

Airworthiness Bulletin

AWB 85-026 Issue 2 - 21 April 2022 Lycoming Engines - Valve Train Failure Checks

An Airworthiness Bulletin is an advisory document that alerts, educates and makes recommendations about airworthiness matters. Recommendations in this bulletin are not mandatory.

1. Effectivity

All Lycoming reciprocating engines.

2. Purpose

To advise owners, registered operators, maintenance organisations and Licensed Aircraft Maintenance Engineers of recent valve train failure events resulting in substantial engine damage, power loss and/or engine vibration.

At this time, the airworthiness concern described in this Airworthiness Bulletin is not considered an unsafe condition that would warrant an Airworthiness Directive to be issued under Part 39 of the *Civil Aviation Safety Regulations 1998*.





 Figure 1
 Figure 2

 Combustion Chamber and Piston Crown damage following Intake Valve Tip Failure



3. Background

It is recognised that the valve train is amongst the most highly stressed components in any internal combustion engine with in-service failures occasionally reported. However, in some instances, when a valve or one of its related parts is replaced because of a failure, a subsequent failure of the same part is experienced. This can be the result of neglecting to determine the cause of the original failure.

In a recently reported intake valve failure, it was identified that the failure of a valve tip was most likely caused by the use of a rocker arm where the tip had been altered and no longer conformed to the approve tip geometry. Whilst the Lycoming overhaul manual does allow the replacement of worn rocker arm bushings, the manual is not inclusive of instructions for repairing / refacing rocker arm tips, (Figure 3). If refurbishment is attempted, it is extremely difficult to maintain the original geometry (radius and parallelism) as it relates to the valve tip/cap interface. A misalignment between matting surfaces can impose side-loads on the valve tip leading to an overload condition and valve tip fracture, (Figure 4).

Further, if a dry tappet clearance check is performed indiscriminately, the required running clearance will not be obtained. An excessive dry tappet clearance will not fully open the corresponding valve leading to a noisy engine and some loss of power. A diminished dry tappet clearance will not allow the valve to fully seat, which can lead to a damaged / burned valve, (Figures 5 and 6). In either case, the engine will become rough and mechanical failure may be the end result.

The failure of a valve can also be caused by a leaking / collapsed hydraulic tappet plunger assembly, (Figure 7).





Figure 3 Rocker Arm Assembly (Typical)

Figure 4 Valve Stem/Tip Fracture





Figure 5

Figure 6

Valve and Valve Seat Damage as a consequence of inadequate Dry Tappet Clearance





Collapsed Hydraulic Tappet Plunger Assembly (Continental Aerospace P/No: AEL78290 - shown)

4. References

Lycoming - Service Instruction (SI) No. 1011 – Tappets and Lifters Lycoming - SI No. 1060 – Push Rod Identification Lycoming - SI No. 1193 – Inspection in Event of Valve Failure Lycoming - SI No. 1424 - Installation Procedure, Hydraulic Tappet/Plunger Assemblies Lycoming Engine Overhaul Manual – Engine Specific Lycoming SSP-1776 – Table of Limits

Note: Refer to the latest published revision.

5. Recommendations

In the event of a valve failure or any other part of the valve mechanism all the valve train parts should be checked to determine the original failure cause. Accomplishment of the following recommendations will also provide for positive valve train operation.



Rocker Arm Assemblies

- a) Tight rockers, when valves are closed can be an indication of valve regression or a damaged valve tappet. If valve rocker lifts excessively when the valve is closed this can be an indication of a bent push rod or collapsed plunger assembly.
- b) Replace rocker arms when mechanical refacing of the rocker arm tip (pad) is required or has been previously performed.
 If the geometry of the rocker arm tip (pad) is not correct, a greater part of the force created by the motion of the rocker arm will push the valve stem laterally as well as vertically. When this happens, the valve stem scrubs against the valve guide causing excessive wear in the guide. This wear will open up the valve guide leading to poor valve control.

Any refurbishment of the rocker arm tip (pad) can only be carried out in accordance with the applicable provisions of the approved maintenance data for the component.

Hydraulic Tappet Plunger Assemblies

- a) During engine overhaul all plungers should be replaced regardless of their apparent condition, (Lycoming SB No. 240 refers). Prior to installation, examine all new plunger assemblies in accordance with Lycoming SI No.1011 to ensure correct operation.
- b) During scheduled maintenance or any other in-service repair that includes disassembly/reassembly of the valve train, examine the plunger assemblies before reinstallation, in accordance with Lycoming SI No. 1011. However, if valve train failure was identified, replace the hydraulic plunger with a new hydraulic plunger.
- c) Do not mix plunger assemblies with different part numbers in the same engine. The different leak down rates can cause incorrect engine operation. Mating parts are to be kept together, if there is any doubt as to whether the parts have become mixed, install new plunger assemblies.
- d) Record the completion of inspection per Lycoming SI No. 1011, in the engine logbook.

Dry Tappet Clearance

- a) Clearances can change in service however, the most common cause of a change of dry tappet clearance is the replacement or servicing of a cylinder, especially if that servicing involved any valve work.
- b) As a valve seat is ground to restore proper sealing the valve tends to move further into the cylinder head, thus closing-up the dry tappet clearance. If a valve is replaced, it would likely sit further out from the valve seat and thus open-up the dry tappet clearance. If a cylinder is replaced with a new cylinder assembly, the new valve is likely in a slightly different position in the cylinder head compared to the old one. The difference may only be a few thousandths of an inch, but it could be more. The only way to be sure is to check, which is why the dry tappet clearance should be measured and adjusted as necessary in accordance with the applicable Lycoming Maintenance or Overhaul Manual instructions as part of any cylinder service or replacement procedure.



c) If the clearance is not within the prescribed limit, insert a longer or shorter push rod to obtain the correct clearance. Refer to Lycoming SI 1060 or the applicable parts catalogue for applicable push rods.

6. Reporting

Report all instances of engine valve train failure to CASA via the DRS system available on the CASA website. Details of the maintenance history for the system should be provided in addition to information concerning the method of failure detection, the location and condition of the defective parts and any other information on possible triggers for the reported event. This information will facilitate a detailed review of potential failure causes and contributing factors.

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:

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