Australian Government
Civil Aviation Safety Authority

AIRWORTHINESS BULLETIN

Unapproved Parts - Challenger Aero Engineering - Chrome Plated Engine Cylinders

AWB 01-027 **Issue** : 1
Date : 25 January 2013

1. Applicability

All Teledyne Continental Motors (TCM) and Lycoming cylinders repaired by Challenger Aero Engineering.

2. Purpose

Alert aircraft engine overhaulers, maintainers and aircraft owners to the existence of unapproved cylinders.

3. Background

CASA discovered problems associated with repair of engine cylinder assemblies while conducting investigations into Challenger Aero Engineering (formerly Challenger Engineering) in Sydney, Australia.

Challenger had been using unauthorised persons to carry out unapproved repair schemes, including chrome plating repairs to engine cylinder barrels. The chrome plate repair procedure used by Challenger to restore worn and corroded cylinders required that the cylinder heads be removed by unscrewing the head from the barrel for grinding and plating processes and then screwing the head back on.

Figure 1. Typical cylinder head separation for Lycoming and TCM engines for illustration purposes only. (The failed cylinder depicted was not repaired by Challenger)

As the head is screwed back on, in order for the cylinder assembly to achieve the desired reliability of the original design, the threaded joint must have the same pre-load value as when the cylinder was first manufactured. As well, the cylinder base tie down stud and bolt holes must be in proper alignment with the valves and ports in the head at the exact moment that it arrives at the required pre-load or torque.

Since this combination of critical events cannot be guaranteed with absolute certainty during production, some manufacturers drill the holes in the cylinder base flange after the head is screwed on.

Given that some damage (wear) must occur to the threads during removal and re-installation, it can be seen the re-alignment can take place at less than optimal pre-load. Merely achieving the same alignment as before may not achieve the design pre-loading for the threaded joint. Less than optimal pre-loading predisposes the assembly to fatigue failure which typically results in the head separating from the barrel – usually in flight. (See figure 1.)

Because it was considered that there could be no guarantee of the success of the Challenger process and that the threaded joint between the cylinder barrel and cylinder head could not be assessed properly in service, CASA issued Airworthiness Directives in July l990 (7/90) titled AD/CON/58 and AD/LYC/87 which required removal of all suspect Challenger cylinders from service.

Challenger records were inadequate to identify all suspect cylinders, and while operators or owners who were known to have received these cylinders at the time were advised, the ADs only required that the suspect cylinders be placed in quarantine - not mutilation and disposal. It is therefore possible that following cancellation of the ADs that the unapproved cylinders might be removed from quarantine and installed in aircraft as “serviceable” cylinders.

The seriousness of the problem cannot be overstressed as some of the subject cylinders were reported as having suffered major defects at the time.

As a guide, the suspect cylinders would only have been released for installation into engines after January l989, so spare cylinders from Challenger received or installed or placed into quarantine on or after that date should be reviewed carefully. Owners and operators should refer to their maintenance organisations for details of release notes etc. Suspect cylinders may also carry markings of "WB l4" or a "CAE" prefix number.

4. References

1. AD/CON/58 Challenger Engineering Chrome Plated Cylinder Barrels. (Cancelled).

2. AD/LYC/87 Challenger Engineering Chrome Plated Cylinder Barrels. (Cancelled)..

5. Recommendation

CASA recommends that:

(a). Maintainers, overhaulers, operators and owners should pay particular attention to determining the source and identity of all components used on their engines and use only approved parts.

(b). All cylinders repaired by Challenger Aero Engineering (formerly Challenger Engineering) should be removed from service, identified and subjected to mutilation and disposal to prevent re-use.

6. Enquiries

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

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