

CONTINENTAL AIRCRAFT ENGINE

MAINTENANCE MANUAL

**STANDARD PRACTICE
FOR SPARK IGNITED ENGINES**



Technical Portions Accepted by the Federal Aviation Administration

Publication M-0

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Supersedure Notice

This manual incorporates maintenance and service information contained in Continental Motors Service Documents common to the horizontally opposed, spark ignition, AvGas aircraft engines conforming to Type Certificate held by Continental Motors. This document is supplemental to the Instructions for Continued Airworthiness provided in the manuals listed in Section 1-1.1. Instructions contained in the Service Documents listed in Section 1-2.4 are superseded by instructions in this manual upon release, except for those Mandatory Service Bulletins (MSBs) and Critical Service Bulletins (CSBs).

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Chapter 6. Engine Inspection and Service

6-1. Engine Inspection Introduction

Inspections described in this chapter apply only to the Continental Motors engines covered by this manual. Perform the engine inspections according to the instructions provided. Perform aircraft inspections according to the aircraft manufacturer's instructions. Refer to the following sections:

- Section 6-2, "Inspection and Maintenance Schedule"
- Section 6-3, "Time Between Overhaul"
- Section 6-4, "Scheduled Inspections"
- Section 6-5, "Unscheduled Maintenance"
- Section 6-6, "Inspection Checklists"

Some inspections are at predetermined intervals (scheduled) while others are based on circumstance (unscheduled). Engine servicing is performed at scheduled intervals but may also be performed "on condition." The first part of this chapter is devoted to scheduled maintenance intervals and associated procedures; unscheduled maintenance instructions follow the scheduled maintenance instructions.

NOTE: Discrepancies discovered by the person conducting the scheduled or unscheduled inspections, even if the discrepancy is not an itemized inspection item, should be corrected upon discovery. Fuel and oil system contamination affects engine performance and service life. If oil or fuel system contamination is discovered, do not limit the correction to the symptom; isolate and correct the source of the contamination, including any residual material left in the engine by the source of the contamination.

6-2. Inspection and Maintenance Schedule

Unless another FAA-approved Inspection Program is established, the Engine Inspection and Maintenance Schedule shows the inspections for the subject engines covered by this manual in their original type design. The inspections described in this chapter apply to the engine and not to the aircraft. Refer to the Aircraft Manufacturer's manual for airframe inspection requirements.

The inspections are progressive; commencing from the date the engine is placed in service. The inspection intervals are tracked by Engine Log entries and designated by hours of operation or calendar time, whichever occurs first. Inspection techniques must be executed consistently for reliability.

6-3. Time Between Overhaul

Continental Motors (CM) provides operational limitations and instructions for your engine along with the requirements for continued airworthiness as specified in the engine Operator Manuals, Maintenance Manuals, Overhaul Manuals, and Service Documents. The Time Between Engine Overhaul provided in this document applies only to engines that have been operated and maintained in accordance with these instructions. Engine mounted components and accessories require overhaul at the same hourly and calendar intervals as the engine, unless otherwise specified by the component or accessory manufacturer.



Engine Inspection and Service

An engine's published TBO DOES NOT mean that every engine will operate the number of hours or years listed without requiring component replacements and/or unscheduled maintenance events. Noncompliance with CM instructions for continued airworthiness, operational and/or environmental factors may necessitate repair or replacement of the engine, engine components and accessories earlier than the published TBO.

TBO periods were established on most CM engines beginning in the 1960s. Since that time, CM has made significant engineering improvements to virtually all major engine components. CM has refined manufacturing processes and implemented computer numerical controlled (CNC) machining tools enabling CM factory engines to meet higher standards than possible when the engines were originally granted FAA Type Certificates. These improvements have enabled CM to increase TBO limits for many of our new and rebuilt engines.

CM recommends the following factors be used, along with the engine's published TBO, to determine the engine's continued airworthiness:

1. Environmental corrosion occurs internally and externally on an engine. This naturally occurring process can affect continued airworthiness of the engine and engine mounted components or accessories. Regardless if the engine has been operated regularly or has been in storage; gaskets, seals, and synthetic and natural rubber goods deteriorate over time. Replace or overhaul the engine upon accumulating the operating hours specified in Table 6-1, or twelve (12) years after being placed in service, whichever occurs first.
2. For engines used in aerial spraying, TBO is 1200 hours or twelve (12) years whichever occurs first.
3. Engines used in parachute jumping, glider towing, banner towing, blimp propulsion, or other unusually stressful applications may require more frequent overhauls than listed.
4. The quality of parts, accessories and workmanship utilized during routine maintenance, engine top overhaul and major overhaul has a direct effect on the service life of the engine. Also, the maintenance and condition of engine-related components - including, but not limited to, propeller, propeller governor, vacuum pump, gear driven alternator, mount, baffles, instrumentation, and controls has a direct effect on engine durability. The TBO periods listed are predicated on the engine having been maintained according to the Instructions for Continued Airworthiness, (ICA) accepted by the FAA, specified in the engine Maintenance Manual, Overhaul Manual, and Service Documents, and operated within the limitations published in the engine operating instructions or the aircraft manufacturer's Aircraft Flight Manual / Pilot's Operating Handbook (AFM / POH).
5. Continental Motors does not provide a TBO for engines that have been:
 - Assembled with parts not supplied by Continental Motors
 - Assembled with parts that do not conform to the original FAA approved type design for the engine
 - Modified from the original type certificate configuration



- Overhauled or repaired in a manner that is inconsistent with the specifications, limits, and instructions provided in the CM Instructions for Continued Airworthiness and FAA Airworthiness Directives
6. The “Hobbs Meter” is commonly used by the aviation industry as an acceptable device to record time elapsed while electrical power is applied to the device. The conditions under which the Hobbs Meter records operation vary widely within the aviation industry. Continental Motors does not specify a method to record engine operating hours, rather, Continental Motors defers to the end application installer.

NOTE: TBO periods specified in this document are only estimates and do not reflect warranty periods. For engine warranty coverage, refer to the original Aircraft Engine Warranty received with the engine.

Table 6-1. Engine Time Between Overhaul (TBO)

		HOURS/YEARS	
		ENGINE S/N BEFORE 1006000	ENGINE S/N 1006000 AND LATER
ENGINE MODEL	SEE NOTE		
A65, A75 and C75, C85, C90 Series	1	1800/12	
O-200-A, B	1, 2	1800/12	2000/12
O-200-D	1	2000/12	2200/12
IO-240-A, B	1, 2		
IOF-240-B	1, 2		
IO-346-A	1	1500/12	
C125, C145 Series and O-300-A, B, C, D	1	1800/12	
GO-300-A, C, D, E	1	1200/12	
IO-360-A, AB, B, C, D, G, H, J, K	1	1500/12	
IO-360-CB, DB, GB, HB, JB	1, 2	1500/12	1700/12
IO-360-AF, ES, KB	1, 2	2000/12	2200/12
TSIO-360-A, AB, B, C, D, E, F, H	1	1400/12	
LTSIO-360-E	1		
TSIO-360-CB, DB, HB, JB	1, 2	1400/12	1600/12
L/TSIO-360-EB, FB, GB, KB, LB, MB, RB, SB	1, 2	1800/12	2000/12
E165, E185, E225 Series	1	1500/12	
O-470-A, B, E, G, N, P	1		
O-470-J, K, L, M, R, S	1, 2	1500/12	1700/12
O-470-U	1, 2, 3	2000/12	2200/12
IO-470-C, D, E, F, G, H, J, K, L, M, N, P, R, S, U, V, VO	1, 2	1500/12	1700/12
TSIO-470-B, C, D	1	1400/12	
IO-520-B, BA, C, M	1	1700/12	
IO-520-A, BB, CB, D, E, F, J, K, L, MB	1, 2	1700/12	1900/12
L/IO-520-P	1, 2	2000/12	2200/12



Engine Inspection and Service

Table 6-1. Engine Time Between Overhaul (TBO)

ENGINE MODEL		HOURS/YEARS	
		ENGINE S/N BEFORE 1006000	ENGINE S/N 1006000 AND LATER
	SEE NOTE		
GTSIO-520-F, K	1	1200/12	
GTSIO-520-C, D, H	1, 4	1600/12	
GTSIO-520-L, M, N	1		
TSIO-520-B, D, E, J, K, L, N	1	1400/12	
TSIO-520-BB, C, DB, EB, G, H, JB, KB, LB, M, P, R, T	1, 2	1400/12	1600/12
TSIO-520-NB	1, 2,	1600/12	1800/12
TSIO-520-M, P, R	1, 2, 5		
TSIO-520-AF, CE, UB, VB, WB	1, 2		
L/TSIO-520-AE	1, 2	2000/12	2200/12
TSIO-520-BE	1, 2		
IO-550-A, B, C, D, E, F, L	1, 2	1700/12	1900/12
IO-550-G, N, P, R	1, 2	2000/12	2200/12
IOF-550-N	1, 2		
TSIO-550-B, E	1, 2	1600/12	1800/12
TSIO-550-C, G, K, N	1, 2	2000/12	2200/12
TSIOF-550-D, J, K, P	1, 2		
TSIOL-550-A, B, C	1	2000/12	

1. If an engine consistently accumulates 40 or more hours per month since being placed in service, add 200 hours to recommended TBO.
2. Engines with Serial Number 1006000 or higher include an additional 200 hours to TBO (as noted in Table 6-1, column 3).
3. Applies to: new and rebuilt O-470U Model Specifications 11, 12, 13, 14, 17, 18, and subsequent numbers manufactured, new or rebuilt, or overhauled (2002 or later).
4. Applies to GTSIO-520-C, D, H engine models listed utilizing cylinder part number 653453, or superseding (cylinder production released APRIL 1993-verify part number on cylinder flange). Also, all parts must be replaced as directed by the applicable current service bulletins, illustrated parts catalogs, and overhaul manuals. A log book entry is required.
5. Applies to new and rebuilt TSIO-520-M Spec. 6, 7, and 8; TSIO-520-P Spec. 5 and 6; TSIO-520-R Spec. 7, 9, 10, and 11, or new and rebuilt TSIO-520-M, P, and R model engines with subsequent specification numbers.



6-4.11.3. Cylinder Borescope Inspection

Regular engine operation provides an oil coating for the cylinder and minimizes rust formation. New cylinders are particularly sensitive to rust formation if the engine is infrequently used or not properly preserved during storage.

NOTE: Ground operation of the engine is an unacceptable substitute for in-flight engine operation. Ground operation does not provide adequate cylinder cooling and introduces water and acids into the lubrication system.

Purpose

The cylinder borescope inspection provides a non-destructive method of visually examining the internal cylinder components and must be used in conjunction with the “Differential Pressure Test” to assess the condition of the valve, piston top, deposits, and the hone pattern on the cylinder barrel and identify abnormal wear patterns which can contribute to low differential pressure readings or increased oil consumption.

The cylinder wall hone pattern consists of engineered surface “scratches” which aid in ring seating by allowing the ring and wall surface to wear uniformly and provides a reservoir of oil for lubrication during ring travel. The cylinder walls and rings are designed to wear over the life of the engine, particularly in the power stroke area. The visible hone pattern in the upper portion of the bore may disappear during normal operation; and is not cause for cylinder replacement.

Required Equipment

- Mechanics tools
- Borescope

Frequency

- During 100-hour/Annual inspection
- If oil consumption is excessive
- After an engine overspeed incident
- Whenever an anomaly is suspected

WARNING

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

Take preventive measures to avoid burns when performing a Cylinder Borescope Inspection on a hot engine.

Procedure

1. Remove the engine cowling as necessary to gain access to the top spark plugs.
2. Remove the top spark plug from each cylinder.



3. Position the piston at bottom dead center on the power stroke. The exhaust valve will be open with the piston in this position.
4. Insert the borescope probe through the upper spark plug hole and inspect the internal surfaces of each cylinder, including the exhaust valve and exhaust valve seat.
5. Position the piston at bottom dead center at the end of the intake stroke.
6. Insert the borescope through the upper spark plug hole and inspect the intake valve and valve seat. Use Table 6-22 and Figure 6-67 through Figure 6-70 to interpret inspection findings.

Table 6-22. Borescope Inspection Objectives and Corrective Actions

Inspection Item	Objective	If Abnormality Noted
Combustion Chamber	Inspect: •Valve seat inserts for erosion, burning •Spark plug heli-coils for protrusion into combustion chamber •Heavy carbon deposits/presence of excessive oil	Remove cylinder for repair
Exhaust Valve Face	Inspect for signs of leakage or damage indicated by: •Localized discoloration on the valve face circumference (Figure 6-68) •Minute cracks •Erosion (missing material)	Repair or replace cylinder
Intake Valve Face	Inspect for signs of leakage or damage indicated by: •Localized discoloration on the valve face circumference •Erosion (missing material)	Repair or replace cylinder
Cylinder Bore	Inspect exposed surface of bore for: •Heavy scoring/piston rub (Figure 6-71) •Piston pin rub (wide band pattern in horizontal plane at 3 o'clock and/or 9 o'clock position)	Repair or replace cylinder
	Corrosion (Figure 6-70) ¹ Excessive oil in cylinder/heavy deposits of carbon in combustion chamber	Remove cylinder for repair
	Upper portion of cylinder bore has no visible hone pattern (Figure 6-72) and (Figure 6-73)	Normal indication for in service cylinders
Piston Head	Inspect for: •Piston crown for erosion, missing material •Visible damage from foreign debris	Remove cylinder for repair

1. Remove cylinder for repair or replacement. Perform complete inspection of connecting rod bushing for correct installation and finishing.



Figure 6-67. Normal Combustion Chamber

Exhaust valve has reddish deposit in center with dark outer edge. Intake valve has light brown combustion deposits. Combustion chamber has light brown deposits.



Figure 6-68. Burned Exhaust Valve

Note the edge of valve face has lost all combustion residue with striations moving toward center of valve.



Figure 6-69. Phosphate-Coated Cylinder w/ Revised Hone Pattern

Phosphate coating provides increased corrosion protection during initial hours of engine operation.



Figure 6-70. Phosphated Cylinder Bore

Phosphate coating in valleys of the cylinder bore hone pattern. Light corrosion at top of cylinder bore, above piston ring travel limit in this area is normal.

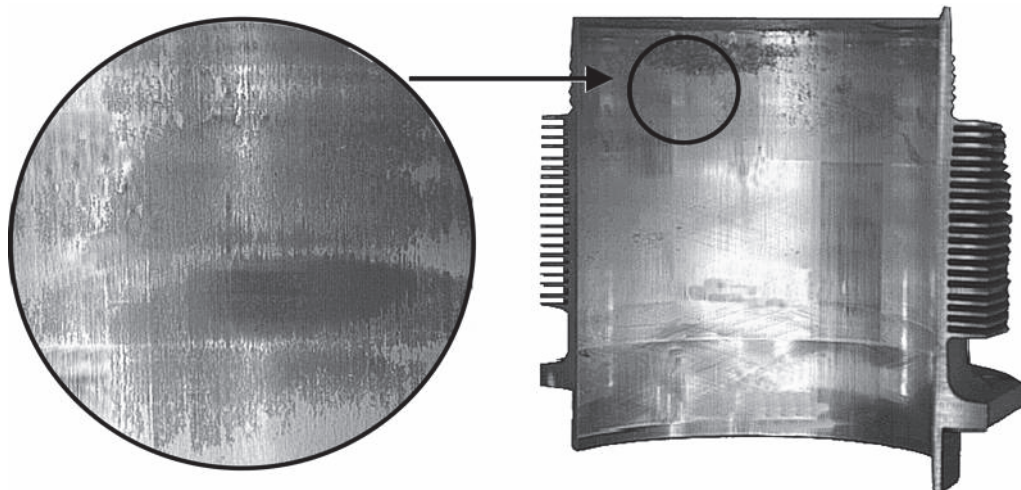


Figure 6-71. Cylinder Barrel Scoring and Piston Rub

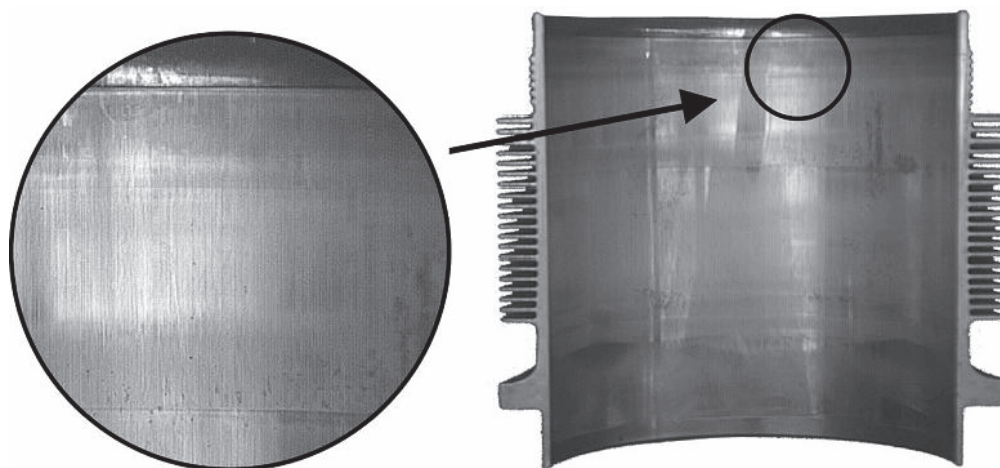


Figure 6-72. Typical Wear in Upper Ring Travel

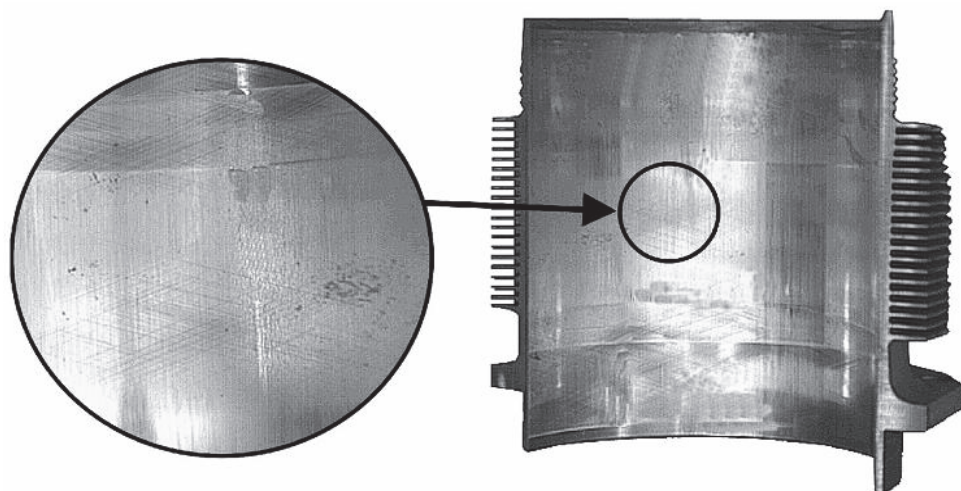


Figure 6-73. Typical Cylinder Wear