



Piston Engine - Cylinder Differential Pressure  
(Leak) Test

**AWB** 85-019 **Issue** : 1  
**Date** : 20 November 2015

## 1. Effectivity

Aircraft owners, operators, Licensed Aircraft Maintenance Engineers and others involved in the performance of piston engine cylinder differential pressure (leak) tests.

## 2. Purpose

To provide generalised advisory material regarding acceptable means and principle factors for the performance of piston engine cylinder differential pressure (leak) tests where data from the engine manufacturer is not available.

NOTE: The content of this AWB supersedes the advisory material given in AAC 6-32 Issue 1, in relation to AD/ENG/4 Amdt.11, Appendix A, Requirement A2:b.

## 3. References

- FAA AC 43.13-1B, Change 1, Chapter 8, Section 1, Paragraph 8-14
- Lycoming Service Instruction No, 1191A
- Continental Motors Service Bulletin SB03-3

## 4. Background

To effectively monitor the continuing airworthiness of a piston engine in service, certain maintenance actions should be carried out to establish the condition of the engine. Those maintenance actions should not only establish the condition of the engine at the time of the maintenance, but also establish a level of trend monitoring.

The trends can then be used to plan maintenance in a pro-active manner, rather than in a reactive manner. This is a practice no different to turbine engine trend monitoring.

A prime factor in piston engine trend monitoring is the cylinder leak test. A cylinder leak test should be carried out at specified intervals to establish and monitor the condition of the engine cylinders. The procedure should not only establish the rate of cylinder leakage but also the source of the leakage. For example; whilst a level of leakage past the piston rings may be acceptable, any leakage past a valve seat or from the head to barrel joint renders that cylinder unserviceable.

The cylinder leak test should be carried out by a person or an organisation approved for the purpose in accordance with the requirements of CAR 42ZC.

The procedure involves the use of a calibrated differential pressure tester and applying a regulated pressure (80psi) into the cylinder bore with the piston at Top Dead Centre (TDC) of the compression/power stroke. The



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difference between the pressure indication of the cylinder pressure gauge and the regulator (supply) pressure gauge is the amount of leakage through the cylinder, giving an indication of the condition of the parts in the combustion chamber of the cylinder.

## 5. Recommendations

### a) Test Procedure

Perform a differential pressure (leak) test in accordance with FAA Advisory Circular (AC) 43.13-1B Change 1, Chapter 8, Section 1, Paragraph 8-14 or other equivalent and approved maintenance data.

**CAUTION:** Ensure all necessary precautions are taken against accidental firing or rotation of the engine.

### b) Test Equipment

The use of a calibrated differential pressure tester is mandatory for accurate readings. The following recommendations will supplement the instructions accompanying the equipment.

- i. The differential pressure tester must be kept clean and should be checked regularly for accuracy. Check equipment with the shutoff valve closed and regulated pressure at 80 psi (the cylinder pressure gauge must indicate 80 psi plus or minus 2 psi) and hold this reading for at least 5 seconds.
- ii. The restrictor orifice that is placed between the gauges must be calibrated to provide a sufficient volume of air yet restrict air to allow pressure to build. More airflow is required for larger cylinders, so two different orifices are recommended depending on engine cylinder bore size. Test results will be unreliable unless the correct orifice is utilised;
  - a) For an engine cylinder having less than a 5.00-inch bore; 0.040-inch orifice diameter; 0.250 inch long; and a 60-degree approach angle.
  - b) For an engine cylinder with 5.00 inch bore and over: 0.060 inch orifice diameter, 0.250 inch long, and a 60 degree approach angle.

**NOTE:** A number of the smaller displacement production engines can still have larger cylinder bores, (5 inch or larger), therefore requiring the 0.060 inch orifice diameter.

- c) A typical schematic diagram of a differential pressure tester is shown in Continental Motors SB03-3.
- iii. If erratic readings are observed on the equipment, inspect compressor system for water or dirt.



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**c) Leak Rates**

The following leak rates are acceptable to the Authority in the absence of engine manufacturer's data;

- i. Leakage past the piston rings of less than 25% or an equivalent outlet reading of 60 psi are acceptable. That is; 60/80 or better.
- ii. Leakage past the piston rings at a rate of more than 25%, (less than 60/80) will require maintenance action. The maintenance required is;
  - a) Better than 50/80: The engine may continue in service subject to recording the results of the cylinder leak test on the maintenance release and listed as maintenance required:
    - i. Oil consumption – an accurate review of the oil uplift records is to be undertaken to ensure there is no adverse trend or forecast that the consumption is likely to exceed the maximum recommended by the engine manufacturer. At each oil uplift.
    - ii. Cylinder leak test – Carry out a differential pressure (leak) test in accordance with FAA Advisory Circular (AC) 43.13-1B Change 1, Chapter 8, Section 1, Paragraph 8-14 or other approved maintenance data at intervals not to exceed 50 hours' time in service (TIS).
  - b) Less than 50/80: Rectification required before further flight.
- iii. Leaks from the following sources are unacceptable and must be corrected:
  - a) valve seats;
  - b) spark plug port seals;
  - c) cracks in the cylinder head, barrel or cylinder to barrel joint seal.

This however, does not automatically translate to cylinder removal and repair as a retest may be performed.

- i. Retest - Run the engine again until normal operating temperatures are reached (not just the minimum temperatures specified for operation).
- ii. Retest as soon as possible after the engine is shutdown to ensure that the piston rings, cylinder walls and other engine parts are well-lubricated. If a leak is still evident, further troubleshooting can be conducted in accordance with FAA AC 43.13-1B Change 1, Chapter 8, Section 1, Paragraph 8-14b.(5)(j).



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d) **Indications and sources of leakage**

To determine a cylinders problem area, have someone turn the propeller by hand, in the direction of rotation until the piston (in the cylinder being checked) is at TDC of the compression/power stroke. Whilst opening the air valve and applying regulated compressed air at 80 psi, listen for;

- i. Ring snap on applying air pressure that may indicate worn rings and piston ring lands.
- ii. Air noise / vapours from oil filler neck indicating leakage past piston rings.
- iii. Air noise from induction system opening indicating intake valve leakage.
- iv. Air noise from exhaust system opening(s) indicating exhaust valve leakage.
- v. Any suspected leakage between cylinder head and barrel is checked with a soap solution (that will bubble if seal is defective or a crack is present).
- vi. Combustion chambers with five piston rings tend to seal better than 3 or 4 piston rings, with the result that the differential test may not consistently show excessive wear or breakage where 5 piston rings are involved.

## 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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or in writing, to:

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