1. Effectivity

Aircraft owners, operators, Licensed Aircraft Maintenance Engineers and others involved in the procurement of reciprocating engines from foreign sources.

2. Purpose

The Registered Operator (RO) in combination with the Maintenance Repair Organisation (MRO) and Licensed Aircraft Maintenance Engineer (LAME) installing an imported engine are responsible for ensuring that all Australian regulatory requirements and standards are met.

The RO should source an engine from an entity that can provide extensive details regarding the build standard and configuration of the engine prior to its export. This will enable the RO to make an informed decision as to whether a particular engine meets their operational requirements whilst also ensuring that their responsibilities under the civil aviation regulations are met.

To assist in those decisions, this AWB provides generalised advisory material regarding:

- the variety of terms used by the aviation community to describe types of reciprocating engine overhaul;
- the standards used by engine overhaul providers during reciprocating engine overhaul; and
- the administrative requirements which should be satisfied at the time of engine importation and induction.

Note: The primary focus of this AWB is in relation to reciprocating engines exported to Australia from the United States of America under the Federal Aviation Administration (FAA) system.

3. References

- CAO 100.16 - Administration and procedure – distribution and rejection of aircraft components and aircraft materials.
- FAA 14 CFR Part 43, § 43.2. § 43.9, § 43.13(a) and § 43.13(b)
- FAA 14 CFR Part 91, § 91.405, § 91.417 and § 91.421
- FAA AC 21-2L - Complying with the Requirements of Importing Countries or Jurisdictions When Exporting U.S. Products, Articles, or Parts
- FAA AC 21-2J Appendix 2 - Commonwealth of Australia – Special Requirements.

4. Definitions

For the purpose of this AWB; the following definitions address the issue of various terms used and are an amalgam of the standard engine overhaul terms published by the FAA and major engine manufacturers.

a) **New Limits** - These are the approved production drawing tolerances and limits that all new parts must conform to during manufacture and are held to specific quality control standards as required by the National Airworthiness Authority (NAA) in the issuance of the engine type certificate.

Notes:

1) This may be accomplished by using standard and approved undersized or oversized dimensions for a new engine.

2) A ‘new limits’ part is not necessarily a newly manufactured part. It also includes used Original Equipment Manufacturer (OEM) parts that have been inspected and found to conform to the production drawing tolerances and limits for a new part or be of approved oversize or undersize dimensions for a new engine.

b) **Service Limits** - are the allowable wear fits and tolerances, published by the OEM that a ‘new limits’ part may deteriorate to and still be a useable component. This may also be accomplished using standard and approved undersized or oversized dimensions.

Note:

1) If an engine is overhauled to ‘serviceable limits’ the parts must conform to the tolerances and limits as published in the OEM overhaul manuals and other Instructions for Continuing Airworthiness (ICA).

c) **New Engine** - is an engine that has been manufactured from all new parts and tested by the OEM. The engine will have no operating history except for test cell time when received.

Notes:

1) Only the OEM can produce or assemble a new engine.

2) A ‘new engine’ is made to ‘new limits’ and will have all new OEM parts.

d) **Overhauled Engine** - is an engine which has been completely disassembled, cleaned, inspected & repaired as necessary and tested using the approved maintenance data for that product. The engine may be overhauled to ‘new limits’ or ‘service limits’ or a combination of the two, using used parts and new OEM or new aftermarket, [Parts Manufacturing Approval (PMA)] parts. The engine’s previous operating history is maintained and it comes with a zero Time Since Overhaul (TSO) and the same Time Since New (TSN) as before the overhaul.

e) **Rebuilt Engine** - is an engine that has been ‘overhauled’ to ‘new limits’ using a combination of new and used OEM parts. The engine's previous operating history is eradicated and it comes with zero hours Total Time in Service (TTIS), even though the engine may have had used components installed that have a previous operating history.

Notes:

1) Only the OEM or an agency approved by the OEM can produce or assemble a rebuilt engine and zero time its hours.

2) Lycoming has previously used the term remanufactured to describe their factory rebuilt engines. Although this term is not recognised by the FAA and has no meaning in Australian regulation, when used by Lycoming (and only Lycoming), the term remanufactured can be considered the same as the term rebuilt.

3) Refer to FAA 14 CFR part 91, §91.421 for further information.

5. Background

a) Engine Overhaul Standards

i) Engine overhauls can be accomplished to a variety of standards with many Approved Maintenance Organisations (AMOs) promoting a seemingly endless array of overhaul options and techniques.

ii) The standard to which an engine is overhauled usually depends on the terms used by the person or entity selected to perform the work. The FAA has specific requirements for the use of the terms OVERHAULED and REBUILT in an engine's maintenance records. If the requirements of FAA 14 CFR part 43, §43.2 are not met, it is illegal in the USA to use these terms.

Note:

1) In most cases, the use of the methods, techniques, and practices (“standards”) prescribed in the OEM overhaul manual are standards acceptable to the FAA in the performance of the required engine maintenance.

iii) Any other terms used to describe the work performed during an engine overhaul are defined by the person or entity using them. They have no regulatory meaning and can often be misleading and may not be delivering what you are expecting. Terms like "overhauled to factory specs or tolerances", "rebuilt equivalent", "overhauled to like new condition" and "remanufactured to factory fits and limits" and any other terminology used needs to be investigated as to what those terms actually mean.

b) Engine Overhaul Facilities

Under the FAA regulatory system engine overhauls can be performed by providers ranging from;

- the engine manufacturer, or a manufacturer approved agent;
- large or small FAA certified repair stations;
- custom overhaul engine shops; and
- individual certified powerplant mechanics.

Regardless of the type or size of the facility they are all required to comply with FAA 14 CFR part 43, § 43.13(a) and 43.13(b). The engine overhaul facility is also required by § 43.9 to make appropriate entries in the engine records of maintenance that was performed on the engine.

The selection of an overhaul facility can have a major bearing on the outcome of an overhaul. Some of the key considerations include;

- In-house capability; i.e. which operations are controlled and conducted in-house and which operations are contracted to outside facilities and what controls are exercised between the two parties.
- The documented engine test procedures and acceptance criteria.
- Warranty period and support provided.

6. Recommendations

a) The Registered Operator should clearly understand what tolerances and limits have been used when the engine has been presented for overhaul. There should also be a thorough understanding of any replacement parts, regardless of condition, as a result of a manufacturers overhaul data, service documents, or Airworthiness Directives (ADs).

b) It is the responsibility of the RO to assure that proper entries have been made in the engine records in accordance with § 91.405 and § 91.417. The owner should also ensure that the engine overhaul facility references the tolerances used ('new limits' or 'service limits') to accomplish the engine overhaul.

c) An engine to be exported to Australia need not incorporate modifications or manufacturer's service documents made mandatory by Australian ADs until the engine is installed into an Australian aircraft. However, it may be difficult to determine in Australia whether the product complies with Australian ADs upon installation, so details of all modifications and repairs carried out and the design data or documents used should be provided. A statement written by the person or organization issuing the FAA Form 8130-3, (Authorized Release Certificate / Airworthiness Approval Tag) will be accepted as evidence of the engine's status. This statement may be written in the logbook or in a separate document.

Experience has shown that some engine overhaul facilities are better than others at documenting and logging the details of the overhaul. In the event of a recall or regulatory action against a particular part or component, a detailed engine log statement from the overhauler could save you the anguish of unnecessary downtime and expense of an exploratory teardown only to discover that an AD didn't actually apply.

d) Whilst conforming to the requirements for "overhaul", it is critically important to fully understand the standard to which an engine has been overhauled. This includes thorough knowledge of the overhaul work scope, which can have a direct or indirect influence on the durability and reliability of an engine and its ability to meet its expected Time Between Overhaul (TBO).

The following points identify the key elements;

i) **The minimum parts replacement list:**
Major engine manufacturers, such as Lycoming and Continental Motors, publish a list of items to be replaced at overhaul, regardless of their apparent condition, (latest revisions of SB No. 240 and

SB97-6 refer respectively). The RO needs to consider the potential impact on the continuing airworthiness of the engine, if the preventative maintenance actions addressed within these types of service documents are not followed.

ii) **The included Service Bulletin and Service Letters list:**
Current certification requirements for aircraft engines require the preparation of Instructions for Continuing Airworthiness (ICA) for all engine parts, that are acceptable to the administrator (Appendix 'A' to FAA 14 CFR part 33 refers). Engine manufacturers make available maintenance data and all information necessary to maintain, repair and overhaul their products by means of overhaul manuals and other related service publications. Using the Lycoming Direct Drive Overhaul Manual, (Publication No. 60294-7) as an example, the front matter of the manual states that additional overhaul and repair information is published in the form of Service Bulletins and Service Instructions and that the information contained in these publications is an integral part of, and is to be used in conjunction with the information contained in the overhaul manual.

In considering whether to implement a manufacturer's Instruction for Continuing Airworthiness (ICA), the RO should not be questioning "Is this service document mandatory?" The question the RO holder should be asking is "Does this ICA need to be incorporated to maintain the required standards of safety to meet the certification basis of the Type Certificate?" It is good practice to record the reason and justification for decisions to not comply with manufacturers ICA's should the decision be questioned at a later time.

iii) **Major components:**

1) Crankshafts are routinely reused but to which tolerances and limits? The crankshaft, major gears and accessory drive gears are expensive therefore the overhaul facility may use the more marginal 'service limits' for these parts in lieu of 'new limits'.

2) Although camshafts may be reground, there is a very strict limit on the amount of grinding which can be tolerated. If the hardened surface of the cam lobe is removed, the softer material is exposed and accelerated wear can ensue.

3) The options associated with cylinders are wide and varied along with the reconditioning techniques on offer. Anecdotal evidence suggests that more problems arise from cylinders than major rotating parts therefore any potential cost saving associated with the use of exchange cylinders with an unknown history or

the overhaul of multiple life cylinders may end up being false economy compared to the fitment of new OEM or aftermarket cylinders.

4) Manufacturers periodically introduce product improvement initiatives which can roll the part number or modification status of a component/part, for reasons such as durability or reliability. If the latest parts standard or modification status has not been specified, earlier configuration parts held in stock by the overhauler which are not inclusive of the product enhancements may be used.

iv) **Accessories:**
In addition to being cognisant of the inclusions, engine accessories not included as part of the standard engine overhaul need to be understood. For example, the overhaul or exchange of the vacuum pump, tach generator, exhaust risers, should be known as these items may normally only be included upon special request.

v) **Repair and Modification procedures:**
Are the methods, techniques and practices prescribed by the OEM followed for the repair or modification of all components or are alternative procedures internally approved by the overhaul provider used.

7. 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

or in writing, to:

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