienced until the choke switches off. After 1 minute the engine is ready for take-off. Avoid prolonged ground running as dust and dirt can damage the propeller and contaminate the air filter.

ENGINE MAINTENANCE SCHEDULE

FREQUENCY	ACTION
Before and after each use	Check Oil Level
	Visually check all oil and fuel connections
	Check exhaust security
	Check that throttle returns to fully closed position and full throttle can be obtained
	Check propeller leading edge for damage
	Check *all* securing nuts/bolt/engine mounts
After Initial 10 hours	Replace engine oil
	Check valve clearances
	Check drive belt tension
Every 15 hours	Replace engine oil
	Inspect all fuel connections
Every 50 hours	Drain carburettor float bowl (small drain screw at base of carburettor)
	Check drive belt tension
	Check valve clearances
Every 100 hours	Check and reset spark plug gap
Every 200 hours	Renew spark plug
	Replace engine mounts
	Replace drive belt
	Remove & wash air filter (with genuine K&N filter cleaner only – **do not oil!**)

'Laying-up' / Storage Instructions (If not using machine for longer than 3 months)

1) Remove battery pack, charge for 1 hour every 6 weeks
2) Loosen drive belt
3) Remove and drain fuel tank
4) Drain carburettor float bowl, with drain screw open, squeeze primer bulb and evacuate all fuel from system and then re-tighten screw
5) Remove spark plug, inject 10cc of oil into cylinder, then re-fit spark plug & turn engine over by hand 10 times
6) Periodically every 2 weeks turn engine over by hand 10 times if possible

Returning the machine to service after 'Laying-up'

1) Drain and renew engine oil
2) Remove spark plug, tip engine cylinder down and turn over by hand 10 times (this will purge the oil from the cylinder out of the exhaust port)
3) Re-fit a new spark plug
4) Re-fuel
5) Re-tension drive belt
6) Re-fit charged battery pack

ENGINE MAINTENANCE PROCEDURES

Oil Change Procedure

Please note that the engine must be up to normal operating temperature before draining oil.

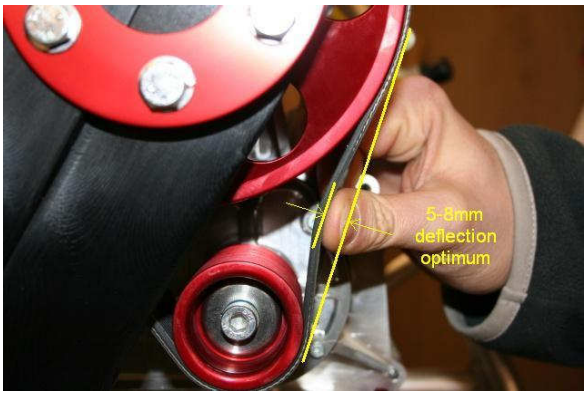
1) On a flat/even surface, place a small block of wood under the front of the chassis, effectively tilting the engine backwards (to stop drained oil from dripping onto the exhaust system)
2) Remove the oil drain plug (as shown in picture below) with a 10mm socket.
3) Drain all used oil into suitable container
4) Remove wooden block so that engine is now level
5) Replace and tighten oil drain plug with a 10mm socket (do not overtighten)
6) Remove red anodised oil filler/level cap (do no turn propeller with this plug removed)
7) Carefully fill with fully synthetic 4 stroke motorcycle oil (Castrol R4 5W-40 is recommended) until the oil is level with the bottom of the threads in the filling hole
8) Replace and tighten red anodised oil filler/level cap

Oil drain plug location

Oil filling location

Drive Belt Tensioning Procedure

The ideal drive belt tension is the minimum required to prevent any slippage. Some slipping (slight chirping noise) at idle is quite normal. We recommend an optimum belt deflection of 5-8mm (as shown in picture on the right)



There is a simple test to tell if the drive belt is slipping; From cold allow the engine to briefly warm up and then hold at full power for 20 seconds and stop the engine. If the drive belt is cold to touch, then the tension is correct, if it feels hot then it may be slipping and may require adjusting. In reality the belt will be pre-tensioned at the factory and we have found that even after 200 hours, no drive belt adjustment has been necessary.

The drive belt can be adjusted by slackening the two M6 bolts on the top of the reduction pylon and turning the eccentric drive belt adjuster, with an 8mm Hex key inserted into the centre of the large reduction pulley, a slight clockwise rotation will tighten the belt, anti-clockwise rotation will loosen the belt. After adjustment re-tighten the two M6 bolts and test the belt deflection.

N.B. Do not over-tighten belt – This may lead to premature bearing failure and reduction in available thrust.

ENGINE MAINTENANCE PROCEDURES

Valve Clearance Adjustment

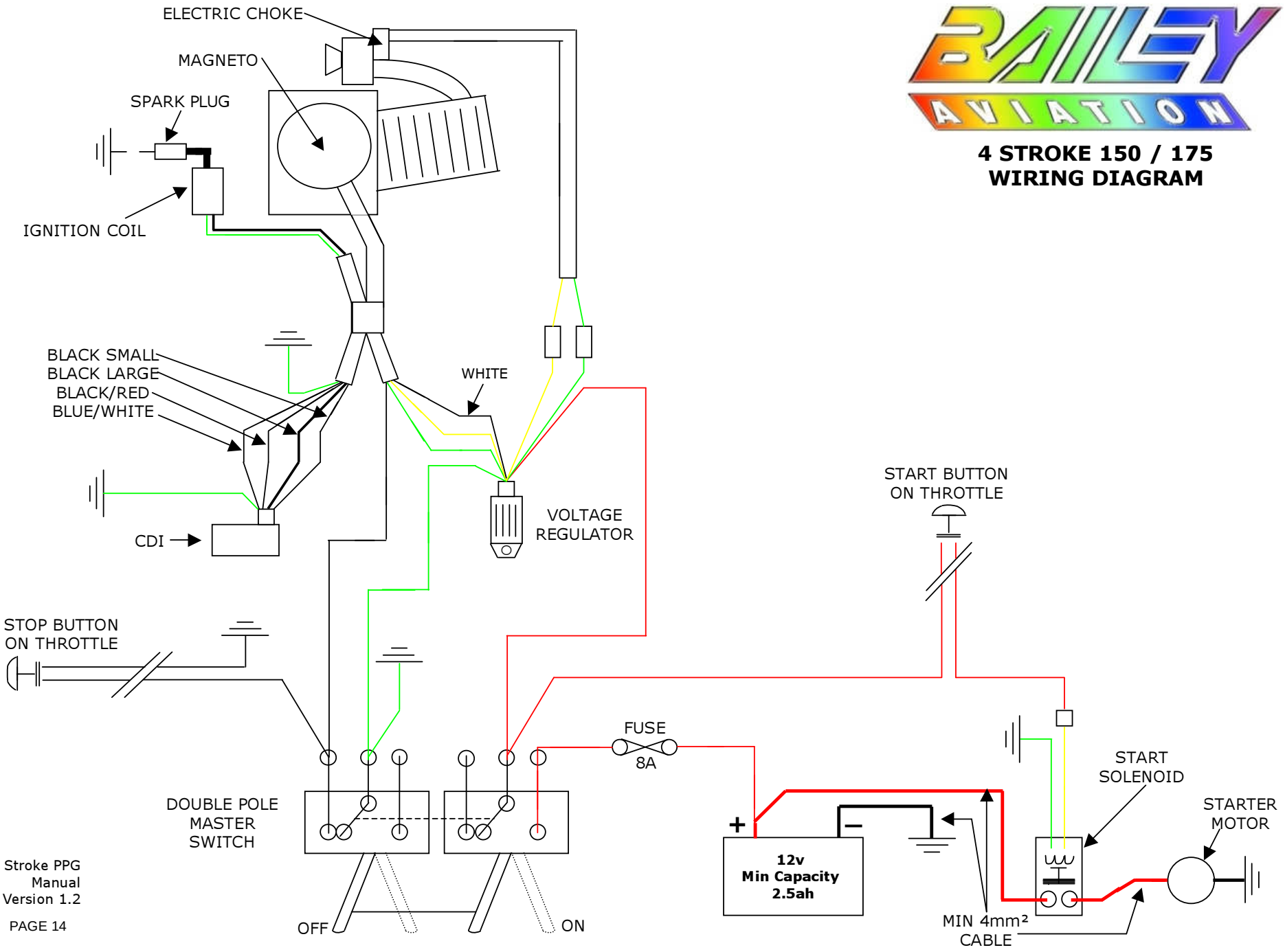
Firstly ensure the master switch is off.
Disconnect engine breather hose and remove cam cover. Rotate propeller until inlet valve (nearest the top of the engine) is fully closed and the cam lobe is 180^{o} from the cam follower. Using a suitable feeler gauge, inserted between the valve top and the cam follower adjusting screw, check and/or adjust by loosening the 9mm lock nut (see specifications for valve clearances)

The same procedure is used on the exhaust valve (nearest the exhaust). After adjustment ensure both lock nuts are tightened and re-fit cam cover and engine breather hose.

Please be careful not to overtighten the two cam cover bolts, these have an M6 thread and must be tightened gently.

Wipe off any excess oil from the lower cylinder head fins.

4 STROKE 150 / 175
WIRING DIAGRAM



WARRANTY
Bailey Aviation offers a 12-month limited parts and labour warranty on all paramotor and engine components for the original purchaser. All warranty claims are return-to-base and can only be carried out by Bailey Aviation. Bailey Aviation cannot be held responsible for the payment of any delivery/freight charges, including customs duties or taxes.

Warranty claims *will not* be accepted for the following situations:-
Damage caused through immersion in water
Damage caused through improper use
Damage caused through failure to carry out proper **PRE-FLIGHT CHECKS** (page 9)
Damage caused through neglecting the **MAINTENANCE SCHEDULE** (page 11)
Damage caused by physical dropping, falling or shocks to the paramotor or engine
Damage caused through incorrect adjustment of drive belt tension
Damage caused through incorrect adjustment of valve clearances
Damage caused through the use of incorrect fuel or oil type or grade
Damage caused through lack of oil

Parts *not* covered under the limited warranty are:-
Battery pack
Propeller
Cage netting
Throttle handle or trunking
Hang bars
Velcro Straps
Nylon cage inserts
Plastic chassis blanking plugs

N.B.
Any modification whatsoever to the engine or paramotor design, without prior written approval from Bailey Aviation will render the manufacturers warranty null and void.

DISCLAIMER

DANGER
This engine, by its design is subject to sudden stoppage! Engine stoppage can result in forced landings. Such forced landings can lead to serious bodily injuries or death.

Never fly an aircraft equipped with this engine at locations, airspeeds, altitudes or other circumstances from which a successful no-power landing cannot be made, after sudden engine stoppage. Aircraft equipped with this engine should only fly in DAYLIGHT VFR conditions.

Paramotors are not certified or licensed aircraft and it is the responsibility of the owner/pilot to use the machine in accordance with the rules and regulations set out by the governing body in their designated country or territory. Bailey Aviation will not accept any claim for damage or death caused through the mis-use of any product manufactured or used by them on their products.

WARNING
This is not a certified aircraft engine. It has not received any safety or durability testing and conforms to no aircraft standards. It is for use in experimental, uncertified aircraft and vehicles only in which an engine failure will not compromise safety. User assumes all risk of use and acknowledges by his use that he knows the engine is subject to sudden stoppage.

E. & O.E.