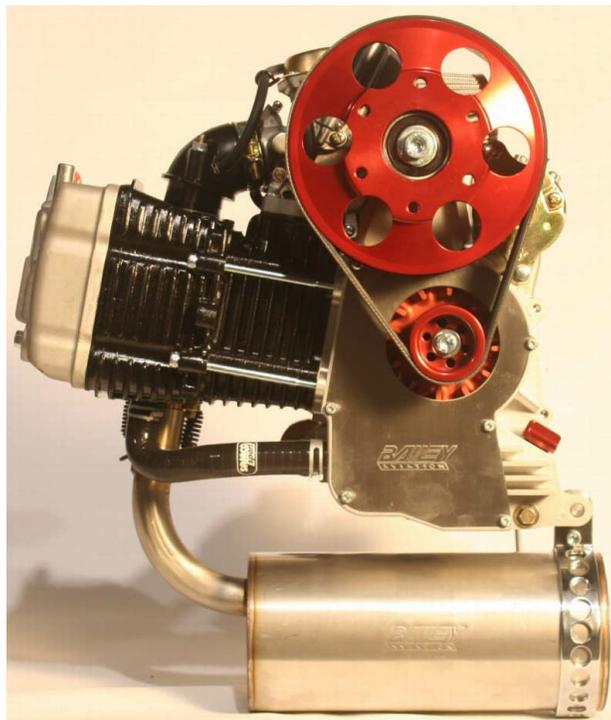


ENGINE OPERATION AND MAINTENANCE MANUAL

BAILEY 4-STROKE



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Engine No:

Purchase Date:/...../.....

4 Stroke Engine
Manual
Version 1.2

BAILEY **4-STROKE**

ENGINE OPERATION AND MAINTENANCE MANUAL

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DISCLAIMER/WARRANTY

INTRODUCTION

Congratulations on the purchase of your Bailey 4 Stroke engine.

This is the first production 4 Stroke engine in the world and has already proved to be a great success, winning countless UK and International Paramotor Championships and has completed 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 led to the birth of a new generation of engine.. The Bailey 4Stroke.

The Bailey 4Stroke engine is available in either 150 (149cc) or 175 (178cc) versions. 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 4 Stroke design also returns fuel consumption figures simply not possible with a 2 stroke, with approx 4-6 hours range¹ with a 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 (NOT SUPPLIED)
- Permanently engaged starter motor with uni-directional clutch
- Built-in alternator – Output 6A @ 5000RPM

ENGINE TECHNICAL SPECIFICATION

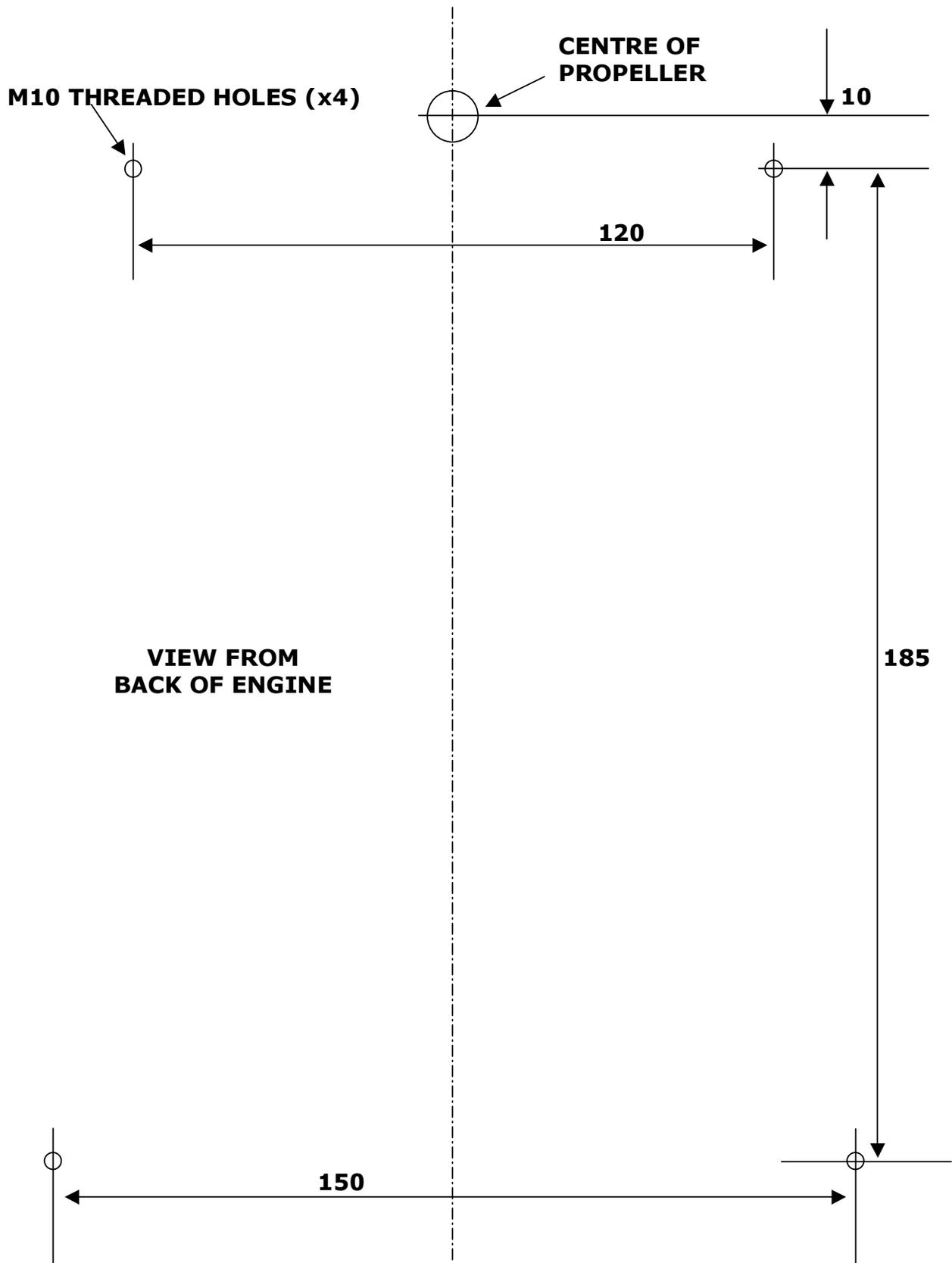
Engine Type	Bailey 4 stroke 150	Bailey 4 stroke 175
Engine Capacity	149cc	178cc
Valve clearances	In: 0.05mm (0.002in) Ex: 0.07mm (0.003in)	In: 0.10mm (0.004in) Ex: 0.10mm (0.004in)
Power	14.5 BHP at 7700 RPM (Maximum normal static RPM 7600 ± 100 RPM)	18 BHP at 8000 RPM (Maximum normal static RPM 7800 ± 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)	
Recommended 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.	

ENGINE LIMITATIONS

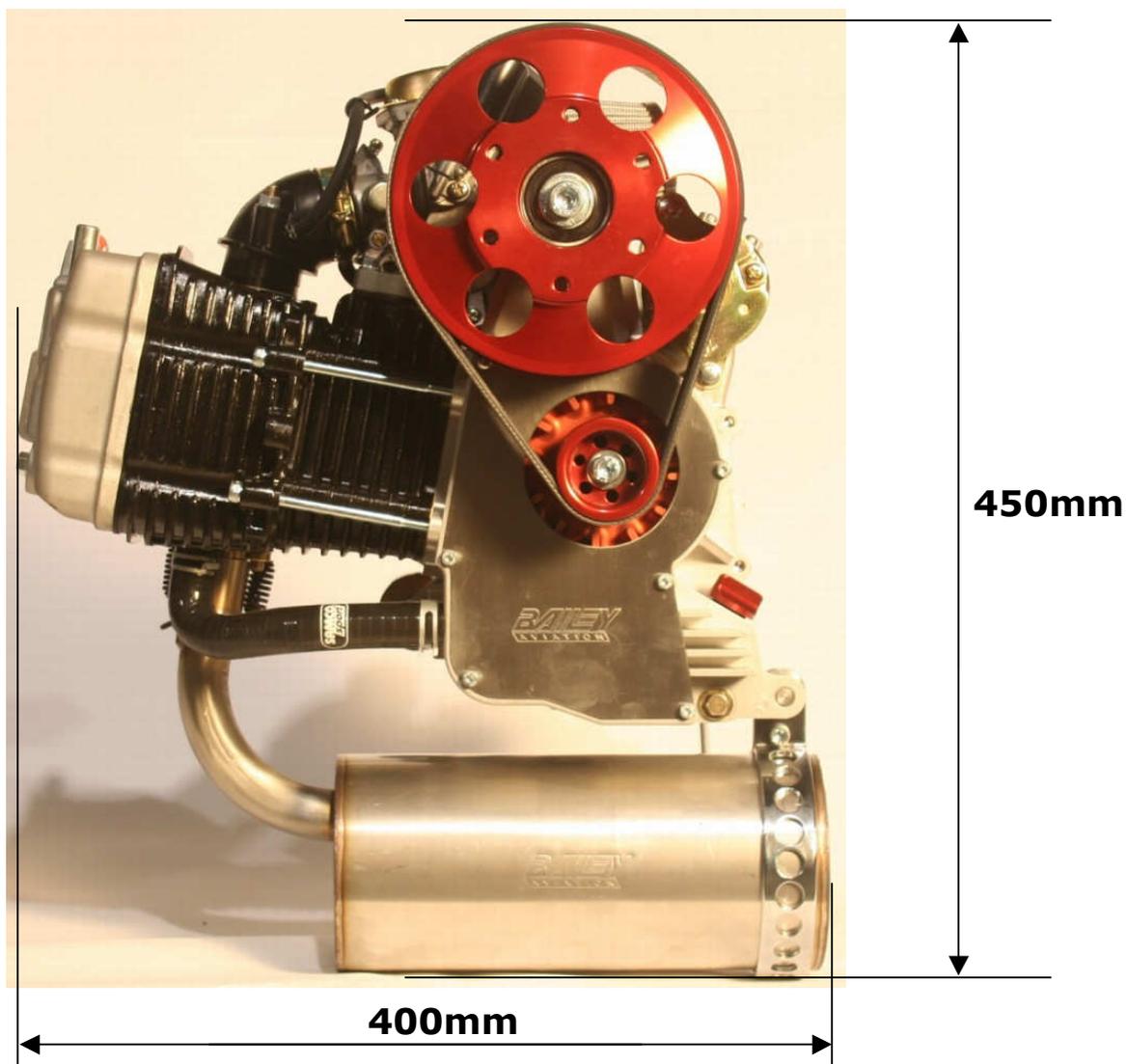
Engine Type	Bailey 4 stroke 150	Bailey 4 stroke 175
Max Oil Temperature	130°C / 266°F	
Max Cyl. Head Temperature	220°C / 428°F	
Max Continuous RPM	7700	8000
Min Oil Quantity	450cc or 10mm below oil filler plug threads	



BAILEY 4 STROKE 150 / 175 ENGINE MOUNTING SCHEMATIC



ENGINE DIMENSIONS



Width from engine mounts to propeller face is 300mm

INSTALLATION NOTES

1. FUEL SYSTEM

The Bailey 4Stroke engine is supplied with a pulse operated fuel pump with an integral pressure relief valve; this should be mounted with the pulse connection pointing downwards. This is to ensure no fluid (condensation, fuel) enters the pump, On Bailey Aviation machines we also use a 'pulse tube drain' this is simply a plastic 'Y' piece with a short piece of tube fitted to collect any fluid at the lowest point (see pic) Without this drain, over time (especially in winter) enough fluid can collect in the pulse tube to stop the pump working. Some type of manual 'primer' will be required to initially fill the carburettor with fuel care must be taken not to 'force' fuel into the carburettor as this will flood the engine.



2. ELECTRICS

The wiring loom and connectors supplied with the engine are **NOT** waterproof; ensure the customer does not wash the engine with water. On electric start models the voltage regulator should be positioned in good airflow, as this component can get hot during normal use. The CDI unit does not require any air-cooling and can be positioned in an enclosed position if required.

3. EXHAUST

Due to the higher exhaust gas temps of a 4 stroke engine do not position anything within 300mm of the exhaust outlet. The body of the exhaust also runs very hot; ensure wiring looms etc are positioned well clear.

4. ENGINE BREATHER

Due to the crankcase volume change with every revolution on a 4 stroke engine it requires a crankcase breather; this is located on the cam cover and should be connected to a suitable hose and vented to atmosphere. On the Bailey Aviation machines we run a tube 'inside' the chassis and vent out through the base of the chassis. Do not restrict this breather in any way, as this will damage the engine oil seals.

5. OIL

The Bailey 4Stroke engine uses the minimum possible oil quantity (oil is dead weight). The oil is also used for internal engine cooling and therefore is very highly stressed. It is **VERY IMPORTANT** that the oil is kept at the maximum level and is changed strictly in accordance with the maintenance schedule. During the first 10 hours or so the engine **WILL** consume engine oil. Please ensure that the end user is advised accordingly.

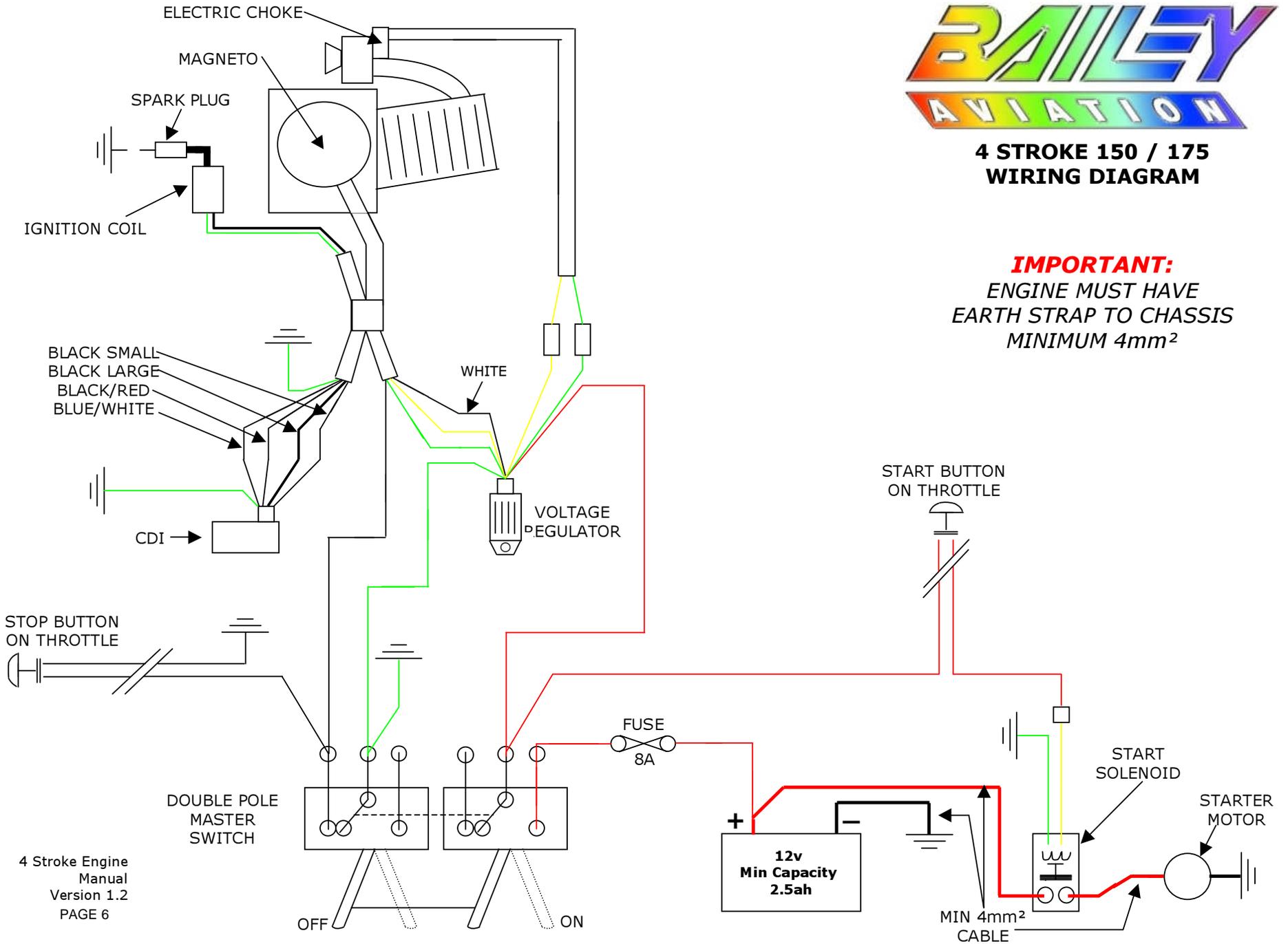
6. IDLE SPEED

Engine idle speed should be set at 3000 rpm, it has been found that although the engine will idle much slower than this vibration can cause fuel in the carburettor to 'froth'.



4 STROKE 150 / 175 WIRING DIAGRAM

IMPORTANT:
ENGINE MUST HAVE
EARTH STRAP TO CHASSIS
MINIMUM 4mm²



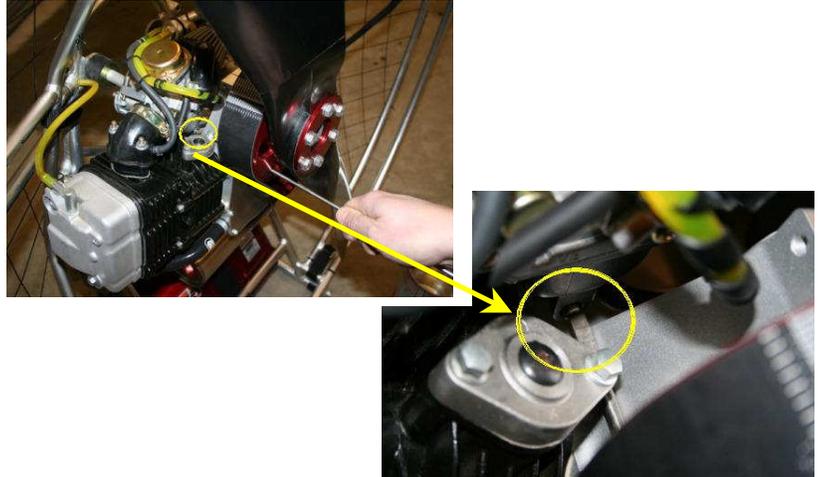
GENERAL OPERATING NOTES

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 (if fitted) 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.



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) or 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.

Care of your machine / Storage

- ❑ Do not clean the engine 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 engine.
- ❑ If the engine 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.
- ❑ There is an engine breather on the cam cover, which must be routed to vent to atmosphere. 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.

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



BAILEY AVIATION 4STROKE
PARAMOTOR SHOWN ABOVE FOR
ILLUSTRATION PURPOSES ONLY

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 $\frac{1}{4}$ 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.

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 <i>all</i> 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 as per manufacturers advice
- 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

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 over-tighten)
- 6) Remove red anodised oil filler/level cap (do not 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.

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° 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.



WARRANTY

Bailey Aviation offers a 12-month limited parts and labour warranty on all 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**

Damage caused through neglecting the **MAINTENANCE SCHEDULE**

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

N.B.

Any modification whatsoever to the engine 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.

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