

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

SUBJECT: RECIPROCATING ENGINE OVERHAUL, TERMINOLOGY AND STANDARDS

DATE: 4/7/76

Advisory Circular No: 43-11

Initiated by: AFS-830

1. PURPOSE.

This advisory circular discusses engine overhaul terminology and standards that are being used in the aviation industry:

- a. To inform the owner or operator of the variety of terms used to describe types of reciprocating engine overhaul.
- b. To clarify the standards used by the industry during reciprocating engine overhaul.
- c. To review the Federal Aviation Regulations (FAR) regarding engine records and standards.

2. REFERENCES.

FAR 43, Sections 43.9, 43.13(a), and 43.13(b); FAR 91, Sections 91.173 and 91.175.

3. BACKGROUND.

In the maintenance of aircraft engines, terms such as top overhaul, major overhaul, etc., are used throughout the aviation industry. The standard to which an engine is overhauled usually depends on the terms used by the person who is performing the engine overhaul. These terms are familiar to the aviation community, but their specific meanings are not fully understood. This could result in similar engines being overhauled to different tolerances. We believe that through the discussion that follows, owners or operators and engine overhaul facilities will have a better understanding of the terms and standards relating to those terms.

4. DISCUSSION.

- a. The selection of an overhaul facility by the average aircraft owner is usually determined by the cost quoted by the engine overhauler. Engine overhauls can be accomplished to a variety of standards. They can also be accomplished by many different facilities, ranging from engine manufacturers, large repair stations, or individual powerplant mechanics. The selection of an overhaul facility can and does, in most cases, determine the standards that are used during overhaul. The FAR requirement in Section 43.13(a) is that the person performing the overhaul

shall use methods, techniques, and practices that are acceptable to the Administrator. In most cases, the standards that are outlined in the Engine Manufacturer Overhaul Manuals are standards acceptable to the Administrator.

- b. These manuals clearly stipulate the work that must be accomplished during engine overhauls and outline limits and tolerances used during the inspections. There is no dictionary that provides a commonly accepted standard definition of all the terms used in the aviation industry. The terms discussed in this advisory circular are offered for information purposes only and are not to be considered as definitions set forth in the Federal Aviation Regulations.
- c. The only definition regarding engine overhaul is the word "rebuilt." This is defined in FAR 91.175 and refers to rebuilt engine maintenance records.

5. ENGINE OVERHAUL TERMINOLOGY

- a. "Rebuilt."
 - (1) The term "rebuilt" is defined in FAR 91.175. The definition allows an owner or operator to use a new maintenance record without previous operating history for an aircraft engine rebuilt by the manufacturer or an agency approved by the manufacturer.
 - (2) A rebuilt engine as defined in FAR 91.175, "is a used engine that has been completely disassembled, inspected, repaired as necessary, reassembled, tested, and approved in the same manner and to the same tolerances and limits as a new engine with either new or used parts." All parts used must conform to the production drawing tolerances and limits for new parts or be of approved oversized dimensions for a new engine.
- b. Overhaul. In the general aviation industry, the term engine overhaul has two identifications that make a distinction between the degrees of work done on an engine:
 - (1) A major overhaul consists of the complete disassembly of an engine, inspected, repaired as necessary, reassembled, tested, and approved for return to service within the fits and limits specified by the manufacturer's overhaul data. This could be to new fits or limits or serviceable limits. The determination as to what fits and limits are used during an engine overhaul should be clearly understood by the engine owner at the time the engine is presented for overhaul. The owner should also be aware of any parts that are replaced, regardless of condition, as a result of a manufacturer's overhaul data, service bulletin, or an airworthiness directive.
 - (2) Top Overhaul consists of the repair of parts outside of the crankcase and can be accomplished without completely disassembling the entire engine. It can include the removal of cylinders, inspection and repair to cylinders, inspection and repair to cylinder walls, pistons, valve-operating mechanisms, valve guides, valve seats, and the replacement of pistons and piston rings. A top overhaul is not recommended by all

manufacturers. Some manufacturers indicate that if a powerplant requires work to this extent, it should be given a complete overhaul.

6. FITS AND LIMITS.

As discussed above, two kinds of dimensional limits are observed during engine overhaul. These limits are outlined in the engine overhaul manual as a "Table of Limits" or a "Table of Dimensional Limits." These tables, listing the parts of the engine that are subject to wear, contain minimum and maximum figures for the dimensions of those parts and the clearances between mating surfaces. The lists specify two limits as follows:

- a. **Manufacturer's Minimum and Maximum.** These are also referred to by some manufacturers as new parts or new dimensions. These are the dimensions that all new parts meet, during manufacture and are held to specific quality control standards as required by the FAR in the issuance of an Engine Type Certificate to a manufacturer. It is important to note that new dimensions do not mean new parts are installed in an engine when a manufacturer or his authorized representative presents zero time records in accordance with FAR Section 91.175. It does mean that used parts in the engine have been inspected and found to meet the manufacturer's new specifications.
- b. **Service Limits.** These are the dimensions that represent limits that must not be exceeded and are dimension limits for permissible wear.
 - (1) The comparative measurements of parts will determine their serviceability; however, it is not always easy to determine which part has the most wear. The manufacturer's new dimensions or limits are used as a guide for determining the amount of wear that has occurred during service. In an engine overhaul certain parts must be replaced regardless of condition. If an engine is overhauled to "serviceable" limits, the parts must conform to the fits and limits specifications as listed in the manufacturer's overhaul manuals and service bulletins.
 - (2) If a major overhaul is performed to serviceable limits or an engine is top overhauled, the total time on the engine continues in the engine records.

7. REMANUFACTURE.

- a. The general term remanufacture has no specific meaning in the FARs. A new engine is a product that is manufactured from raw materials. These raw materials are made into parts and accessories that conform to specifications for the issuance of an engine type certificate. The term "remanufactured" infers that it would be necessary to return the part to its basic raw material and manufacture it again. "Remanufactured," as used by most engine manufacturers and overhaul facilities, means that an engine has been overhauled to the standards required to zero time it in accordance with FAR 91.175.
- b. However, not all engine overhaul facilities which advertise "Remanufactured Engines" overhaul engines to new dimensions. Some of these facilities do overhaul to new dimensions,

but may not be authorized to zero time the engine records. As outlined in FAR 91.175, only the manufacturer or an agency approved by the manufacturer can grant zero time to an engine.

8. ENGINE OVERHAUL FACILITIES.

- a. Engine overhaul facilities can include the manufacturer, or a manufacturer's approved agency, large and small FAA certificated repair stations, and engine shops that perform custom overhauls or individual certificated powerplant mechanics. The services offered by these facilities vary. However, regardless of the type or size of the facility, all are required to comply with FAR 43.13(a) and 43.13(b). In this regard, it is the responsibility of the owner to assure that proper entries are made in the engine records (Refer to FAR 91.165 and 91.173).
- b. Engine overhaul facilities are required by FAR 43.9 to make appropriate entries in the engine records of maintenance that was performed on the engine. The owner should insure that the engine overhaul facility references the tolerances used (new or serviceable) to accomplish the engine overhaul.