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MANDATORY

SERVICE BULLETIN

DATE: December 1, 1997 Service Bulletin No. 505B (Supersedes
Service Bulletin No. 505A) Engineering
Aspects are FAA Approved

SUBJECT: Inspection of Crankshaft I.D. for Corrosion

MODELS AFFECTED: The following Textron Lycoming four cylinder engines which utilize fixed pitch propellers except those installed in rotary wing aircraft or new engines shipped after February 15, 1997:

All 320 series engines; and
All 180 horsepower, 360 series engines except the O-360-A4A, -A4D, A4G, -A4J, -A4K, -A4M, -A4N, -A4P -C4F, -C4P, IO-360-L2A and AEIO-360-B4A engine models.

TIME OF COMPLIANCE: **Uncoated Crankshafts (no "PID" stamped on flange OD, see Figure 1)**

A. Initial Inspections:

For new, rebuilt and overhauled engines shipped from Textron Lycoming prior to and including 1984, the initial inspection must be conducted within the next 200 hours of operation or 1 year from date of this Service Bulletin, whichever occurs first.

For new, rebuilt and overhauled engines shipped from Textron Lycoming after 1984, the initial inspection must be conducted at the next overhaul or engine disassembly or within 10 years of the original ship date, whichever comes first.

B. Subsequent Inspections:

1. Serviceable Crankshaft having no corrosion pits.

The inspection must be repeated at each engine disassembly until overhaul and the time interval between each inspection must not exceed 5 years.

2. Pitted Crankshafts.

Fluorescent Penetrant Inspections are required every 100 hours of operation or each year whichever occurs first until the crankshaft is replaced at overhaul or earlier at the owner's discretion, not to exceed 12 years.

As more experience has been gained with aging engines, it is obvious that calendar time and frequency of use are important factors of service life. With age, the effects of corrosion can result in structural problems for engine components. Reports of crankshaft breakage originating from corrosion pits on the inside wall immediately aft of the pilot diameter have been received for fixed pitch propeller aircraft. To preclude the occurrence, this area must be inspected in the manner specified in Section I.



SECTION I. CRANKSHAFT ID INSPECTION.**NOTE**

Magnaflux inspection should be performed whenever a crankshaft is removed from an engine.

- a. Remove the propeller in accordance with the manufacturer's instructions.
- b. Remove expansion plug (P/N STD-1211) (if installed) from end of crankshaft by piercing a 1/8" to 3/16" hole in center of plug.
- c. Measuring in from the crankshaft end, clean the first 3.50 inches of the inside crankshaft wall behind the expansion plug seat.
- d. Remove surface corrosion using a suitable tool which will follow the existing contour of the I.D. and fine abrasive cloth (see Figure 1). Prior to removing the corrosion, precaution must be taken to ensure that the material removed cannot contaminate the engine.

CAUTION

SURFACE CORROSION MUST BE REMOVED UNIFORMLY FROM THE CRANKSHAFT I.D. BUT THE I.D. CANNOT EXCEED 1.910 INCHES.

NOTE

Crankshafts with I.D. of 1.910 inches can only be cleaned with Scotchbrite or an equivalent. No additional material may be removed.

- e. Make a visual inspection from the crankshaft flange inward using a flashlight and magnifying glass (power 4x). A small, right angle, dental examination mirror might be helpful. The above defined area should be clear of pit marks and corrosion.
- f. If during visual inspection any pitting resulting from corrosion is found, the crankshaft must be removed from service immediately or subjected to FPI according to Section II of this Service Bulletin on page 3. Removal of corrosion results in a clean surface that may have an irregular appearance indicated by slight waviness. This condition is deemed acceptable provided the maximum allowable diameter has not been exceeded. Pitting is characterized by holes or fissures of indeterminate depth and direction.

CAUTION

DO NOT ATTEMPT TO REMOVE PITS FROM THE SHAFT BY REMOVING MATERIAL IN LOCAL AREAS. THIS MAY CAUSE STRESS RISERS AND PROMOTE BREAKAGE. APPLYING A PROTECTIVE COATING OVER THE PITTING CONDITION WILL NOT IMPROVE THE STRUCTURAL INTEGRITY OF THE PART NOR ARREST THE PITTING GROWTH.

Textron Lycoming will not assume any warranty or liability in the event a pitted shaft is placed in service without FPI according to Section II. In addition, Textron Lycoming will assume no responsibility for parts which have been reworked by any other entity not in accordance with this Service Bulletin.

Crankshafts which exhibit the above described pitting on the I.D. may be exchanged for a new crankshaft at a special reduced rate. Contact a Textron Lycoming distributor for this price and to arrange the return of the unserviceable crankshaft.

- g. Install new expansion plug (P/N STD-1211) (if removed). Refer to Overhaul Manual, Paragraph 7-62.

- h. Reinstall the propeller in accordance with the manufacturer's instructions.
- i. Run the engine and inspect for leakage at the expansion plug.
- j. Make appropriate log book entries after each inspection.

SECTION II. FLUORESCENT PENETRANT INSPECTION.

An engine, having corrosion pits may be returned to service without disassembly provided an FPI confirms the bore to be crack free. This FPI must be repeated every 100 hours of operation or annually until the crankshaft is replaced at overhaul or earlier at the owner's discretion, not to exceed 12 years.

The process and material utilized for the FPI must comply with the classification contained in MIL-I-25135. The FPI must be fluorescent solvent removable (Method C) utilizing a Type 1 penetrant system with a penetrant sensitivity Level 3 or higher and a Form D-Nonaqueous Developer. Spray containers of the material are acceptable for this inspection. An individual having a mechanic certificate with at least an Airframe or Powerplant Rating who has the capability to perform the FPI inspection method is authorized to perform the FPI inspection. This FPI process involves the removal of penetrant material from the inspection surface. To ensure that contaminants from the cleaning process and the FPI do not enter the engine oil supply, block off the area of the crankshaft bore that is aft of the area being inspected by using a clean, dry, lint-free cloth. When the FPI is completed remove the lint-free cloth from the crankshaft bore before installing the front crankshaft plug. The FPI must be performed using the following steps:

- a. The crankshaft bore surface must be cleaned of visible corrosion prior to the FPI process using Scotchbrite or an equivalent material. Metal-removing processes must not be used for visible corrosion cleaning. In addition, clean all surfaces to be inspected utilizing a cleaner, such as Magnaflux Spot Check Cleaner/Remover SKC-S or equivalent, on the ID of the crankshaft bore. Let the cleaner/remover dry for 5 minutes minimum. Wipe clean with a lint-free cloth.
- b. Spray penetrant, such as ZYGLO ZL-27A Magnaflux Corp. or equivalent Type 1 with a penetrant sensitivity Level 3 or higher, on the ID bore.
- c. Allow a minimum of 10 minutes dwell. For dwell times exceeding 60 minutes the penetrant shall be reapplied to prevent drying.
- d. Remove all bulk surface penetrant by wiping with a clean, dry lint-free cloth. Make a single wipe and then fold the cloth to provide a clean surface for succeeding wipes.
 - (1) After the bulk of the surface penetrant has been removed, lightly moisten a fresh lint-free cloth with cleaner/remover and again wipe the surface. The cloth must not be saturated and the inspection surface must not be flooded with solvent. Excessive solvent will wash penetrant from defects.
 - (2) During wiping, the inspection surface shall be illuminated with black light. Repeat the solvent wipe as necessary until no residual trace of penetrant remains on the inspection surface.
- e. Following the cleaner/remover wipe, wait five minutes and then apply nonaqueous developer by spraying a developer, such as Magnaflux Spot Check Developer ZP-9F or Form D-Nonaqueous equivalent, on the ID bore. Apply a thin uniform layer to the bore surface. The optimum coating thickness is indicated by the visibility of the part surface. If the metallic luster cannot be seen the developer is too thick.
- f. Developer dwell is required to allow the developer time to draw entrapped penetrant from any small defects. The minimum development time shall be 10 minutes. The maximum dwell time for nonaqueous developer shall be 60 minutes.

g. Inspection shall be performed within the allotted dwell time. Components that are not inspected within the allotted dwell time must be reprocessed.

(1) Examine crankshaft bore in a darkened enclosure under ultraviolet (black) light. Allow 1 minute for eyes to adapt to darkened environment prior to inspecting crankshaft bore. Use of photochromic lenses or permanent darkened lenses is prohibited.

NOTE

The black light used for inspection must have an intensity of 1000 microwatts/cm² measured at a distance of at least 15 inches (38 cm) from the front of the bulb or filter.

(2) During inspection make sure that the black light intensity is a minimum of 1200 microwatts/cm² at the bore surface. This can be accomplished by positioning the black light as close as necessary to the bore to achieve 1200 microwatts/cm². White light background shall not exceed 20 lx/m² (2 foot-candles). A photographic light meter may be used to determine the white light background reading.

(3) Crankshaft bores having no crack indications are acceptable.

(4) Magnification (10 x maximum) and/or white light may be used to determine discontinuity type. Indications, on parts exhibiting fluorescent background which interferes with evaluation of questionable indications, shall be evaluated as follows:

(a) Lightly wipe the area once with a soft brush or cotton swab applicator dampened with ethyl alcohol, Do not permit alcohol to flood the surface.

(b) After the alcohol evaporates from the surface, reinspect. If an indication reappears, evaluate it immediately. If the indication does not reappear, reapply developer. The redevelopment time shall equal the original development time. Thereafter, reinspect.

h. After inspection, clean residual penetrants and developers from the crankshaft bore. Remove the lint-free cloth from the crankshaft bore prior to installing front crankshaft plug. Failure to do so may result in oil restriction within the engine and in turn cause engine failure.

i. Install new expansion plug (P/N STD-1211) (if removed). Refer to Overhaul Manual, Paragraph 7-62.

j. Reinstall the propeller in accordance with the manufacturer's instructions.

k. Run the engine and inspect for oil leaks at the expansion plug.

l. Make appropriate log book entries after each inspection.

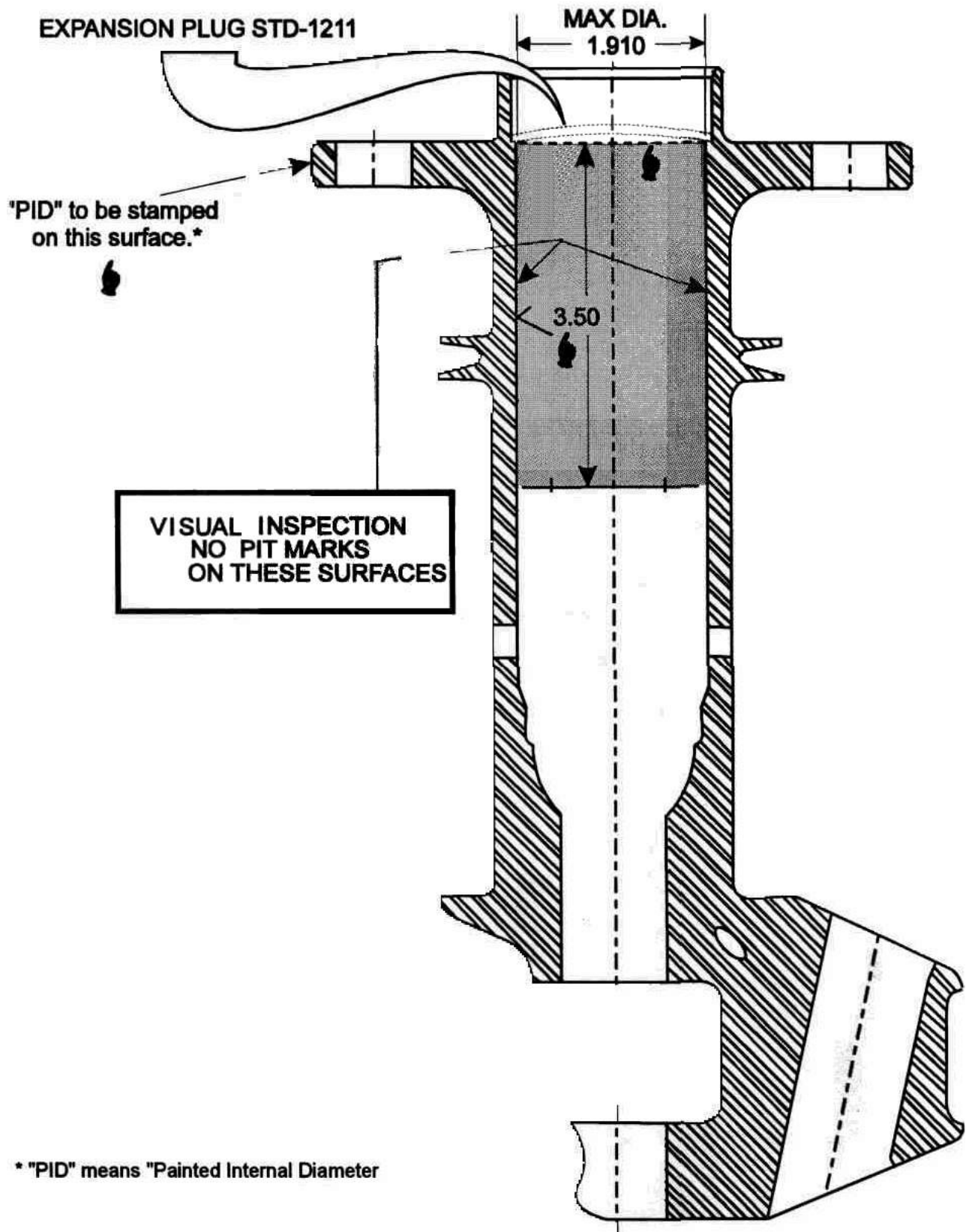


Figure 1. Area to be Inspected