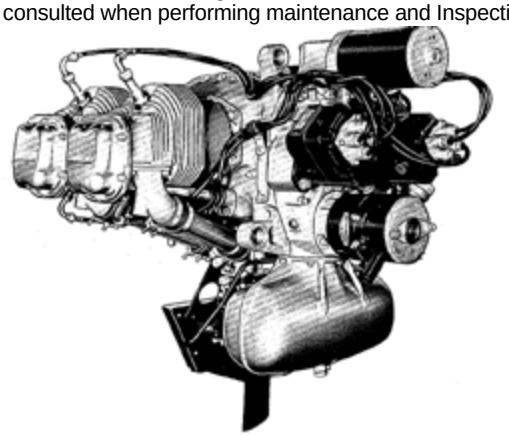
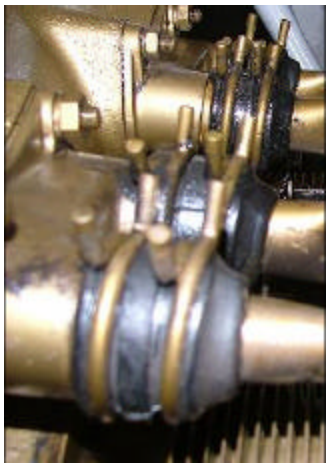
Section 3: Engine Group

Note: Due to the number of engine's and options that have been installed on the Taylorcraft B model, this portion of the document will only attempt to highlight problematic areas of the most common engines. It needs to be reiterated that FAR 43 AND the manufacturers approved data must always be consulted when performing maintenance and Inspections.



❑ Engine section - for visual evidence of excessive oil, fuel, or hydraulic leaks, and sources of such leaks.

Very common to all the smaller Continental engines is push rod seal oil leaks. It is a rubber 'connector' that connects the push rod tube to the hydraulic lifter housing. The push rod tubes also tend to leak were they attach to the cylinder head. The tube is beaded and pressed into the head. The steel bead can fret into the aluminum head and loosen over time. Generally, these types of oil leaks do not compromise airworthiness and tend to be a nuisance more than anything. However, this is up to the mechanic and sometimes it is elected to repair or re-bead the push rod tubes and replace the seals. One thing to note on this is Teledyne Continental AD 94-05-05 R1 which requires the cylinder rocker arm boss to be dye penetrant inspected at each cylinder removal. New style push rod tube seals are available from a company called REAL as kits which add a spring and seal to the push rod tube and cylinder head. Typically this modification is done when the cylinder needs service and/or replacement but has also been successfully done in the field without removing the cylinders.



Another potential oil leak area is the crankcase thru bolts. Over time these steel bolts can fret the case holes and oil tends to worm its way passed the bolts and nuts. Again, typically this does not compromise airworthiness and most people elect to deal with this at the engine overhaul in which the thru bolts and holes can be drilled and oversized.

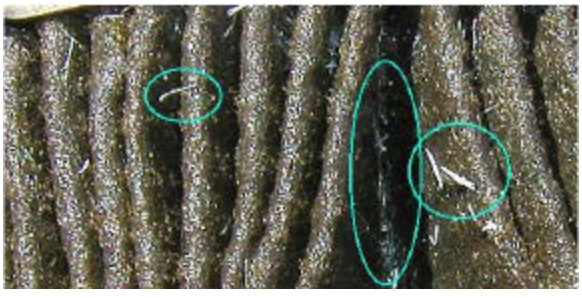
❑ Studs and nuts - for improper torque and obvious defects.

The cylinder hold down studs (not the thru bolts mentioned above) are heli-coiled into the case halves. These have been known to pull out during installation of the cylinders. It is always a good idea to pay attention to these studs and check torque if any indication of movement or rotation is noted. Special care should always be taken at cylinder replacement to NOT over torque these studs. Torque seal can be applied after cylinder installation to the nuts to make future inspections easier. The Continental Overhaul manual which can be downloaded for free online, has a chart in the back that outlines are torques for fasteners used on the engine.

❑ Internal engine - for cylinder compression and for metal particles or foreign matter on screens and sump drain plugs. If there is weak cylinder compression, for improper internal condition and improper internal tolerances.

If cylinder compression is found less than 80/80, listen for air noises in the intake, breather and exhaust. This will give an indication of the location of the wear and source. If it's heard in the induction or exhaust, the most probably location is the associated valve. Noise from the breather indicates lack of sealing of the piston rings. Even with the cyl. compression within limits, the cylinders themselves should be thoroughly inspected for cracks especially near the exhaust port both on the top and bottom. A good portion of cracks emanate in this port area and relieve at the spark plug hole. Chocolate brown carbon streaking between the cylinder fins is common however not all cracks will present themselves this way. Applying pressurized air in the cylinder and soaping the cylinder head is also a good way to detect them. Note: a lot of cracks will not 'open' themselves on a cold engine. Running up the engine to operating temperature helps expand the metal as well as the crack.

It cannot be stated enough, the importance of the oil screen contents. This is by far the most important indicator of internal engine condition. The composition of the contents can be studied and the source can be pin pointed to almost the exact component by people trained in engine overhaul and heavy maintenance. As a rule of thumb; magnetic or ferrous materials are generally from the rotating group ie: gears, crankshaft and camshaft. Bronze is generally from plain bearings in the connecting rods and rocker arms. It can also be produced from the wearing in of valve guides. Non-ferrous or aluminum material is generally from the pistons, piston pins or crankcase (sometimes a spun bearing). Chrome particles can be from a number of sources including thrust or centrifugal bearings, piston rings, cylinder bore as well as other hardened surfaces. Black carbon is a sign of high temperature scorching the oil as is the case with blow-by or worse; a hole in the piston. Although engine component breakdown preceding a catastrophic failure can sometimes be caught during an inspection of oil and filter, the overall idea is to establish a trend of the engine wear and what is normal for that particular engine. You must take into considerations such as time since overhaul or major engine component replacement. It's not uncommon to see brass and chrome specks soon after a cylinder replacement as the rocker shaft bushings and cylinder bore and rings are breaking in. Below are some pictures of advanced wear in the screen of a spin on type oil filter. Anything beyond a speck or small sliver is reason to investigate further.



Spectro-analysis of the oil and filter can also be accomplished if something major is suspected. They will give you a complete graph of what was found and potential area's it came from. Another excellent resource is your local Aircraft Engine overhaul shop. Taking the oil filter contents into the shop and having a trained technician look at them is an excellent idea. Often times they will recognize the material immediately. They also can be a relief of anxiety when their evaluation is of completely normal wear.

❑ Engine mount - for cracks, looseness of mounting, and looseness of engine to mount.

The engine mount assembly on the small continentals is not particularly prone to any major issues other than normal vibration isolator sagging etc… Obviously, the weld points and gusset areas should always be inspected. If the aircraft had damage history particularly a nose over, attention should be given to the engine mount as this is often overlooked and the engine itself is the point of focus.

❑ Flexible vibration dampers - for poor condition and deterioration.

❑ Engine controls - for defects, improper travel, and improper safety.

Throttle cable rod ends as well as the carburetor arm are often times found to be worn. A lot of times, the securing bolt is installed loose and cotter pinned as to allow a nice free and smooth throttle actuation. Unfortunately over time, this can wear out the throttle arm hole on the carburetor. Snug the bolt but don't 'over-snug' it and it should work freely without unneeded wear to the arm and fork end. The carb. heat control is just a wire pinched into a bolt with a bearing cup. They have the propensity to get out of adjustment easily. Many times, the maladjustment is from an Adel clamp somewhere on the cable housing that has allowed the housing to slip. This throws the hole rigging off. This is true for all engine controls. The internal rubber on the clamp softens when exposed to petroleum and heat thereby losing its ability to secure properly. 'Blue' Adel clamps are more expensive but can withstand high temps and exposure to oil and fuel. Engine control cables are also a source of chaffing. The spiral wire housing can saw into just about anything they are secured to or rub against. Spending a little time clamping and securing engine controls will eliminate a lot of problems in the future.

❑ Lines, hoses, and clamps - for leaks, improper condition and looseness.

AD 43-13-02 addresses some old fuel hoses that needed to be replaced. It is extremely unlikely any of these still exist in the fleet but it is still an active AD and thus, must be checked.

AD 87-03-08 addresses the oil pressure gauge hose. A particular hose was affected by this AD. Please refer to the details in the AD for identification of the effected hose assemblies.

There are other AD's pertinent to specific models of Continental engines and various accessories. An AD search, aircraft record correlation and compliance is always part of an annual inspection to be done by the owner and IA / Mechanic.

❑ Exhaust stacks - for cracks, defects, and improper attachment.

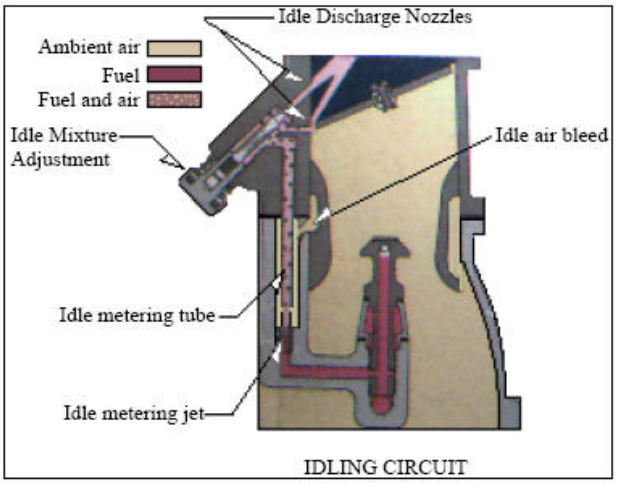
Exhaust components are notoriously prone to cracks due to thermal expansion and retraction. Miss-jigging or tempering at assembly can also cause stresses at tube radius and flanges were they are welded. Particular attention should be made at welded cylinder

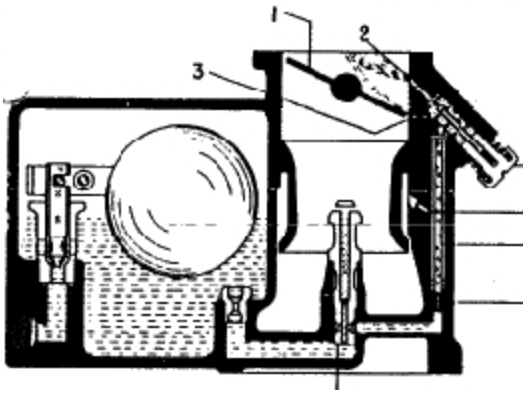
flanges. Look for chocolate brown carbon streaking near or around the exhausts on the cylinders, spark plugs or induction tubes. This is an excellent way to detect exhaust cracks. The flange gaskets are also very prone to leaking. New style 'No-Blow' gaskets should be used whenever the exhaust is removed. A bead of high temp (orange or red) silicone on both sides of the flange gasket can help seal the exhaust flange, gasket and port especially if light erosion on the port is noted from prior exhaust leaks. The muffler and shroud should also be inspected thoroughly as this is the path of cabin air. Depending on the muffler, internal baffling is also important as it eliminates hot spots. Finally, the exhaust can be pressurized with air and the exterior of the exhaust 'soaped' to detect bubbles which indicate a leak and cracks.

❑ Accessories - for apparent defects in security of mounting.

It is beyond the scope of this manual to elaborate on every issue with every accessory that has been mounted on the smaller Continentals. Suffice to say that each accessory should be researched, inspected and maintained as required by the manufacturer. Bendix magnetos have a slew of AD's and SB's pertaining to impulse couplings, distributor gears, rotating magnets, coils so on and so forth. As for starters and generators; the obvious inspection of brushes, commutators, bearings etc… should be done every year. The Continental pull-starter clutch does indeed require annual (and sometimes more frequent) maintenance and adjustment. This is critical for proper pinion gear engagement into the crankshaft gear. Harry Fenton's web page is an excellent resource for maintenance tips for these starters as well as many other small Continental issues. http://www.bowersflybaby.com/tech/fenton.htm

Carburetors – This section would not be complete without a small discussion about the Bendix (Stromberg) NA-S3 carburetor. These old carbs have proven to be reliable for many people for many years. They can also be a source of hair pulling problems for many others. The key to reliable performance of this simple little fuel metering device is maintenance. Neal Write wrote a series of 'tips' for the Stromberg which are outstanding. They can be found here. http://www.bowersflybaby.com /tech/engines.htm#stromberg. Plugging off of the idle and intermediate bleed holes with foreign debris are the primary source of rough engine complaints. The float level must also be set correctly. Lastly, various float needle materials were used in these carbs. Stainless and Delrin were prone to ground 'weeping' whereas the Neoprene tipped needles were known to swell and causing inadvertent leaning of the mixture sometimes even causing a unplanned landing. Most of the neoprene problems seemed to arise with the advent of the auto-gas STC's. Personal research and experiments were done by various people and the conclusion was that the swelling was directly dependant on the quality of auto-gas and the mixture of alcohol into the fuel blend.





❑ All systems - for improper installation, poor general condition, defects, and insecure attachment.

Continental AD 93-22-05 deals with inspection the air flapper valve for cracks. This is applicable to C85 engines and beyond, however all intake air boxes and parts should be carefully inspected regardless of AD applicability. Many forced landings have occurred due to induction problems on a variety of different aircraft. The air filter should always be removed and the entire air box and mechanisms scrutinized for cracks and defects. This is also a great time to check carburetor heat control rigging and for full flapper travel.

❑ Cowling - for cracks, and defects.

The engine cowlings are fabricated with the 'softer' aluminum alloy range and as such, tend to dent easily. Many of these defects can be worked out with good ol' manual labor. Body repair tools such as dollies and soft body hammers can work but much care must be taken to not make the problem worse. One trick is to use a spoon and using its contour with a light hammer to 'manipulate' the metal. Hammering is to strong a word to use when talking about soft aluminum. Working a piece of 3003 aluminum is a great way to practice prior to delving into your cowling. As with any aluminum, cracks can emanate from just about any fastener location or hole radius especially around the induction intake. These can be fixed using traditional sheet metal practices outlined in 43.13-1A. Another somewhat problematic area is the ignition wire cutout 'cups' or domes. They are a plastic / fiberglass and definitely get brittle over time. These cups can be a bit tricky to get. It has been said that Ercoupe cups have been used successfully but need some modifying. These cups can also be repaired or even fabricated in ones own shop. Some have been stamped out with soft aluminum and others have been molded with fiberglass. A little ingenuity will render for 4 nice new cups in a minimal amount of time and expense.

Comments or Observations:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____