Australian Government
Civil Aviation Safety Authority

AIRWORTHINESS BULLETIN

AWB 85-020 Issue 3 – 14 August 2017

Lycoming Engines - Connecting Rod Bushing Premature Wear

Reason for Revision
Clarifies effectivity and makes editorial changes throughout the text to include latest information from Lycoming and requirements given in FAA AD 2017-16-11

1. Effectivity - (Suspect Populations)

Group 1 - All Lycoming reciprocating aircraft engines which were new, factory rebuilt or factory overhauled during the 2011 calendar year.

NOTE: Events have been reported on O-360, O-540 or IO-540 series engines installed in Robinson R22 and R44 Helicopter Models, and GippsAero GA8 aircraft.

Group 2 –

(a) Lycoming reciprocating aircraft engines with a serial number listed in Table 1 of Lycoming Service Bulletin (SB) No. 632B.
(b) Lycoming reciprocating aircraft engines repaired or overhauled using connecting rod assemblies or connecting rod bushing identified in Table 2 of Lycoming SB No. 632B.

NOTE: Whilst the part number of the connecting rod bush has not changed, its physical appearance was recently altered. Stocks of Connecting Rod Small End Bush P/N LW-13923 received by Australian customers since early 2016 have a wide pre-set split line profile, (see Figure 1 and Figure 2 for more details).

Figure1 - The bush on the right is a Connecting Rod Small End Bush P/N LW-13923, identifiable by the pre-set split line which is almost twice the width of the bushing previously received from Lycoming, shown on the left.

Figure 2 - Packaging on the left with new style bar coding containing bushing with the wide pre-set split line. Packaging on the right without bar coding previously received from Lycoming containing bushing with the narrower split line.

2. Purpose

To advise owners, registered operators, maintenance organisations and Licenced Aircraft Maintenance Engineers of specific interrogative maintenance to detect and give warning of possible adverse internal engine wear on the suspect populations of engines.

The content and scope of this document may be updated and amended should additional information become available.

3. Background

There has been an increase in reported incidences of connecting rod small end bush wear. The sequence of events leading to the axial displacement of the connecting rod bushing and development of cracking at bush edges on the suspect populations of engines is not fully understood at this time.

Group 1 Engines - Engines presented with one or more Small End Bushes (P/N LW-13923) that have migrated axially in their Connecting Rod. Migration of the Bushing results in the protruding edge being milled away by contact with the piston pin towers.

A reduction in the bearing surface creates an increasing bearing load on the remaining bushing, leading to an over-load condition and progressive break-up of the protruding bush edge through rocking of the piston pin as a result of the combustion process. The development and progression of the condition is relatively slow and predictable. See Figure 3 and 4 for more details.

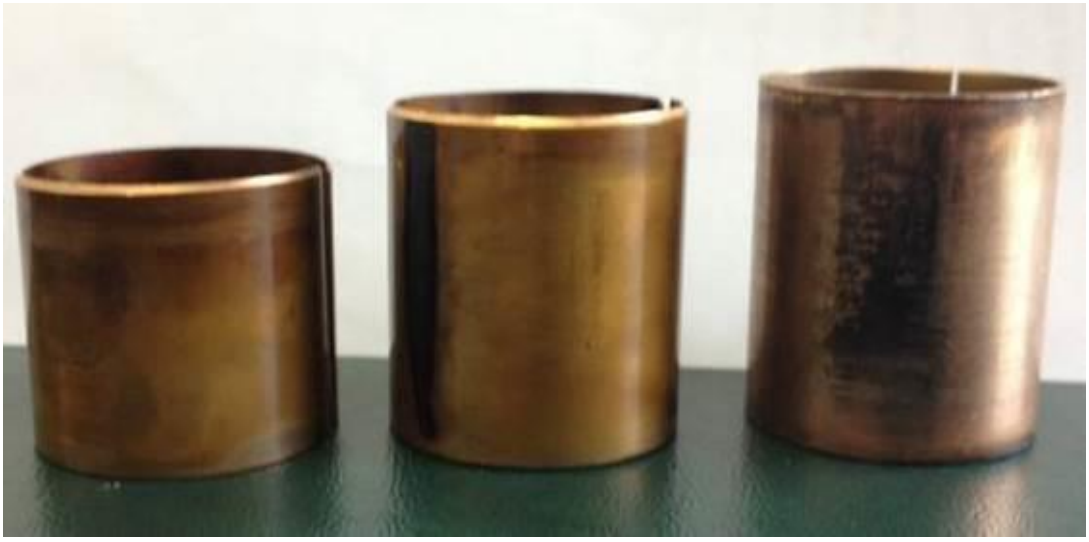

Figure 3 - Three (3) P/No LW13923 Bushes from an O-360-J2A engine which had accumulated 1000 Hours since rebuild in September 2011, showing varying degrees of abrasive wear and consequential reduction in bush axial length. The bush on the right has a relatively unworn axial length.

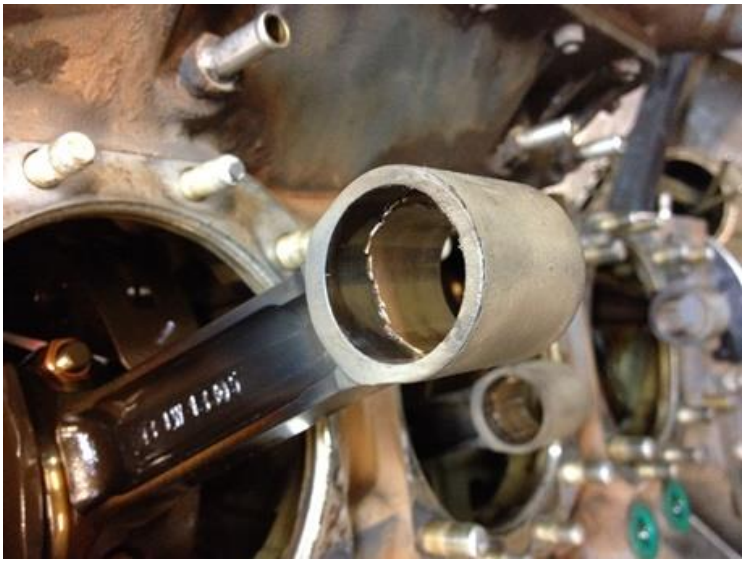

Figure 4 -Partially disassembled O-540-F1B5 engine with an accumulated Time Since New from September 2011 of 1031 Hours, showing material loss and breakup of the connecting rod little end bush. Four (4) of the six (6) bushes from this engine had varying degrees of material loss.

Engine oil and oil filter inspections have been effective at detecting the onset of such wear. Another leading indicator has been the reporting of unusual ticking sounds emanating from the engine at start-up and during operation.

Group 2 Engines - The suspected non-conforming bushing may not have been adequately restrained within the connecting rod bore upon completion of the bushing installation process. Large variations in the push-out force required to move installed bushes have been recorded during subsequent investigation.

Lycoming has determined that a small percentage of the bushings manufactured by a sub-supplier during a specific time period were diametrically undersized, resulting in a tightness of fit below factory accepted tolerances.

Once the connecting rod assembly is installed the development and progression of this non-conformance is much more unpredictable and rapid when compared to the Group 1 engine events.

The migration and progressive destruction of the bush enables the initiation of fatigue cracking between adjoining components under normal engine operational loads. The continued operation of an engine in this state will ultimately lead to fatigue failure of the piston pin end of the connecting rod, with associated damage to crankcase, crankshaft, camshaft, cylinders, and pistons.

A total of five uncontained engine failures have been reported worldwide with one failure reported by an Australian operator on an IO-540-E1B5 Engine.

4. References

- Federal Aviation Administration (FAA) AD 2017-16-11
- Lycoming Service Bulletin No. 632B – Identification of Connecting Rods with Non-Conforming Small End Bushings

- Lycoming Knowledge Base – SB No. 632 Frequently Asked Questions https://www.lycoming.com/sb_632_faqs
- Lycoming Service Bulletin No. 630A – Connecting Rod Bushing Inspection After Cylinder Removal
- Lycoming Service Bulletin No. 480F – Oil Servicing, Metallic Solids Identification After Oil Servicing, and Associated Corrective Actions.
- Lycoming Service Letter No. L171 – General Aspects of Spectrometric Oil Analysis.

5. Recommendations

A. Group 1 Engines - CASA strongly recommends that;

1) At each engine oil change - Change the oil and filter and carry out inspection per the provisions of Lycoming SB 480F, (or subsequent).

2) When carrying out the engine oil and oil filter change procedure take appropriate precautions to drain the oil whilst the engine is still hot and strain the hot oil through a fine mesh screen filter.

   i. Draining the oil whilst it is hot will assist in flushing out metal particles, if present.

   ii. To ensure no external contaminants enter the oil filter/suction screen, use clean containers for collecting oil; and perform inspections on clean surfaces.

   iii. The connecting rod little end bushing is a high precision, low friction plain bush with a bronze alloy construction. Inspecting the oil, oil filter and suction screen contents provides valuable information relative to the condition of engine internal components, if performed diligently.

3) Inspect for a high concentration of bronze alloy in the oil, oil filter and suction screen, indicated by a shining metallic (brass/copper) residue, particles, shavings, or flakes.

   i. Failure to look for metal in the screens and filter, or ignoring adverse indications or unusual behaviour of the engine, can lead to catastrophic engine failure.

   ii. A good description of any metal found and/or metallurgical analysis will assist in identifying the origin of the material and whether it has been produced by impact, abrasion or pressure.

   iii. The quantity, source, form, and type of metal, together with the service history and previous filter element inspection findings, time accumulated since the engine was new or overhauled, previous failures, and type of operation are important factors. All these aspects need to be considered and addressed when determining the continued serviceability of the engine. If in doubt, contact your overhaul facility or Lycoming Field Service Technical Representative.

4) Visually inspect condition and check security of connecting rod little end bushes in accordance with Lycoming SB No. 630A (or subsequent).
    i. For engines with less than 800 Hrs TSO - At any time direct access to connecting rod little end bushes is available.
    ii. For engines with more than 800 Hrs TSO – At next periodic inspection.
5) The use of spectrographic oil analysis to monitor engine component wear rates is also recommended. Refer to the latest revision of Lycoming Service Letter No. L171 for details.

B. Group 2 Engines -

1) Perform inspection requirements and take corrective actions in accordance with FAA Airworthiness Directive (AD) 2017-16-11.
    i. This will require compliance with the service information given in Lycoming SB No. 632B, within 10 operating hours from 15 August, 2017.

    NOTE: Compliance with earlier versions of Lycoming SB No. 632, prior to 15 August, 2017, satisfies the actions required by AD 2017-16-11.

    ii. It is crucial that any adverse indications and/or unusual behaviour during operation of an applicable engine yet to have the actions of the AD performed are thoroughly investigated prior to further flight.
    iii. The removal and installation of connecting rods in accordance with the instructions of Lycoming SB 632 should only be accomplished by an experienced technician. Contact your engine shop and/or Lycoming Field Service Technical Representative for assistance.

6. Reporting

Report all instances of connecting rod little end bushing defects to CASA via the Defect Reporting Service available on the CASA website. Details of the last overhaul and identity of the maintenance provider should be provided in addition to information concerning the method of failure detection, and location and condition of the defective bushing. Information on the condition of the oil and filter should be provided including results from previous filter and screen inspections. This information will facilitate a detailed review of bushing failure causes.

7. Enquiries

Enquiries with regard to the content of this Airworthiness Bulletin should be made via the direct link email address:

AirworthinessBulletin@casa.gov.au

or in writing, to:

Airworthiness and Engineering Standards Branch
Standards Division
Civil Aviation Safety Authority
GPO Box 2005, Canberra, ACT, 2601