Australian Government
Civil Aviation Safety Authority

AIRWORTHINESS BULLETIN

Lycoming Engines Model L-TIO540-J2BD Engine Crankcase and Accessory Gear Housing Reliability

AWB 83-001 **Issue** : 1
Date : 7 April 2006

Applicability

Registered Operators of PA31-350 aircraft, Registered Operators of L/TIO540-J2BD engines (other than PA31-350) Maintainers, Engine Overhaulers and AOC holders.

Purpose

Civil Aviation Safety Authority (CASA) has been reviewing failure of several Lycoming crankcase and accessory gear housings installed on engine model L/TIO540-J2BD at location around the magneto idler (#2 gear) position. This AWB discusses possible causes of failure and recommends actions that are likely to improve reliability of crankcase(s). Please note that whilst the reported failures have occurred on the Left Hand rotating engine the crankcases are interchangeable between the LH and RH rotating engines.

This AWB is essentially a follow up of an All Operators Letter (AOL) dated 22 December 2005 sent from CASA General Aviation Operations Group to the operators of Piper PA31-350 aircraft.

The Lycoming L/TIO540 – J2BD can also be fitted to other aircraft via STC and so the advice contained in this AWB may be applicable to operators of aircraft other than the PA31-350.

Background

CASA has received several service difficulty reports (SDR) related to the failure of crankcase and accessory gear housings installed on Lycoming engine model L/TIO540-J2BD.

These failures occurred around the magneto idler gear position (#2 gear position) and had active failure modes that included failure of the magneto idler gear (LW-10292 & LW -10297) and failure of the gear supporting bosses on the crankcase and accessory gear housing.

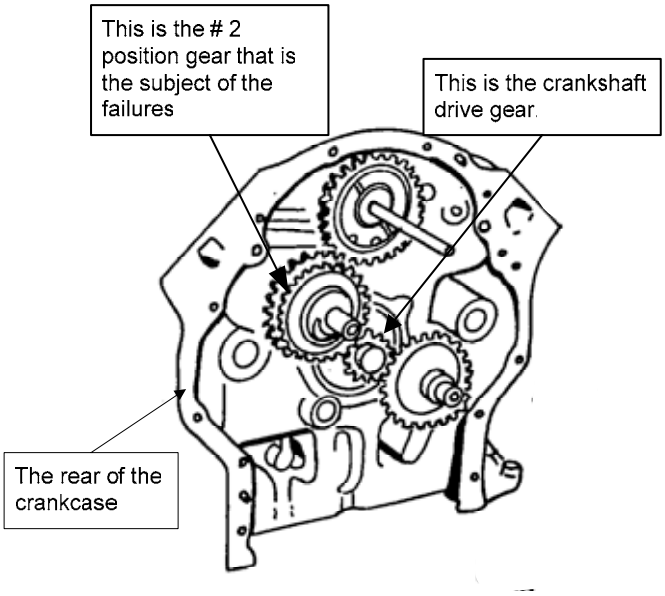

Figure 1. #2 Gear position & Crankshaft drive gear position

Preliminary analysis suggests that failures in the area can have several contributors as noted below:

- Reuse of the idler gear at overhaul.
- Crankcase dimensions
- Fuel and Oil quality
- Crankcase repairs
- Operational issues.

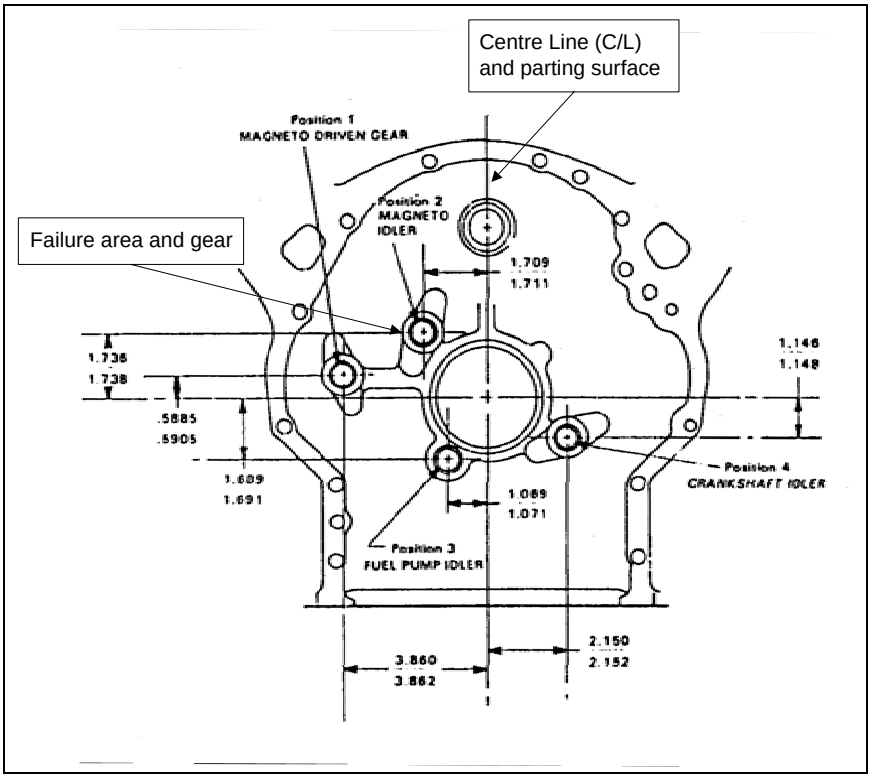

Figure 2. Gear boss positions and dimension.

Recommendation

CASA highly recommends the following actions:

A. The magneto idler gear be replaced with a new item at overhaul. Engine build-specification should also be reviewed with a view to replacing all accessory gears at overhaul and to specify the maximum life of crankcases. For those engines with extended manufacturers TBO or with engines 'on condition' the Registered Operator should also review the timing for replacement of these gears.

B. Where crankcase halves have undergone any machining process or modification: In order to maintain in-service reliability, particular attention should be paid to manufacturer's crankcase dimensional tolerances, and should be checked for accuracy as a part of the machining process. This should be reflected in the relevant EO or modification documentation.

   For accessory drive gear case bosses, as shown in figure 2 and Lycoming Service Instruction, SI 1417, the accuracy of all dimensions should be determined as part of the machining process before going for assembly. The gear drive backlash check is for assembly purposes only, and not intended to be a measurement of accuracy of prior machining processes, it is simply not an accurate enough indication for that purpose.

   (Note: always refer to the most current data for any dimensional checks).

   Additionally the deck height of the crankcase halves should be checked. The CASA recommends that the deck height should be as close to nominal (4.500") as possible with a minimum deck height of 4.480", representing a maximum 0.020" reduction.

   For organisations conducting crankcase machining operations or overhauling engines it is considered that entries should be made in the engine log book component tracking mechanism, and on the release documentation advising of any reduction in nominal deck height and that its effect should be taken into account. Wording may include, for example.

   "Crankcase average deck height is 4.48'' (LH) and 4.486" (RH), a reduction of approximately 0.014" to 0.015" from the nominal height. This reduction should be taken into account with any subsequent maintenance or modification conducted or incorporated on any engine utilising this crankcase"

   When Crankcases are to be imported into Australia the purchaser should specify that not only is the case to have a recognised Authorised Release Certificate (refer CAAP 42W-1 and CAAP 42W-2) but also the case has a minimum deck height of 4.480", the gear boss positions are as per approved data (currently SI 1417). It should also be specified that gear boss repairs such as shown in figure 3 are not acceptable. See also AAC 1-90 Engine problems after Overhaul.

C. Critical components that are currently not serialised such as the, gears should be uniquely identified and their history tracked via a component history mechanism that both remains with the item and in the maintenance logs of the engine they are fitted to. The component history mechanism for all serialised and critical components should record time in service, inspection history, special inspection history (eg NDT), maintenance history (including items such as prop strikes and machining and welding), and a record of parts or materials fitted. This will give appropriate people the ability to determine the history of a critical component to better make decisions on its inspection, retirement or continued use.

D. Some of the failed engines exhibited black sludgy oil which may have been a result of fuel and/or oil contamination. Registered Operators, AOC Holders and maintenance organisations should take all steps to ensure non contaminated and recommended fuels and oils only are used in the operation of the aircraft. It is recommended that oil changes, at a minimum, meet the engine manufacturers recommend time limits. Additionally, low utilisation engines should have the preservation schedule or altered maintenance schedule conducted as recommended by the engine manufacturer at a minimum.

E. A number of the failed engines had unusual repairs in the accessory gear area. Figure 3 shows one of the unusual repairs which are identified by the threaded brass pins locking a machined sleeve inserted into the gear boss areas. It is recommended that any crankcases discovered with the repairs as shown in Figure 3 be removed from service.

[Please note that repairs detailed in Lycoming Service documents, SI1417 for example, are approved repairs and proper adherence to Lycoming repair procedures is fully acceptable. It is the unusual repairs or deviation from Lycoming procedures that may lead to premature crankcase failures.

For example, the repair shown in figure 3 is very different from Lycoming SI 1417 repair (refer also to figure 4). Referring to the extract from SI 1417 (figure 4), the dowel (pin) is singular, non threaded and positioned radially in the bush. On the contrary, the repair scheme depicted in figure 3 reveals three (3), threaded, vertical, brass pins. If the Lycoming repair is properly incorporated, the observer will not see any pins unless one views inside the bushing while in figure 3, three dowel pins are clearly visible.

Lycoming SI1417 repairs ars acceptable while repairs such as depicted in figure 3 are not.]

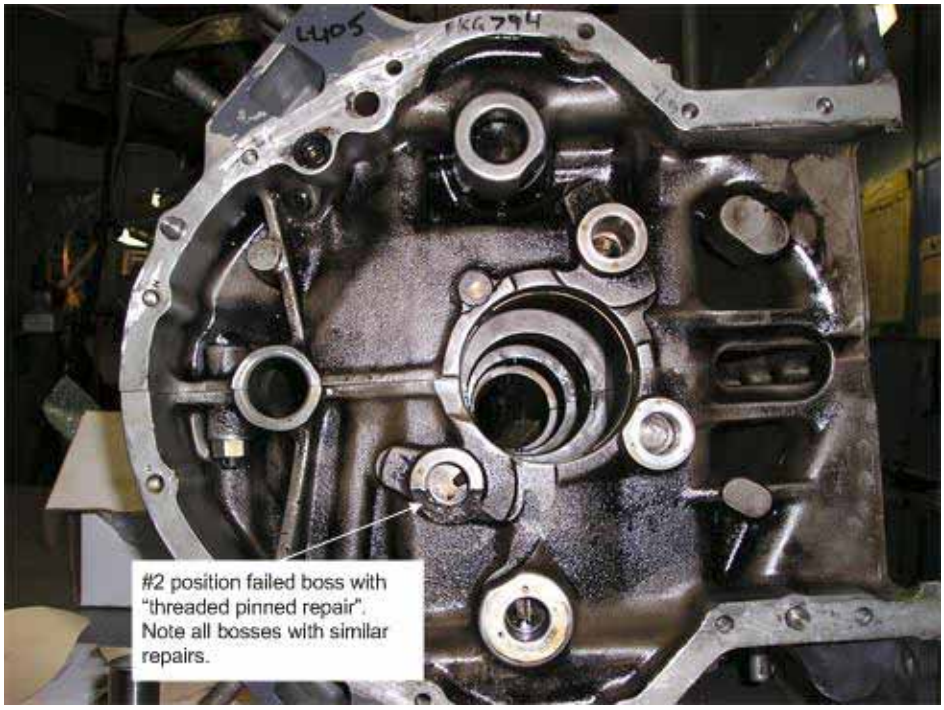

Figure 3. Threaded Pin Repair (not recommended).

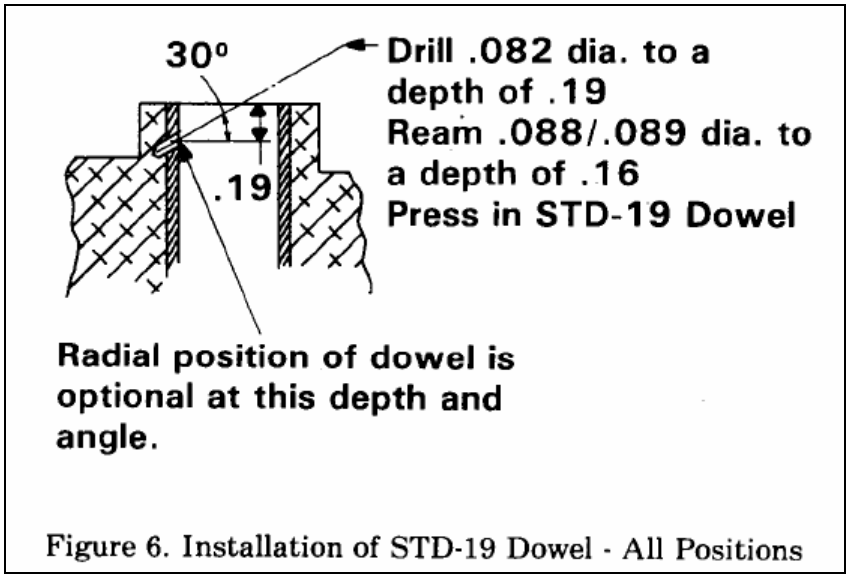

Figure 4. Extract from SI 1417 regarding pinning bush repairs.

F. Operation of the engine inevitably affects not only the performance of the engine but also its reliability. Inappropriate operation can lead to adverse stressors and harmonics on an engine often not manifested until later in the engines life. Additionally inappropriate operation can lead to adverse engine function such as detonation with severe detrimental effects. It is recommended that those operating aircraft closely follow the recommendations of the manufacturer in the operation of the engine. Registered Operators should review their maintenance program to include actions to reduce unwanted engine harmonics such as statically and dynamically balancing rotating components including propellers.

Summary

Inappropriately repaired crankcases can lead to engine failures. Appropriate adoption of the recommended actions is likely to reduce number of crankcase events, improve engine reliability and concurrently safety of operations.

Enquiries

Enquiries with regard to the content of this Airworthiness Bulletin should be made via the direct link e-mail address: AirworthinessBulletin@casa.gov.au

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