

SERVICE BULLETIN

Compliance Will Enhance Safety, Maintenance or Economy of Operation

SB97-6B**FAA APPROVED**Supersedes M87-11 REV. 2,
SB97-6, 6A**SUBJECT:** MANDATORY REPLACEMENT PARTS**PURPOSE:** TO IDENTIFY ITEMS TO BE REPLACED DURING MAINTENANCE,
PREVENTATIVE MAINTENANCE AND OVERHAUL**COMPLIANCE:** DURING MAINTENANCE, PREVENTATIVE MAINTENANCE AND
OVERHAUL**MODELS AFFECTED:** ALL MODELS

During any maintenance or preventive maintenance of engine or components, replace all removed gaskets, seals, packings, hoses, "O" rings, cotter pins, retaining rings (snap rings), safety wire, self locking fasteners (including exhaust and connecting rod nuts) and lock washers with new parts.

Engine mounted accessories must be maintained in accordance with the manufacturer's instructions. All accessories must be overhauled at engine overhaul, or more frequently, in accordance with the manufacturer's instructions.

Items such as spark plugs, alternator drive belts and air-conditioning drive belts must be replaced on condition.

Do not re-use any fasteners that are worn, damaged or deformed. Do not replate any cadmium plated fasteners or washers. If the cadmium plating has been removed discard the item and replace it with a new part.

At engine overhaul the starter, starter adapter, alternator, magnetos, and engine fuel system must be replaced with New, Factory Rebuilt or FAA approved overhauled units. On turbocharged engines, the turbocharger, wastegate, all controllers, bypass valve and exhaust system must be replaced with New, Factory Rebuilt or FAA approved overhauled units. All engine baffles must be repaired or replaced and all flexible baffle seal replaced.

NOTE....Service bulletins published or revised subsequent to the issuance of this service bulletin may mandate the replacement of components and parts not included in this service bulletin. As such,

at engine overhaul the technician must review all service bulletins to insure compliance with the manufacturer's requirements for continued airworthiness.

In addition to the previously listed items, at engine overhaul the following parts must be discarded and replaced with **new parts**.

1. Bearings: connecting rod, crankshaft main and thrust, needle, ball, and roller
2. Bushings: rocker arm, connecting rod, counter weight and crankshaft counterweight blade
3. Counterweight pins, retaining plates and snap rings
4. All connecting rod bolts and nuts
5. Connecting rod forging number 626119, TCM P/N's 646320 and 646321 with beam width less than .625 inches. Reference TCM CSB96-13.
6. Camshaft gear bolts
7. Crankshaft gear bolts
8. Crankshaft alternator face gear bolts and lock plates
9. Woodruff keys
10. Magneto and Alternator rubber drive bushings
11. Exhaust valves
12. Exhaust valve rotocoils
13. Replace all intake valve rotocoils with new rotocoils or solid spring retainers as listed in number 14. following.

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14. Replace intake valve rotocoils with solid valve spring retainers on all E-series, O-470, IO-470, IO-520 / 550, TSIO-520 / 550 TSIOL-550 and GTSIO-520 engines.
15. Intake and exhaust valve keepers
16. Inner and outer valve springs
17. Piston pins
18. Piston rings
19. Pistons
20. Rocker shafts
21. Rocker shaft thrust washers
22. Crankcase through bolts
23. Cylinder deck stud nuts and through bolt nuts
24. Exhaust clamps (Turbocharged engines)
25. Cold Start primer diverter valves
26. Fuel pump drive coupling P/N 631263 must be replaced with 653359 , or subsequent part number drive coupling in accordance with TCM Mandatory Service Bulletin MSB 95-6 or latest revision
27. Crankshaft gear 536421 or 653631 must be replaced with 657175 or subsequent part number crankshaft gear in all SANDCAST applications; O470, IO470,TSIO470, IO520,LIO520, L/TSIO520, IO550and IOF550 engines.
28. Camshaft gear part numbers; 537432, 631845, 655430, 655516 and 656031 must be replaced at overhaul with 656818 or subsequent part number
29. Turbocharger oil supply and return check valves
30. Replace 360 series engine oil suction screens part numbers 649470, 649471, 652669, 652670 with current part number. Reference TCM Service Bulletin SB96-4.
31. Replace C-125, C-145 and O-300 series engine oil suction screen part number 633272 with current part number. Reference TCM Service Bulletin SB96-4.
32. O-300, IO-360, TSIO-360 and LTSIO-360 oil pump gears in accordance with TCM Service Bulletin SB 96-4 and CSB 96-5 or latest revision
33. Ignition system harness

All GTSIO520 starter adapter assemblies must be replaced at overhaul and/or on condition as instructed in MSB94-4 or latest revision and AD 2005-20-04. Replace with New or Factory Rebuilt starter adapter assemblies EQ6642 or current part number. It is recommended that a New or Factory Rebuilt replacement EQ6642 kit be installed during any SB96-11B (or current revision), Prop Strike/Sudden/Stoppage inspection. Replace all 631810 counterweights with 652833 at overhaul. 631810 are to be not to be reused, regardless of condition. (See current revision of SB00-3)

GTSIO-520; All EQ 6642 starter adapter assemblies both New and Factory rebuilt include New Torsional Damper, starter adapter shaftgear and crankshaft gear.

During overhaul, all hydraulic lifters (tappets) must be replaced with New or Factory Rebuilt lifters (tappets).

AFFECTED PUBLICATIONS: Make the appropriate annotations to applicable manuals to call attention to this service bulletin.

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SERVICE BULLETIN**Compliance Will Enhance Safety**

Category 3

SB05-8**Technical Portions
FAA Approved****SUBJECT: IMPROVED CAMSHAFT GEAR P/N 656818****PURPOSE:** To announce the production of an improved camshaft gear P/N 656818 which will supersede the current gear P/N 656031**COMPLIANCE:** At next engine overhaul or at camshaft gear replacement.**MODELS****AFFECTED:** IO-470-U,V; IO-520-Series; TSIO-520-Series; IO-550-Series; IOF-550-Series; TSIO-550-Series; TSIOL-550-Series**GENERAL**

As part of our ongoing product improvement initiative, Teledyne Continental Motors has released for production an improved camshaft gear, P/N 656818, for the above listed engines. The new camshaft gear will supersede the current production camshaft gear P/N 656031. TCM recommends that the new gear be incorporated at the next engine overhaul or whenever replacement of the camshaft gear is required.

The P/N 656818 camshaft gear is nominally 0.060" wider than the P/N 656031 camshaft gear. On engine models utilizing the Sandcast style of crankcase, the P/N 656818 camshaft gear may be installed as a direct replacement for the P/N 656031 camshaft gear. On engine models utilizing the Permold style of crankcase, modification of the starter adapter bearing boss is required to provide clearance for the wider camshaft gear.

NOTE . . . On Sandcast crankcase installations clearance must be verified between the new P/N 656818 camshaft gear and the oil gallery plug located directly below the starter adapter boss. (Reference figure 4.)

PERMOLD CRANKCASE MODIFICATION

The Permold style of crankcase must be modified to allow use of the new, thicker camshaft gear. A clearance cut is made in the starter drive bearing boss in accordance with the dimensions shown in Figure 3. TCM recommends that a properly certified repair station machine the required clearance.

CAUTION... Installation of the new P/N 656818 gear in an unmodified permold style crankcase will result in damage to the gear and/or the crankcase

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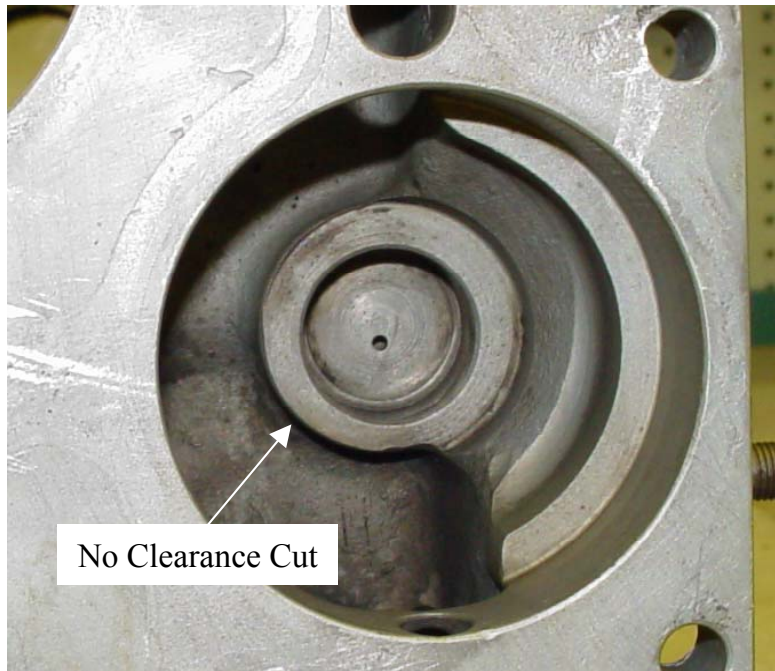


Figure 1. Un-Modified Permold Crankcase

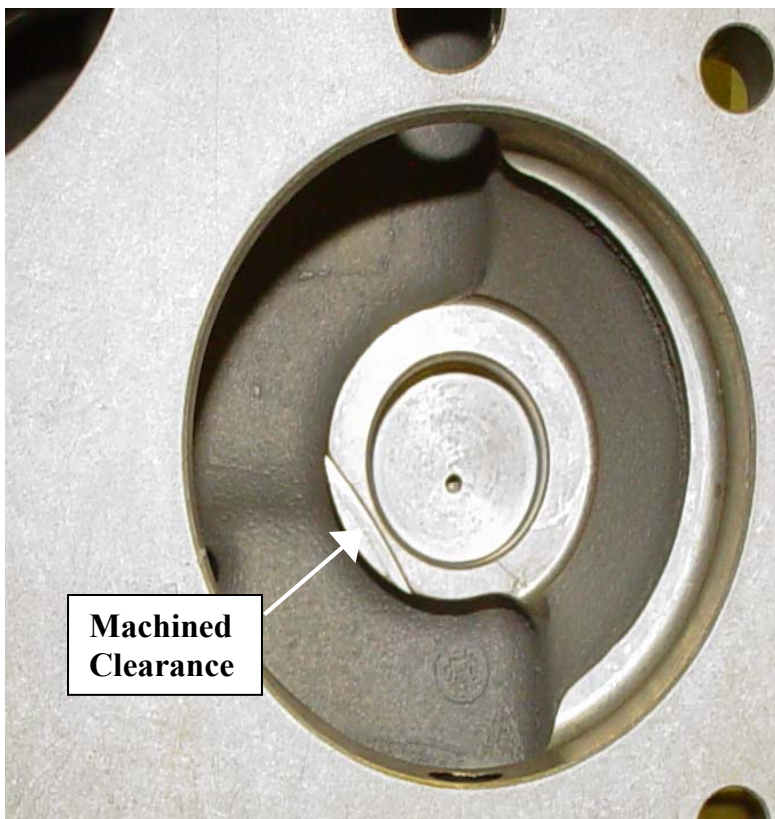


Figure 2. Modified Permold Crankcase

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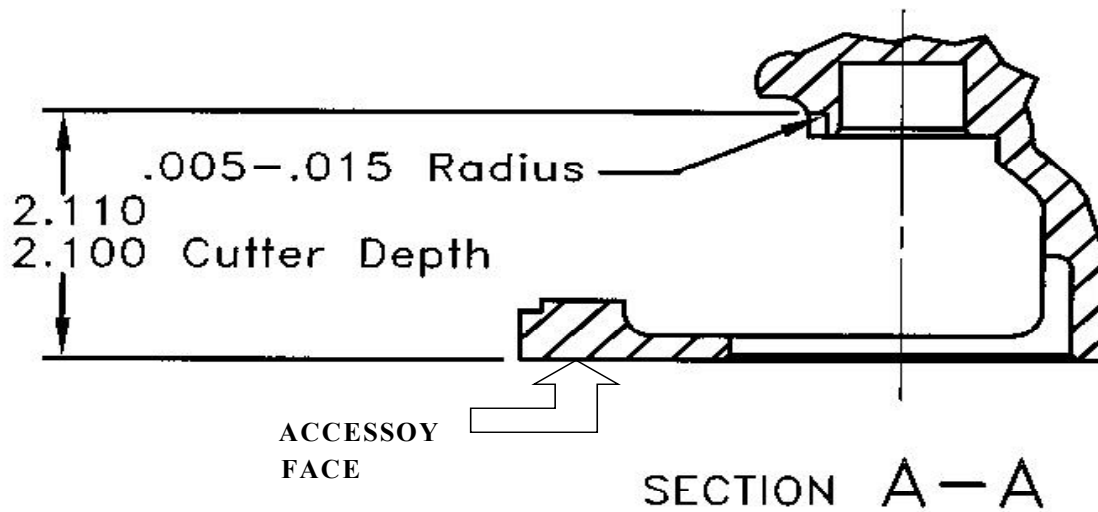
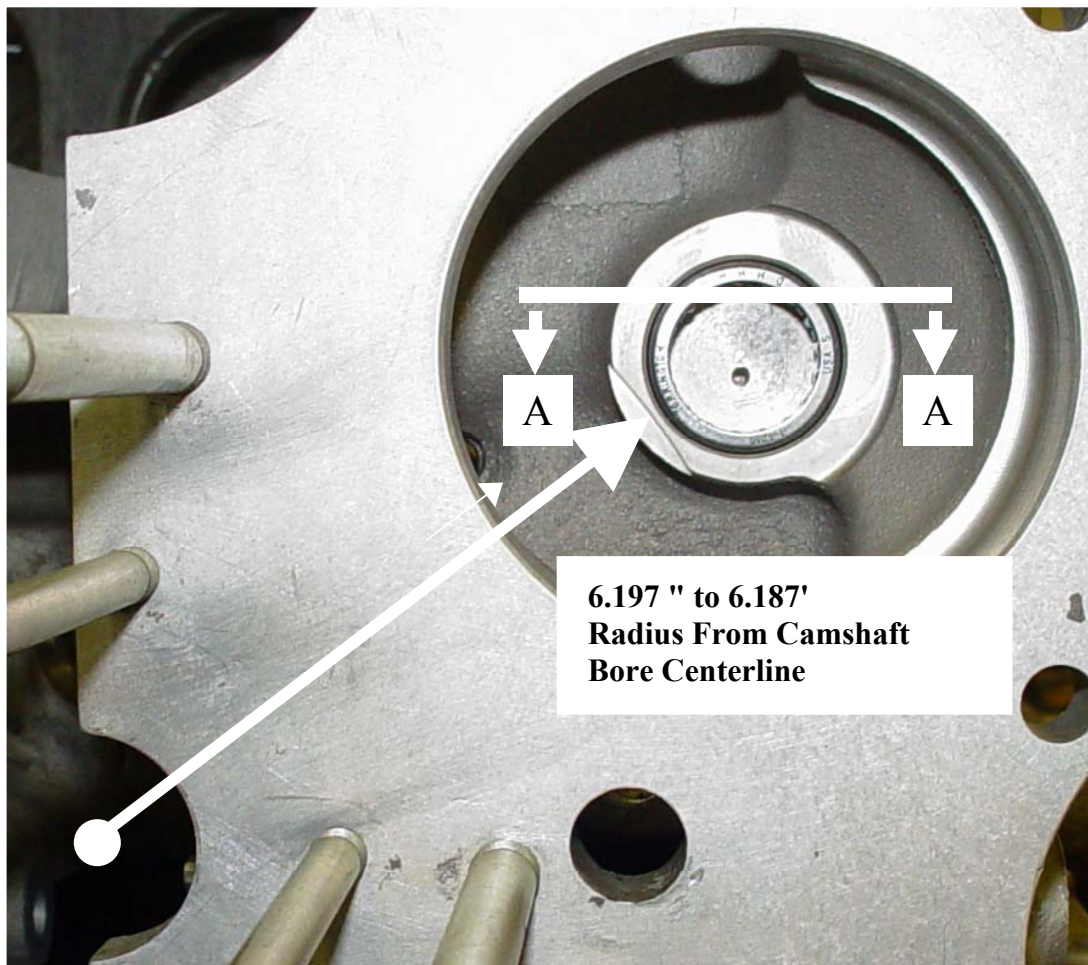


Figure 3. Permold Crankcase Modification

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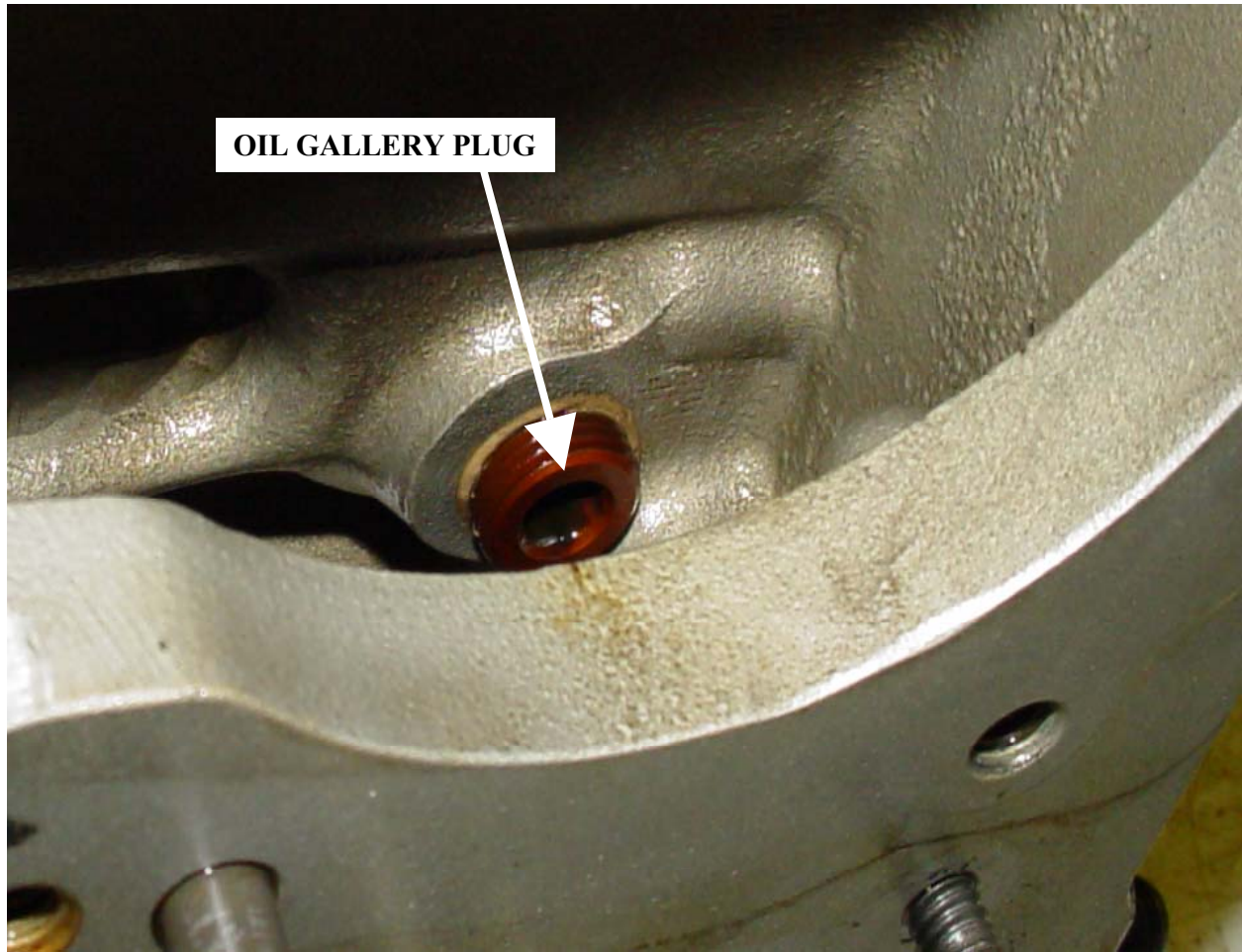


Figure 4. Inspect For Clearance Between The Camshaft Gear And The End Of The Oil Gallery Plug (Where Indicated).

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SERVICE BULLETIN**Compliance Will Enhance Safety**

Category 3

SB05-8A

Supersedes SB05-8

Technical Portions FAA**Approved****SUBJECT: IMPROVED CAMSHAFT GEAR P/N 656818****PURPOSE:** To announce the production of an improved camshaft gear P/N 656818 which supersedes the current camshaft gear P/N 656031**COMPLIANCE:** At next engine overhaul or at camshaft gear replacement.**MODELS AFFECTED:** IO-470-U,V; IO-520-Series; TSIO-520-Series; IO-550-Series; IOF-550-Series; TSIO-550-Series; TSIOL-550-Series

GENERAL

As part of our ongoing product improvement initiative, Teledyne Continental Motors has released for production an improved camshaft gear, P/N 656818, for the above listed engines. The new camshaft gear will supersede the current production camshaft gear P/N 656031. TCM recommends that the new gear be incorporated at the next engine overhaul or whenever replacement of the camshaft gear is required.

The P/N 656818 camshaft gear is nominally 0.060" wider than the P/N 656031 camshaft gear. On engine models utilizing the Sandcast style crankcase, the P/N 656818 camshaft gear may be installed as a direct replacement for the P/N 656031 camshaft gear. On engine models utilizing the Permold style crankcase, modification of the starter adapter shaftgear bearing boss is required to provide clearance for the wider camshaft gear.

NOTE... On Sandcast crankcase installations clearance must be verified between the new P/N 656818 camshaft gear and the oil gallery plug located directly below the starter adapter boss.
(Reference figure 4.)

PERMOLD CRANKCASE MODIFICATION

The Permold style of crankcase must be modified to allow use of the new, thicker camshaft gear. A clearance cut is made in the starter drive bearing boss in accordance with the dimensions shown in Figure 3. TCM recommends that a properly certified repair station machine the required clearance.

CAUTION... *Installation of the new P/N 656818 gear in an unmodified permold style crankcase will result in damage to the gear and/or the crankcase*

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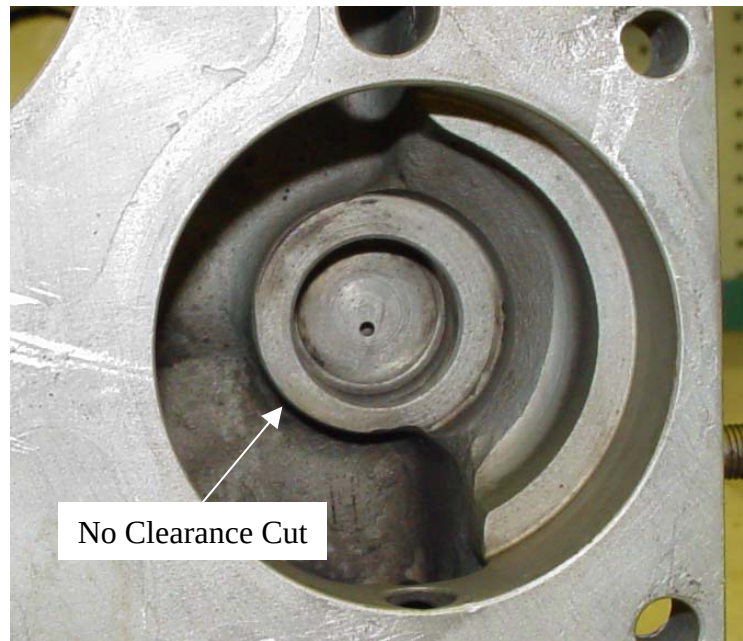


FIGURE 1
UN-MODIFIED PERMOLD CRANKCASE

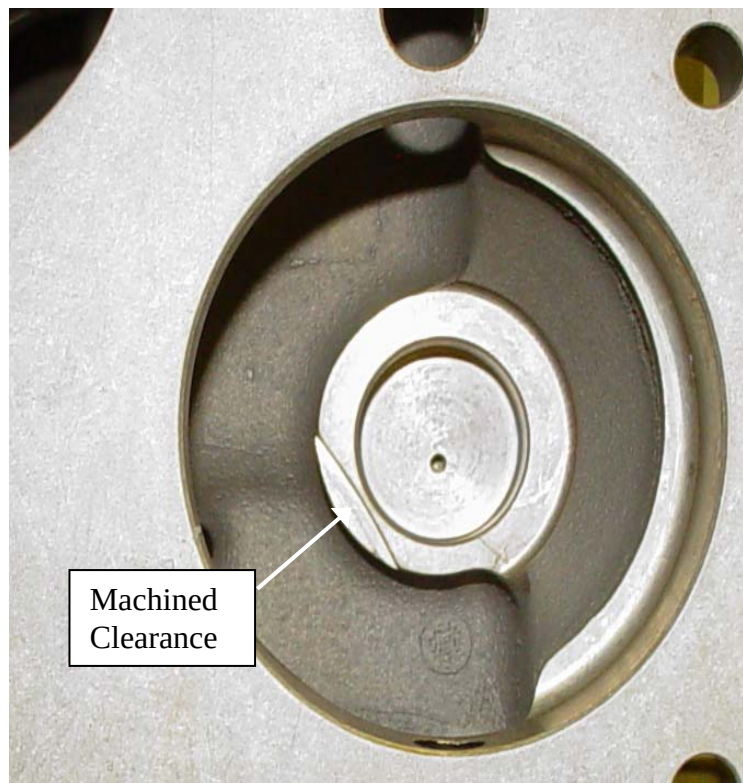


FIGURE 2
MODIFIED PERMOLD CRANKCASE

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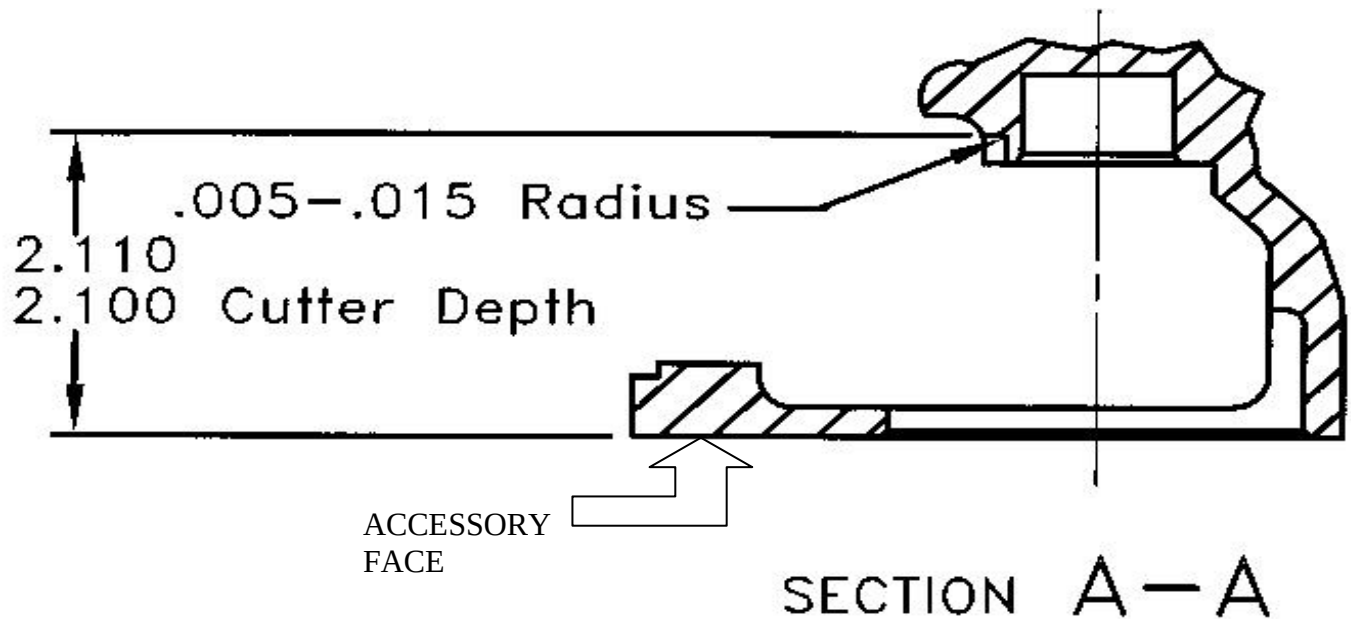
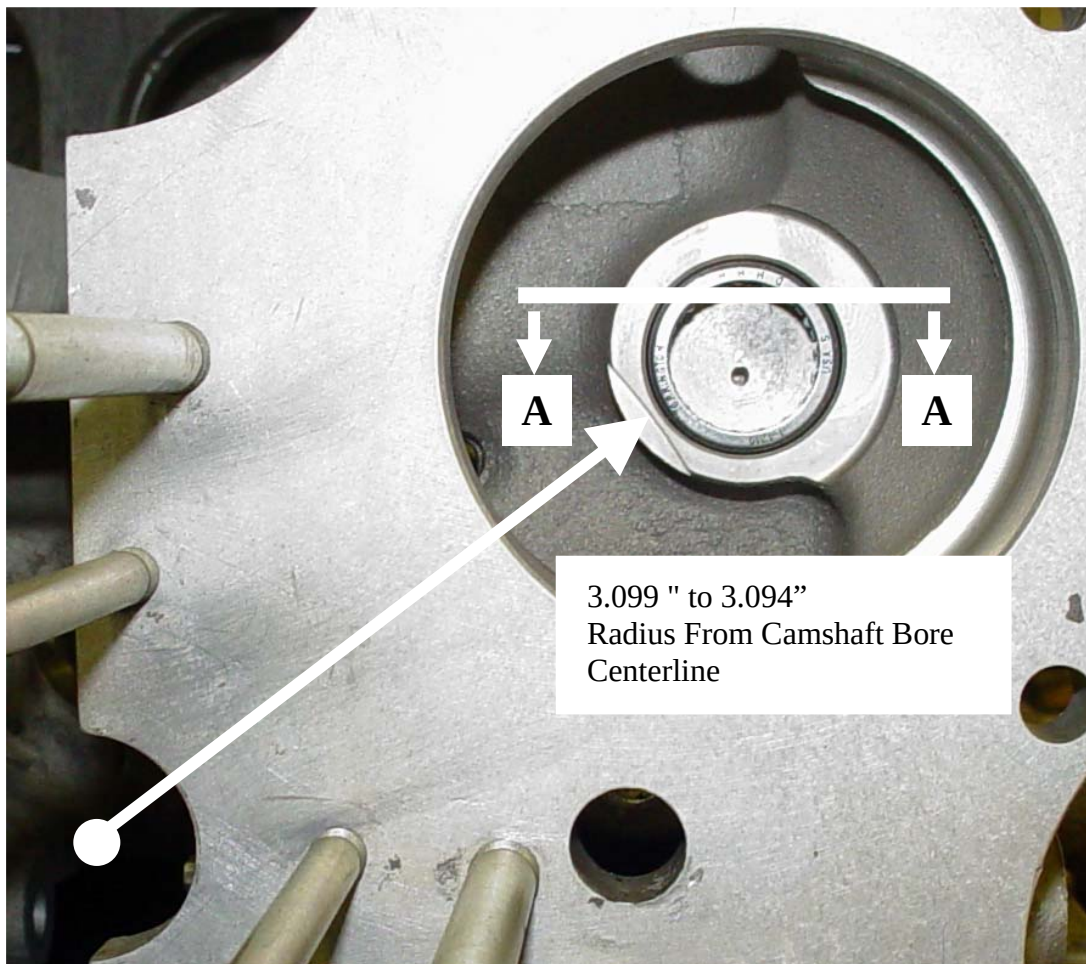


FIGURE 3
PERMOLD CRANKCASE MODIFICATION

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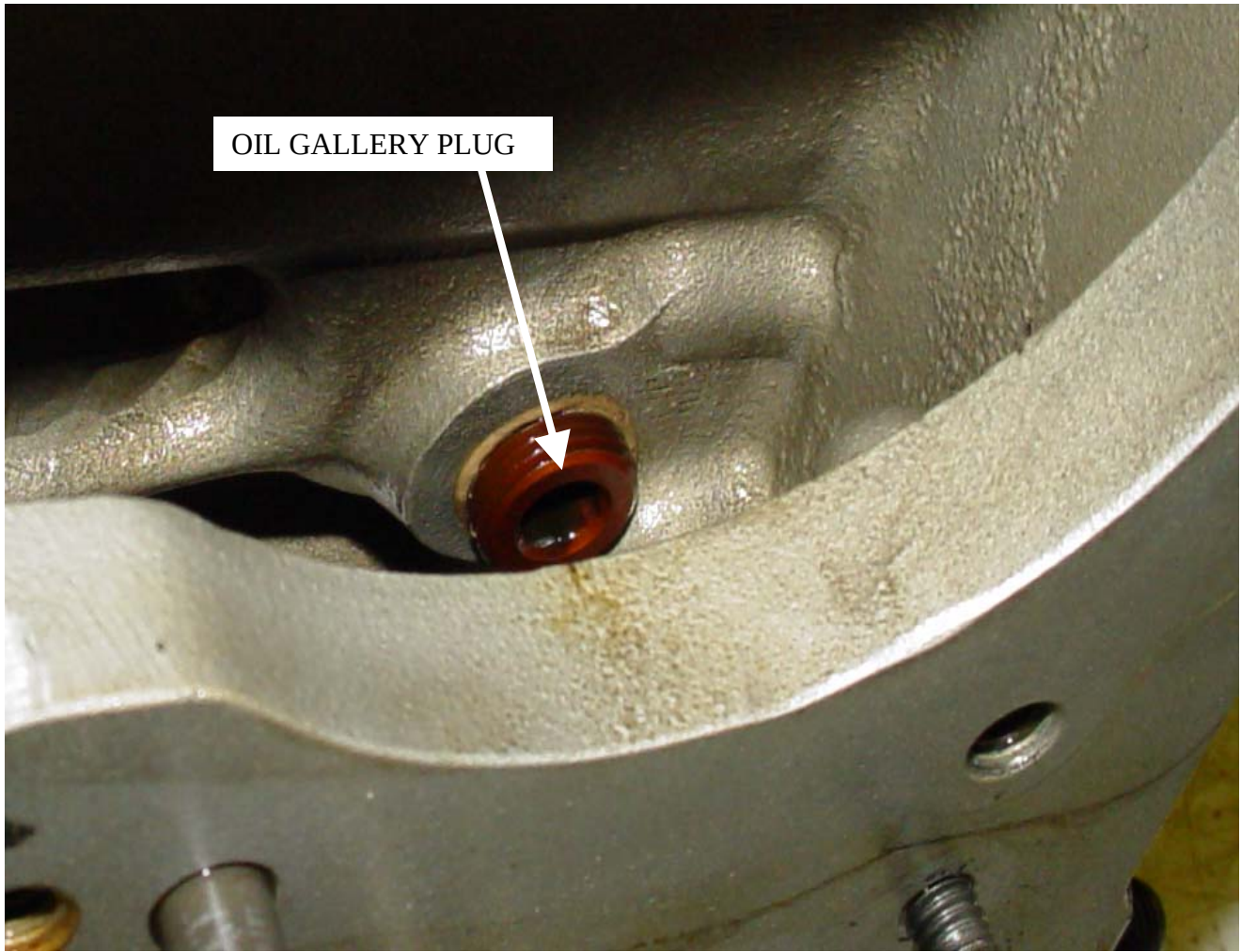


FIGURE 4
INSTALL CAMSHAFT IN CRANKCASE HALF
INSPECT FOR MINIMUM OF .030 CLEARANCE BETWEEN THE CAMSHAFT
GEAR AND THE END OF THE OIL GALLERY PLUG (WHERE INDICATED).

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CONTINENTAL MOTORS® AIRCRAFT ENGINE
MANDATORY SERVICE BULLETIN

CATEGORY 1
MSB05-8B

Subject Matter of This Document may be Incorporated, in Whole or in Part, in
an FAA Issued Airworthiness Directive

Supersedes SB05-8A
TECHNICAL PORTIONS
FAA APPROVED

SUBJECT: Camshaft Gear, Part Number 656818

PURPOSE: Announce release of improved camshaft gear Part Number 656818 and clarifies part number superseding action

COMPLIANCE: Within 100-hours of operation, at the next engine overhaul (not to exceed 12 years engine time in service), or whenever camshaft gear is accessible, whichever occurs first.

MODELS

AFFECTED: IO-470-U, V; IO-520-A, B, BA, BB, C, CB, D, E, F, J, K, L, M, MB, N, NB, P, R; L/TSIO-520-ALL; LIO-520-P; IO-550-A, B, C, D, E, F, G, L, N, P, R; IOF-550-B, C, D, E, F, L, N, P, R; TSIO-550-A, B, C, E; TSIOL-550-A, B, C

I. GENERAL INFORMATION

In 2005, camshaft gear, Part No. 656818, was released as a product improvement for the above listed engines. Service Bulletin SB05-8 was written to identify not only the availability of the new part (P/N 656818), but also provided a required Permold crankcase modification to eliminate interference with the new thicker camshaft gear.

Service Bulletin SB05-8 and revision SB05-8A recommended the new camshaft gear (P/N 656818) be incorporated at the next engine overhaul or whenever replacement of the camshaft gear was required for camshaft gear P/Ns 631845, 655430, 655516, or 656031. This service document revision *promotes the Service Bulletin (Category 3) to a Mandatory Service Bulletin (Category 1)*.

II. SCOPE

Replace the camshaft gear on all engines currently configured with camshaft gear P/Ns 631845, 655430, 655516, or 656031 within 100-hours of operation, at the next engine overhaul (not to exceed 12 years engine time in service), or whenever the camshaft gear is accessible, whichever occurs first, with camshaft gear P/N 656818.

III. SAFETY INTENT

Remove camshaft gear, P/N 655516, from service to eliminate possibility of gear tooth fracture and replace with camshaft gear, P/N 656818.

IV. CONFIGURATION DESCRIPTION

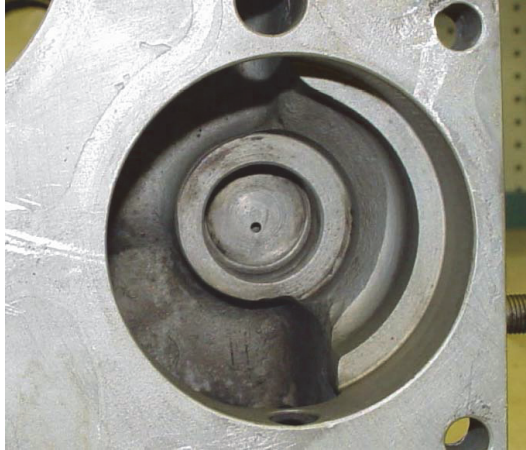
NOTE: Some instructions are identified as Required for Compliance (RC).
If this service bulletin is mandated by an airworthiness directive (AD), the steps identified as RC must be performed to comply with the AD.

RC-Replace camshaft gear, P/Ns 631845, 655430, 655516, or 656031 with camshaft gear, P/N 656818.

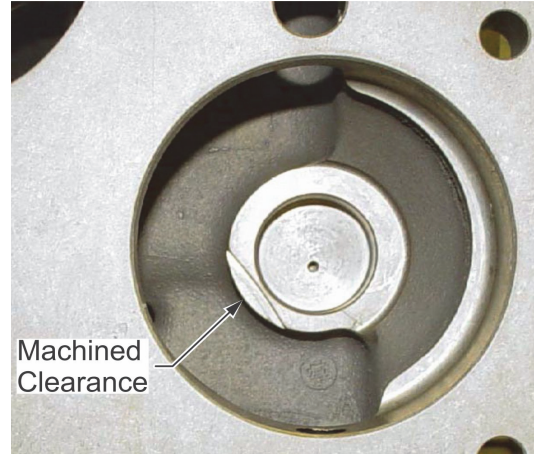
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V. ACTION REQUIRED

Camshaft gear, P/N 656818, is 0.060” thicker than the P/Ns 631845, 655430, 655516, or 656031 camshaft gears. The starter adapter bearing boss in Permold crankcases must be machined with a radius cut to provide clearance for the camshaft gear, P/N 656818. For engines with a Sandcast crankcase, the assembler must inspect the clearance between the new camshaft gear and the oil gallery plug installed in the rear of the crankcase below the starter adapter.



Before Modification



After Modification

Figure 1. 1-3-5 Permold Crankcase Half, Clearance Cut Modification

CAUTION: Installing the new camshaft gear, (P/N 656818) in an unmodified Permold crankcase will result in damage to the gear and crankcase.

This repair must be performed by an appropriately rated entity holding FAA authorization for Continental engine crankcase repair.

Within 100-hours of operation, at the next engine overhaul (not to exceed 12 years engine time in service), or whenever camshaft gear is accessible, whichever occurs first:

1. Disassemble the engine according to the instructions in the primary ICA.
2. During engine disassembly, inspect the camshaft gear to determine the part number.
 - a. Identify the camshaft gear part number. The camshaft gear part number is visible through the starter adapter mounting pad opening (reference Figure 2):
 - 1) Remove the starter adapter according to instructions in the primary ICA.
 - 2) Manually rotate the crankshaft until the camshaft gear part number becomes visible.
 - 3) Create a logbook entry identifying the camshaft gear part number.
 - b. If the camshaft gear is 631845, 655430, 655516, or 656031, discard the camshaft gear, regardless of condition, and reassemble the camshaft assembly with camshaft gear P/N 656818.

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Figure 2. Camshaft Gear Part Number Location, typical
(P/N is visible through the starter adapter mounting pad opening)

3. Inspect the applicable crankcase (Permold or Sandcast) according to the following steps below:
 - a. Permold Crankcase Modification:
 - 1) Inspect the bearing bore in the center of the starter adapter mounting pad. If a clearance cut (Figure 1) is present, crankcase modification has been complied with. If no clearance cut is present, send the 1-3-5 crankcase half to be machined according to the following instructions.

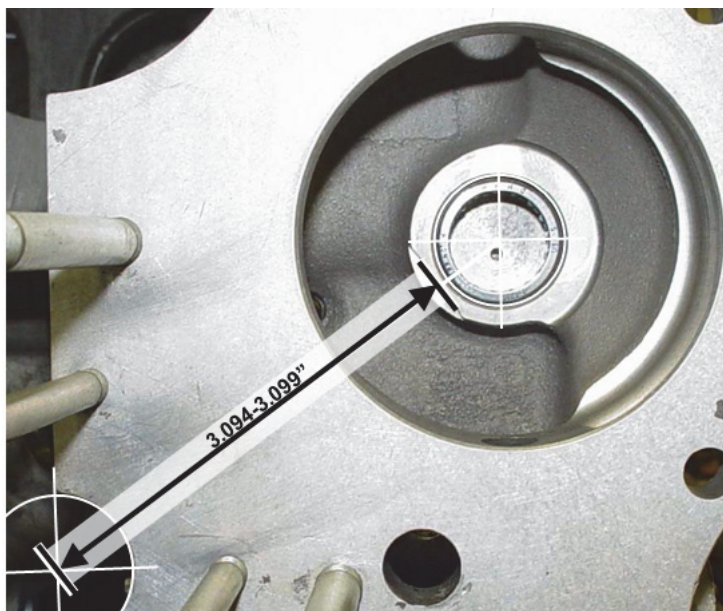


Figure 3. Radius Clearance Cut Distance from Camshaft Centerline

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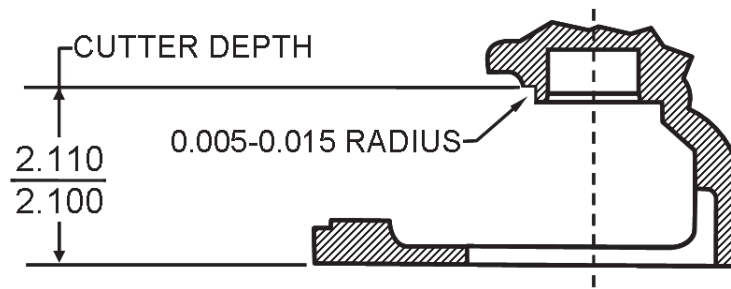


Figure 4. Overhead View of Radius Cut Depth

- a) Measure 3.094"- 3.099" from the camshaft bore centerline to the center of the starter drive bearing boss (Figure 3).
 - b) Cut a 0.005 - 0.015" radius in the outside edge of the starter drive bearing boss at a depth of 2.100 - 2.110" (Figure 4) from the accessory face (see step V. 3. a. 1).
- 2) Proceed with engine overhaul according to the instructions in the primary ICA.
- b. Sandcast Crankcase Inspection:
- 1) Install the camshaft, with camshaft gear 656818, in the crankcase gear according to the instructions in the primary ICA.

CAUTION: Inspect and ensure there is a minimum 0.030 clearance between the camshaft gear (P/N 656818) and the end of the oil gallery plug.

- 2) Measure the clearance between the oil gallery plug and the camshaft gear. If clearance is less than 0.030", remove the plug, clean the sealant residue from the crankcase and plug threads, and reinstall the plug to the maximum allowable torque specified in M-0, "Standard Practice Maintenance Manual," Appendix B and verify required minimum clearance.

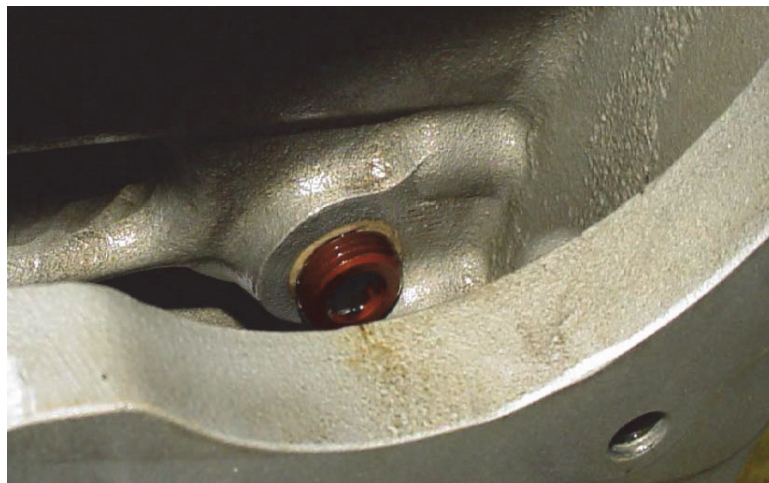


Figure 5. Lower Rear Oil Gallery (Control) Plug - Sandcast 1-3-5 Crankcase Half

- 3) Proceed with engine overhaul according to the instructions in the primary ICA.

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CONTINENTAL MOTORS® AIRCRAFT ENGINE
CRITICAL SERVICE BULLETIN

COMPLIANCE NECESSARY TO MAINTAIN SAFETY

CATEGORY 2
CSB05-8C

Supersedes MSB05-8B
TECHNICAL PORTIONS
FAA APPROVED

SUBJECT: Camshaft Gear (P/N 656818)

PURPOSE: To eliminate the possibility of camshaft gear tooth fracture, resulting in power loss or in-flight shutdown, and to inspect and remove from service P/Ns 631845, 655430, 655516, or 656031 and replace with camshaft gear, P/N 656818. This Service Document initially announced the release of improved camshaft gear P/N 656818 in 2005. It now clarifies part number superseding action and amplifies camshaft gear replacement instructions.

COMPLIANCE: Inspect at next 100-hour or Annual inspection (whichever is applicable based on type of operation or inspection requirements) or next maintenance event when the camshaft gear is made available (whichever comes first). Continue with recurring inspections every 100-hour/Annual inspection until superseded gears are replaced with camshaft gear, P/N 656818 no later than next overhaul.

MODELS

AFFECTED: Continental Motors (CMI) aviation gasoline (AvGas) engines - IO-470-U, V, VO; IO-520-A, B, BA, BB, C, CB, D, E, F, J, K, L, M, MB, N, NB, P, R; L/TSIO-520-ALL; LIO-520-P; IO-550-A, B, C, D, E, F, G, L, N, P, R; IOF-550-B, C, D, E, F, L, N, P, R; TSIO-550-A, B, C, E; TSIOL-550-A, B, C (see Section II for detail)

I. GENERAL INFORMATION

In 2005, camshaft gear, part number (P/N 656818), was released as a product improvement for the above listed engines. Service Bulletin SB05-8 was written to identify not only the availability of the new part (P/N 656818), but also provided a required Permold crankcase repair to eliminate interference with the new thicker camshaft gear.

Service Bulletin SB05-8 (originally issued 09 AUG 2005) and subsequent revision SB05-8A recommended the new camshaft gear (P/N 656818) be incorporated at the next engine overhaul or whenever replacement of the camshaft gear was required. Service Bulletin SB97-6B, "Mandatory Replacement Parts" (revised 18 NOV 2009) listed the camshaft gear (P/Ns 631845, 655430, 655516, or 656031) as a mandatory replacement item at overhaul with P/N 656818. This was also incorporated in the original M-0, "Standard Practice Maintenance Manual" (issued April 2016).

NOTE: Recommended TBO calendar limit for the affected engines is 12 years. Since the original SB05-8 recommending gear replacement was issued in 2005, and the gear was added to the list of MANDATORY REPLACEMENT PARTS in 2009, gear replacement and crankcase repairs should have occurred through attrition.

Per definitions contained in Chapter 1 of M-0, "Standard Practice Maintenance Manual"; MSB05-8B was created in accordance with FAA Advisory Circular (AC) 20-176A, "Service Bulletins Related to Airworthiness Directives", at the encouragement of the FAA and was issued in March 2017. Subsequent analysis by the FAA has determined that an Airworthiness Directive (AD) may not be warranted at the present time therefore, this bulletin is being reissued as CSB05-8C, a Category 2, Critical Service Bulletin.

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II. SCOPE

Inspect the camshaft gear on all engines currently configured with camshaft gear P/Ns 631845, 655430, 655516, or 656031. Inspect at next 100-hour/Annual inspection or next maintenance event when the camshaft gear is made available. Continue with recurring inspections every 100-hour/Annual inspection until superseded gears are replaced with camshaft gear, P/N 656818 no later than next overhaul (see Section VI, “TERMINATING ACTION (PERMOLD CRANKCASE)” or Section VII, “TERMINATING ACTION (SANDCAST CRANKCASE)”). Inspection is required for all engines manufactured prior to 09 August 2005 that **have not** had the camshaft gear replaced with P/N 656818.

III. SAFETY INTENT

To eliminate the possibility of camshaft gear tooth fracture, resulting in power loss or in-flight shutdown, and to inspect and remove from service P/Ns 631845, 655430, 655516, or 656031 and replace with camshaft gear, P/N 656818.

IV. CONFIGURATION DESCRIPTION

Inspect camshaft gear, P/Ns 631845, 655430, 655516, or 656031 at next 100-hour/Annual inspection or next maintenance event when the camshaft gear is made available. Continue with recurring inspections every 100-hour/Annual inspection until superseded gears are replaced with camshaft gear, P/N 656818 no later than next overhaul.

In order to replace the camshaft gear as a terminating action for the inspection:

1. The crankcase halves may be **split** (as occurs at engine overhaul or major inspection). If this is done, the crankcase for the Permold engine must be modified with the required clearance cut to the 1-3-5 crankcase half in accordance with Section VI, B. or with the crankcase assembly **intact** with the special tools and radial grinder fixture specified in Section VI, C.,
-OR-
2. The camshaft gear may be replaced in a Permold engine **without splitting** the crankcase halves using the methods and techniques in Section VI, C.,
-OR-
3. The camshaft gear may be replaced in a Sandcast engine **without splitting** the crankcase halves using the methods and techniques in Section VII.

V. RECURRENT GEAR INSPECTION

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.

1. Remove the starter adapter according to instructions in the primary ICA to gain visual access to identify the camshaft gear.
2. Determine the camshaft gear part number. Manually rotate the crankshaft until the camshaft gear part number becomes clearly visible and the part number can be

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identified. The camshaft gear part number is visible through the starter adapter mounting pad opening (reference Figure 1).

3. If the camshaft gear part number cannot be determined, measure the gear face width at the circumference. Camshaft gear part number 656818 will measure 0.500". All previous part numbers, measure the gear face width as 0.440" at the circumference. The new camshaft gear face is 0.060" wider at the circumference.
4. If the camshaft gear part number is identified as P/N 656818, document compliance with CSB05-8C (list the latest revision) in the engine log book.



Figure 1. Camshaft Gear Part Number Location, typical
(P/N is visible through the starter adapter mounting pad opening)

5. If the camshaft gear is identified as P/N 631845, 655430, 655516, or 656031, perform an inspection of the gear and gear teeth through the starter adapter mounting pad opening according to instructions in M-0, "Standard Practice Maintenance Manual", Chapter 11, sections on "Visual Inspection" and "Gear Tooth Inspection". Additionally:

CAUTION: DO NOT contaminate the oil system with excess cleaning solvent. Use a solvent dampened, clean lint free cloth to remove oil from camshaft gear surfaces and gear teeth.

- a. Clean the camshaft gear of all oil and rotate the crankshaft through two complete revolutions while inspecting all visible camshaft gear surfaces for physical damage, fractures, or cracks. Use supplemental lighting and magnification (10X power) as required to perform inspection. Pay particular attention to the gear tooth root and fillets (see Figure 2).

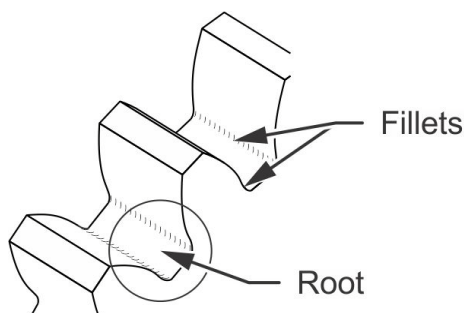


Figure 2. Camshaft Gear Inspection Surfaces, typical

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- b. If fractures or cracks are suspect, remove and replace the gear with P/N 656818 according to instructions for either Permold Crankcase (Section VI), Sandcast Crankcase (Section VII), or the standard disassembly and replacement instructions specified in the primary ICA prior to further flight.
6. If camshaft gears 631845, 655430, 655516, or 656031 exhibit no evidence of fractures or cracks, document the 100-hour inspection in the engine log book.
7. Install the starter adapter (and any parts removed to facilitate inspection) according to instructions in the primary ICA.

VI. TERMINATING ACTION (PERMOLD CRANKCASE)

A. Permold Crankcase Clearance Cut Inspection

Inspect the applicable Permold crankcase according to the following steps below:

1. Inspect the needle bearing boss in the center of the starter adapter mounting pad. If a clearance cut (Figure 3) is present or if a clearance of 0.030" (or greater with the camshaft and gear installed) is provided under all conditions, the crankcase meets the clearance requirement.

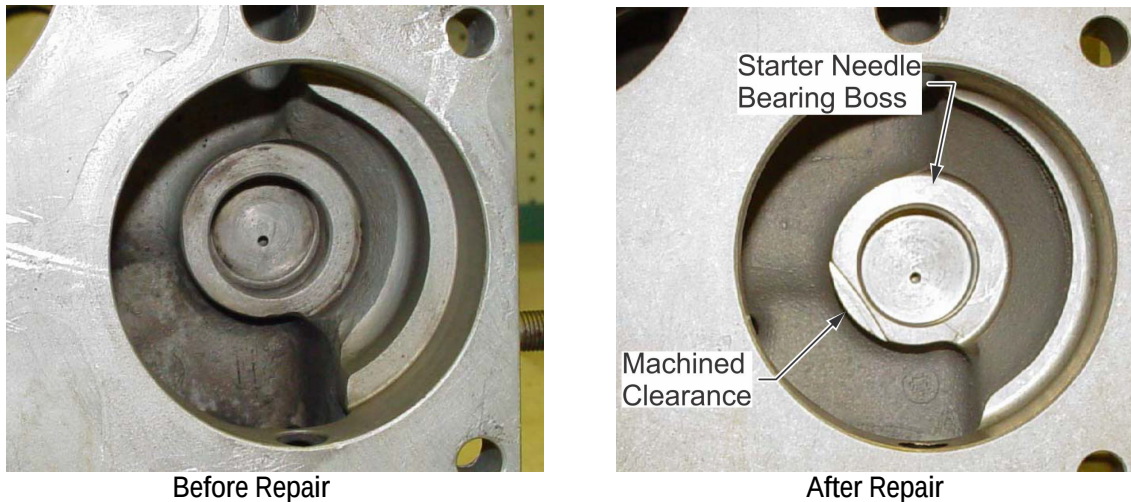


Figure 3. 1-3-5 Permold Crankcase Half, Boss Clearance Cut Repair

2. If no clearance cut is present, or if, (with the camshaft and gear installed) the clearance is less than 0.030" under all conditions, the 1-3-5 crankcase half must be machined according to the following instructions by either:
 - a. sending the 1-3-5 crankcase half to be machined in accordance with instructions in section B. "Option 1, Permold Crankcase Repair, at Overhaul", or by
 - b. replacing the camshaft gear in Permold engines without splitting the crankcase (see C. "Option 2, Permold Crankcase Repair, in Service").

B. Option 1, Permold Crankcase Repair, at Overhaul

Instructions below pertain to machining the crankcase and replacing the camshaft gear in Permold engines during engine overhaul.

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1. Measure and mark 3.100"- 3.105" from the camshaft bore centerline radius to the starter needle bearing boss (see Figure 4).
2. Cut a radius clearance cut in the outside edge of the starter drive needle bearing boss at a depth of 2.100 - 2.110" (see Figure 5) from the crankcase accessory mounting face.

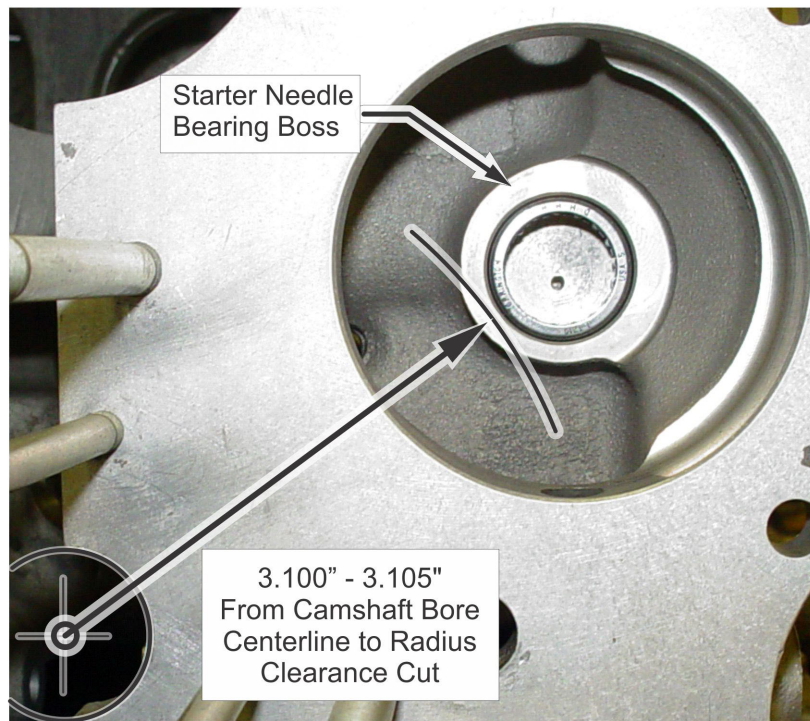


Figure 4. Radius Clearance Cut, Distance from Camshaft Bore Centerline, Permold Crankcase

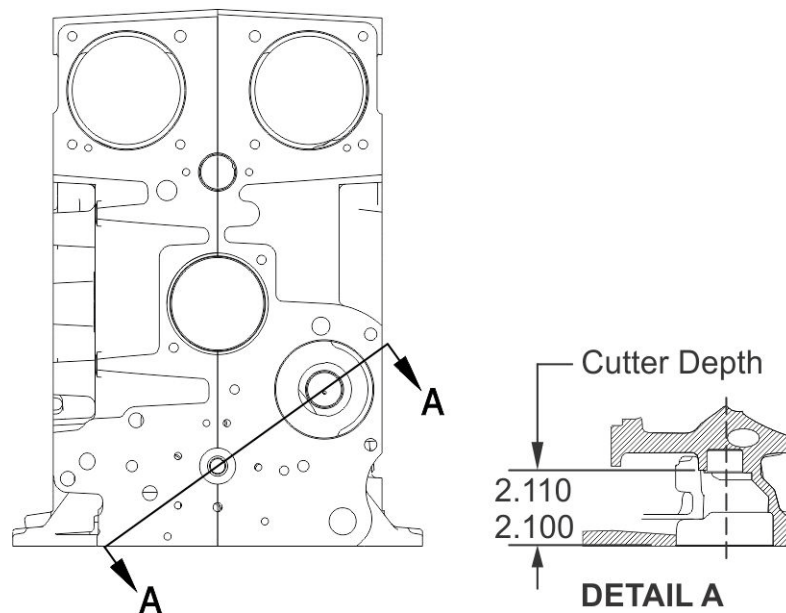


Figure 5. Overhead View of Radius Cut Depth, Permold Crankcase

3. Upon completion of crankcase repair, proceed with overhaul instructions according to the primary ICA, replacing the camshaft gear with P/N 656818.

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C. Option 2, Permold Crankcase Repair, in Service

The instructions below pertain to replacing the camshaft gear in Permold engines without splitting the crankcase.

Special Tools and Supplies

- Continental Motors Radial Grinder Fixture Assembly¹
 - Pencil Die-Grinder (i.e. 5530007545JP)²
 - Carbide Burr Bit (M41209, Cylindrical, Double Cut)²
- 3" x 3" x 8" Open Cell Reticulated Foam Block / Sponge²
- W-9 Cap Plug (P/N 626972-9)²
- De-burring Tool²
- Scotch-Brite® Scuff Pad, Ultra Fine (or equivalent)²

CAUTION: Machine a crankcase radius clearance cut to provide adequate clearance for the new camshaft gear, P/N 656818 (see Section VI, B.1.). Installing the new camshaft gear, (P/N 656818) in an unmodified Permold crankcase may result in damage to the gear and crankcase.

Camshaft gear (P/N 656818), gear face is 0.060" wider at the circumference than the replaced camshaft gear (P/Ns 631845, 655430, 655516, or 656031). Permold crankcases may require repair to the starter adapter bearing boss (needle bearing, see Figure 2). The following procedures were performed by securing the Permold engine to an engine test (nose) stand. Reference the principal ICA for the engine, accessories, and oil sump removal procedures.

1. Remove camshaft gears 631845, 655430, 655516, or 656031, and reassemble the camshaft assembly with camshaft gear P/N 656818 according to the following procedure:

WARNING

Ensure timing marks align throughout the entire camshaft gear replacement procedure.

- a. Rotate the crankshaft until the timing marks on the crankshaft gear and camshaft gear align.
- b. With the crankshaft gear and camshaft gear in the timed position, mark the crankshaft gear and camshaft gear alignment and mark the bolt closest to the starter adapter mount opening to ensure correct alignment of the replacement camshaft gear.

WARNING

Wear eye protection when cutting safety wire to avoid injury from flying debris.

CAUTION: Prevent safety wire, nuts, washers, dirt, etc. from entering the engine.

1. Fabricate locally using supplied drawings
2. Commercially available, off-the-shelf

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- c. Cut and discard safety wire from the four screws securing the camshaft gear to the camshaft.

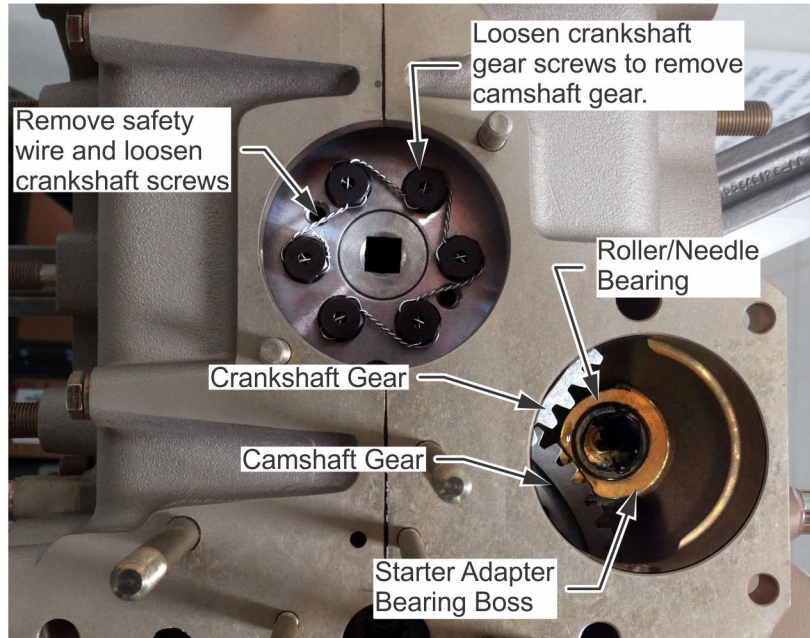


Figure 6. Camshaft Gear Access Locations, Crankcase, typical

- d. Carefully rotate the camshaft and remove the screws securing the camshaft gear to the camshaft. Screws must be removed one at a time. Discard the camshaft gear screws.
- e. Cut and discard safety wire from the crankshaft gear screws (see Figure 6).
- f. Loosen, but do not fully remove, the crankshaft gear screws to allow the large crankshaft gear to be raised in order to remove the camshaft gear through the oil sump area.
- g. Remove the camshaft gear through the oil sump area.

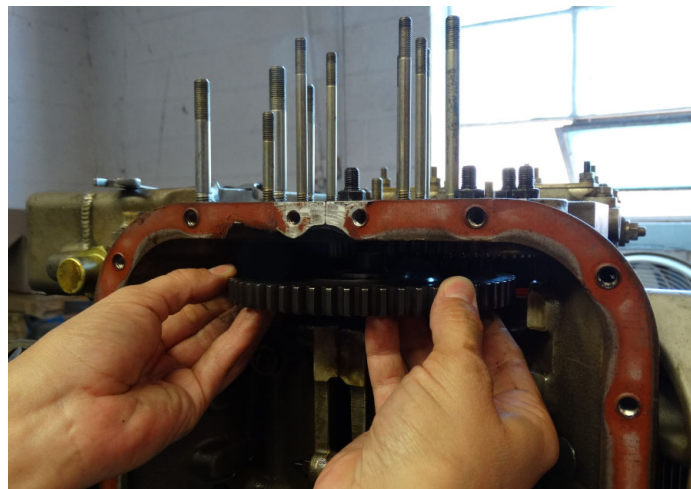


Figure 7. Remove Camshaft Gear through Oil Sump Area

2. Prepare Permold crankcase for clearance cut repair. Protect the crankcase against contamination from debris and metal shavings:

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- a. Insert a reticulated foam block (or equivalent material) to protect the inner crankcase from debris or metal shavings.
- b. Use a long, modified-tipped vacuum and thoroughly suction debris or metal shavings from the crankcase gear work area.

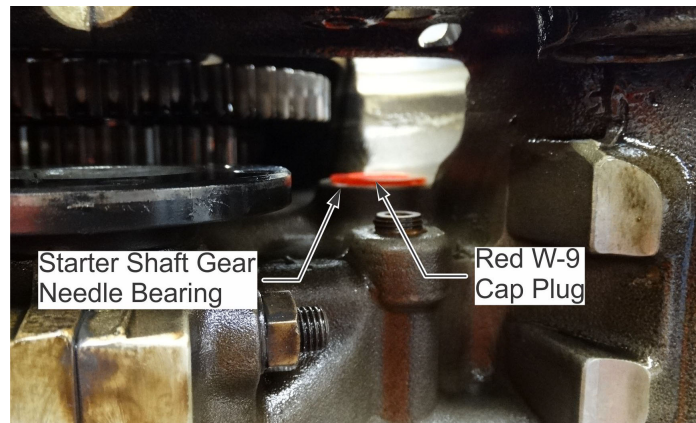


Figure 8. Cap the Starter Shaft Gear Needle Bearing

- c. Place a W-9 Cap Plug (CMI P/N 626972-9) into the starter shaft gear needle bearing (located in the crankcase through the Starter Adapter Mount pad, see Figure 8) to protect the needle bearing from debris or metal shavings. Coat the mating surface of the cap plug with Super Molyshield grease to help capture grinding debris.
- d. Assemble the Radial Grinder Fixture Assembly according to the instructions in Figure 9.

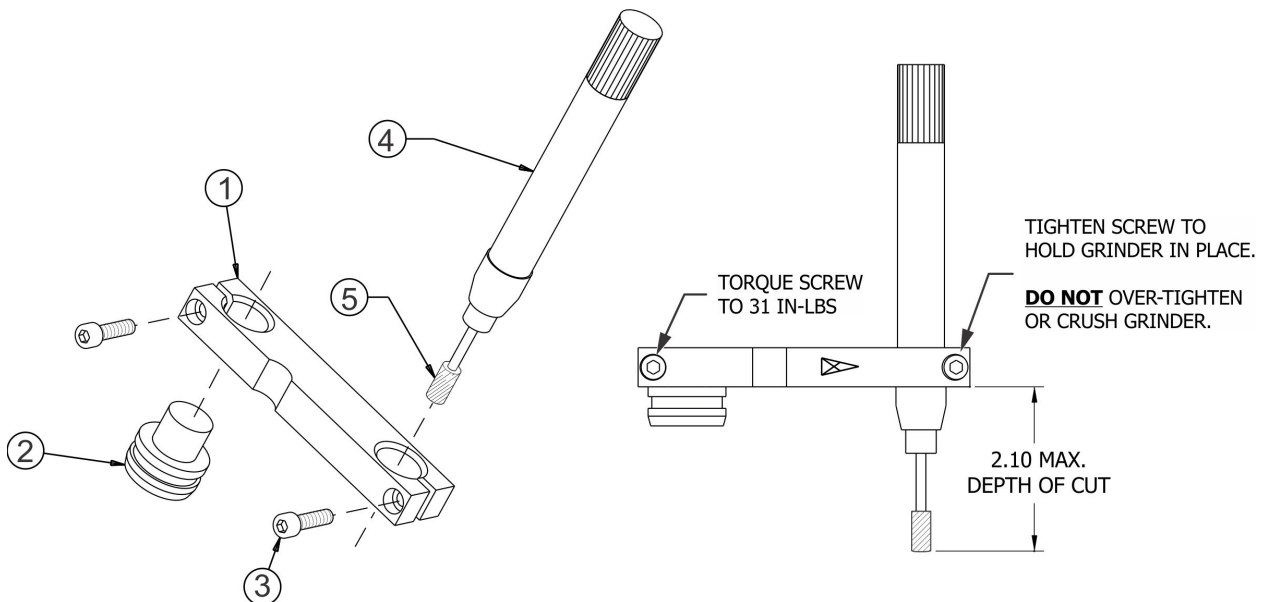


Figure 9. Fixture Assembly, Radial Grinder

- | | | | |
|---|---|---|---|
| 1 | Fixture, Radial Grinder | 4 | Pencil Die Grinder, with vertical air discharge, Jupiter Pneumatic P/N 5530007545JP |
| 2 | Bushing, Radial Grinder Fixture | 5 | M41209 Carbide Burr, Cylindrical, Double Cut, SA51EM 1/4HD x 3/16CL x 1/8SD |
| 3 | Hexagon Socket Head Cap Screw, ANSI B18.3 - 10-32 UNF-0.75 HS HCS | | |

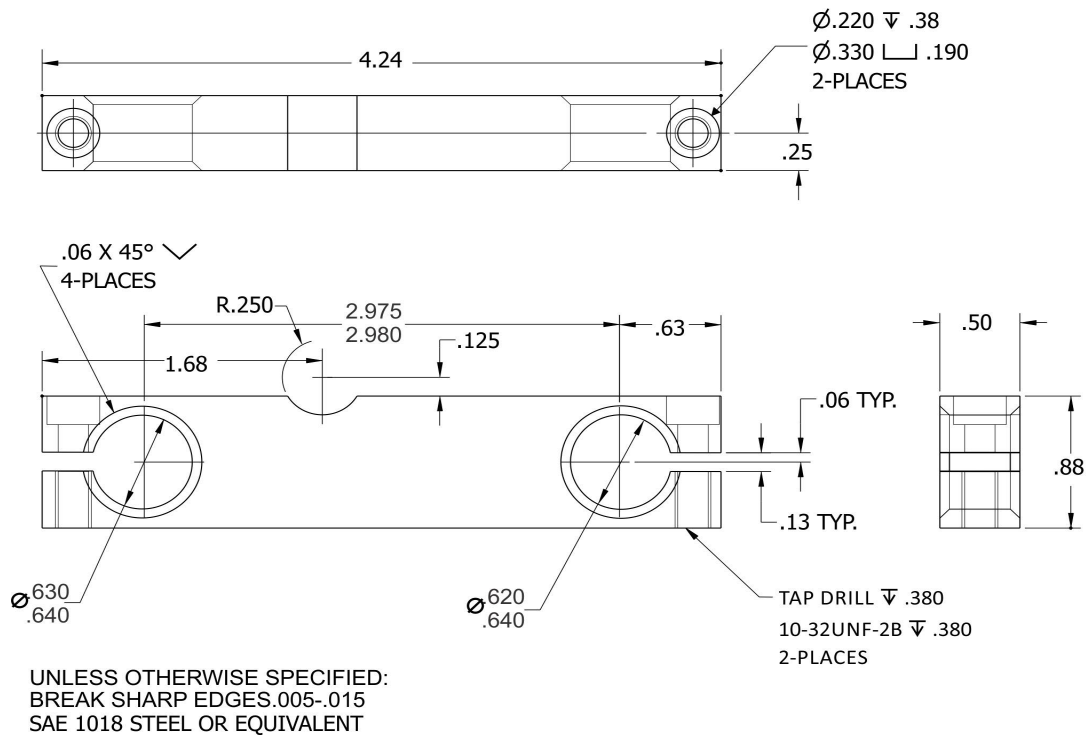


Figure 10. Fixture, Radial Grinder

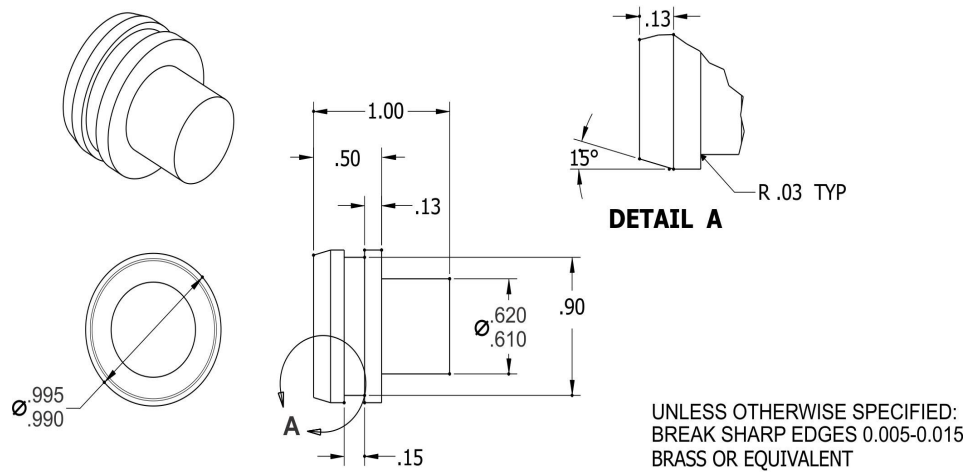


Figure 11. Bushing, Radial Grinder

- e. Insert the radial grinder assembly (bushing) into the camshaft gear boss as shown in Figure 12.

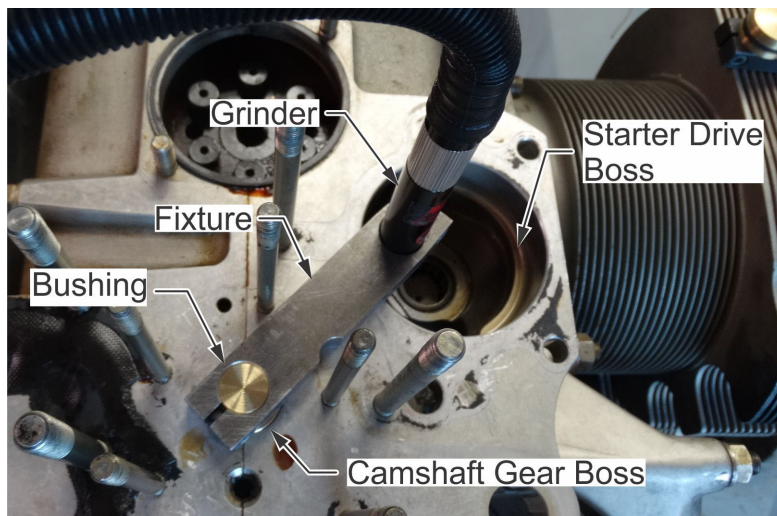


Figure 12. Clearance Cut, Setup

- f. Loosen the screw holding the grinder in place and carefully lower the grinder and burr bit over the clearance cut area (starter drive needle bearing boss).

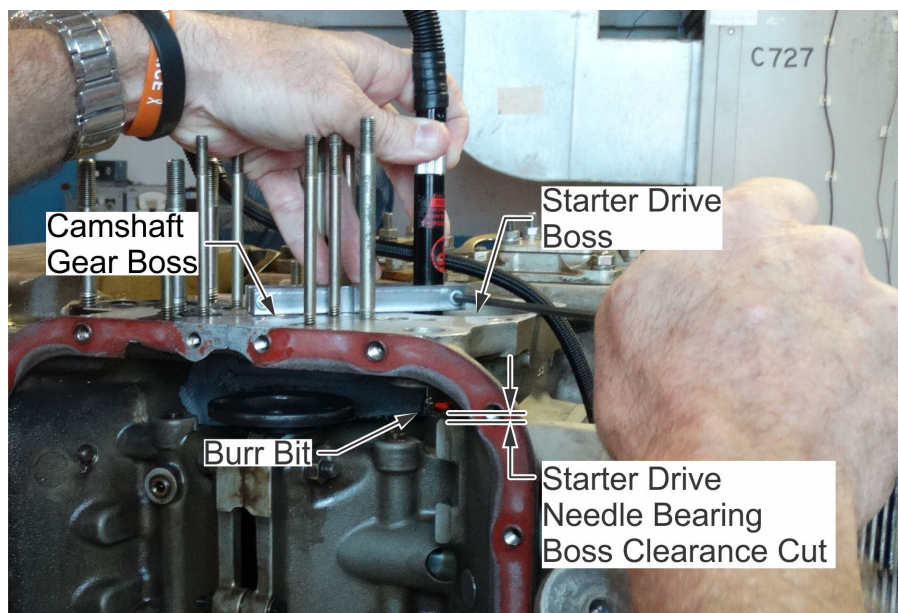


Figure 13. Clearance Cut, Setup (sump view)

CAUTION: DO NOT over-tighten the set screw securing the pencil die grinder to the radial grinder fixture. Damage to the grinder and jamming the grinder motor may occur.

- g. Set the cutting height of the radial grinder fixture assembly flush with the surface of the starter drive needle bearing boss and secure the grinder with the set screw. Cut the bearing boss clearance by removing no more than 0.010" (max.) with each cut.
- h. Continue adjusting cut depth of the pencil die grinder until clearance of 0.030" (or greater with the camshaft and gear installed) is provided under all conditions.

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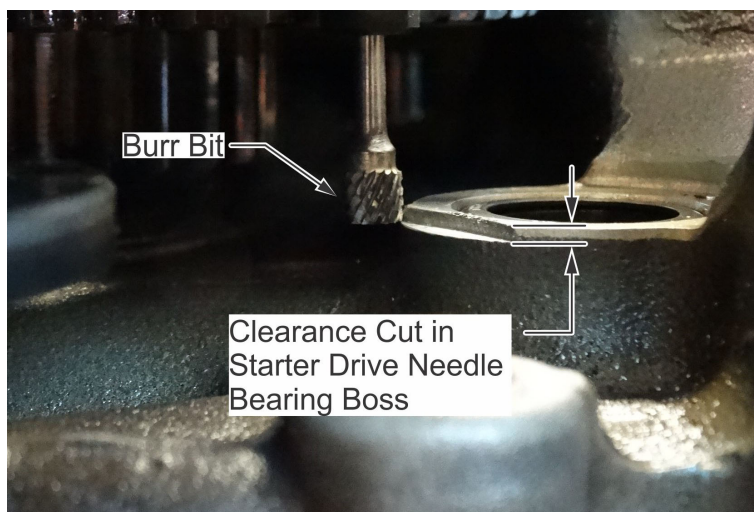


Figure 14. Clearance Cut, Setup

CAUTION: Inspect and ensure there is a minimum 0.030" clearance between the camshaft gear and the starter drive needle bearing boss

- i. Inspect the clearance cut surface and remove all nicks, burrs or sharp edges using a de-burring tool and Scotch-Brite® ultra fine scuff pad.
- j. Vacuum and thoroughly clean all debris or metal shavings from the crankcase gear work area.
- k. Remove cap plug and verify needle bearing has no debris, damage, or contamination.
- l. Transfer the markings from the old camshaft gear to the new camshaft gear to aid in the camshaft gear bolt hole alignment.
- m. Carefully insert camshaft gear P/N 656818 and seat into position over the camshaft.
- n. Ensure camshaft and crankshaft gear timing marks are correctly aligned.

NOTE: Lubricate the threads of all replaced crankshaft gear bolts and camshaft gear screws with clean 50 weight aviation engine oil.

- o. Install new camshaft gear screws in an alternating cross pattern, finger tight.
- p. Remove and install new crankshaft gear bolts (one bolt at a time) in an alternating cross pattern, finger tight.
- q. Verify crankshaft to camshaft timing alignment before torquing screws.
- r. Verify gears are evenly seated before applying torque.
- s. Pre-torque the camshaft and crankshaft gear screws 140 in. lbs. nominal in an alternating cross pattern.
- t. Final torque the camshaft and crankshaft gear screws to the value specified in M-0, "Standard Practice Maintenance Manual, Appendix B."

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WARNING

Wear eye protection when cutting safety wire to avoid injury from flying debris.

CAUTION: Prevent safety wire, nuts, washers, dirt, etc. from entering the engine.

- u. Using 0.032” safety wire, safety wire camshaft gear bolts and crankshaft gear screws according to instructions in M-0, “Standard Practice Maintenance Manual, Table 3-7 (wire size), and Appendix C-3 (method).
3. Proceed with engine assembly and reinstall any engine components that were removed in accordance with the applicable Maintenance or Overhaul Manual.
4. Install engine in aircraft in accordance with the primary ICA.
5. Document compliance with CSB05-8C in the engine log book.
6. Perform a complete engine ground run up in accordance with the aircraft manufacturer’s AFM/POH.

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VII. TERMINATING ACTION (SANDCAST CRANKCASE)

The instructions below pertain to replacing the camshaft gear in Sandcast engines without splitting the crankcase. The following procedures were performed by securing the engine to an engine test (nose) stand. Reference the principal ICA for the engine and sump removal procedures.

CAUTION: Camshaft gear (P/N 656818) is 0.060" wider at the circumference than the replaced camshaft gears (P/Ns 631845, 655430, 655516, or 656031). For engines with a Sandcast crankcase, the assembler must inspect and sustain a minimum clearance (0.030" or greater) between the camshaft gear (P/N 656818) and the oil gallery plug at the rear crankcase below the starter adapter (see step k. and Figure 20)).

1. Replace camshaft gears 631845, 655430, 655516, or 656031, and reassemble the camshaft assembly with camshaft gear P/N 656818 according to the following procedure (typical for cluster gear configuration):
 - a. Rotate the crankshaft until the timing marks on the crankshaft gear and camshaft gear align.
 - b. With the crankshaft gear and camshaft gear (and cluster gear where applicable) in the timed position, mark the crankshaft gear and camshaft gear alignment (see Figure 15) and mark the bolt closest to the starter adapter mount opening to ensure correct alignment of the replacement camshaft gear.

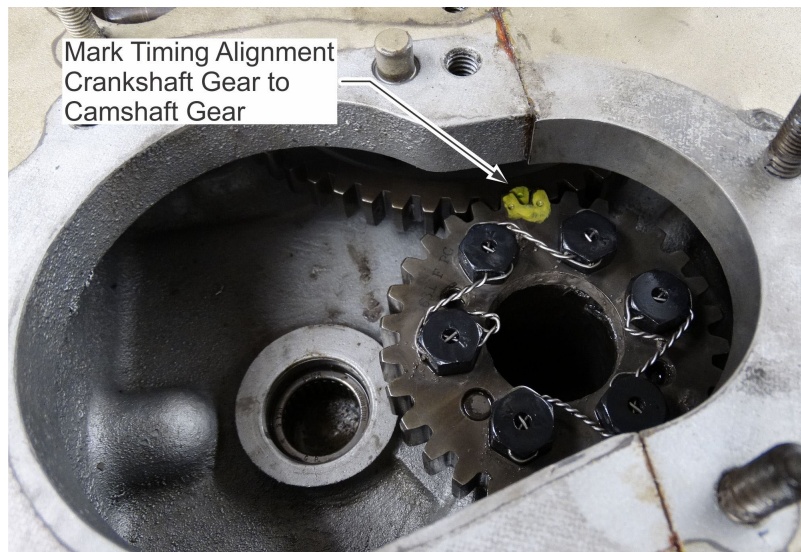


Figure 15. Camshaft Gear Timing Alignment Marked, Sandcast Crankcase

WARNING

Wear eye protection when cutting safety wire to avoid injury from flying debris.

CAUTION: Prevent safety wire, nuts, washers, dirt, etc. from entering the engine.

- c. Cut and remove safety wire from the four screws securing the camshaft gear to the camshaft (or cluster gear where applicable).

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- d. Carefully rotate the camshaft and remove the unmarked screws securing the camshaft gear to the camshaft (and cluster gear where applicable). Screws must be removed (one at a time) through the fuel pump mount opening. Do not remove the last screw (marked) at this time.

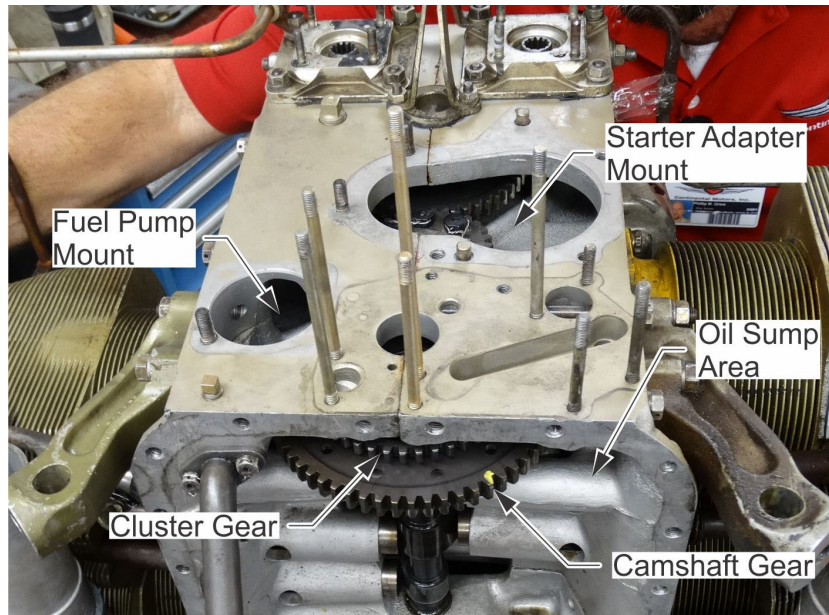


Figure 16. Camshaft Gear Access Points, Sandcast Crankcase

- e. Before removing the last screw (previously marked in step 1.. b.. above), insert and finger tighten a temporary half-height alignment screw, securing the camshaft gear to the camshaft and cluster gear (where applicable). Remove the fourth (marked) camshaft gear screw. Discard and replace all removed screws.
- f. Align and mark the crankshaft gear and camshaft gear 180 degrees from the timing marks (see Figure 18). Remove the half-height alignment screw and remove camshaft gear through the oil sump area.

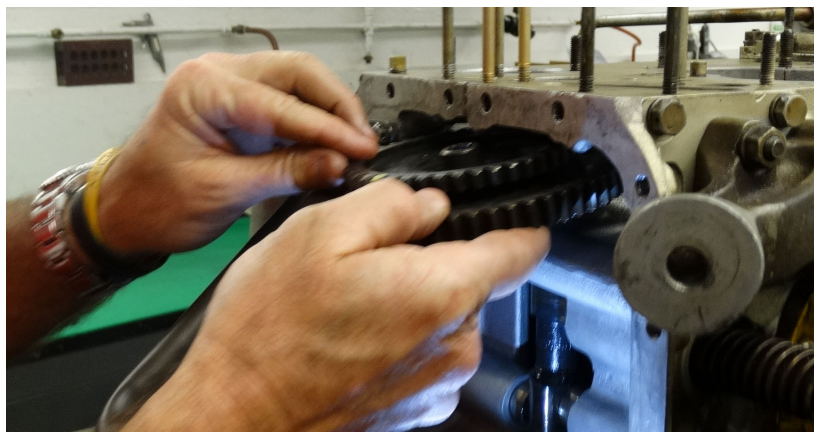


Figure 17. Remove Camshaft Gear and Cluster Gear (where applicable) through Oil Sump Area

CAUTION: Avoid applying direct pressure to the gear teeth.

- g. Carefully separate the two gears (and position for removal) from each other with a soft metal pry-bar (preferable brass). Remove both gears through the oil sump area.

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- h. Transfer the markings from the old camshaft gear to the new camshaft gear to aid in the camshaft gear bolt hole alignment. Clean the cluster gear and fit the new camshaft gear, carefully align the mounting holes on the cluster gear and camshaft gear.

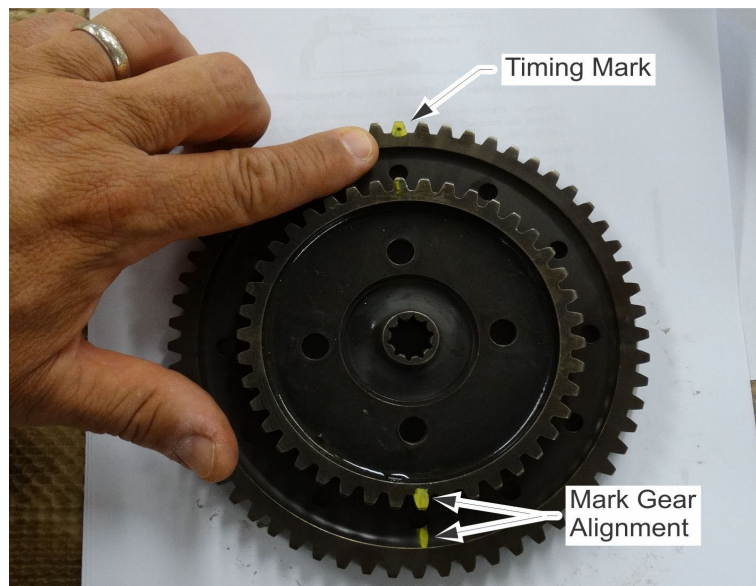


Figure 18. Transfer Gear Alignment Marks

- i. Insert both gears and carefully seat into position on the camshaft. Ensure the marking on both gears remain aligned and timing marks are correctly aligned.
- j. Verify gears mate and seat evenly. Install the half-height alignment screw, finger tight. Do not torque at this time.

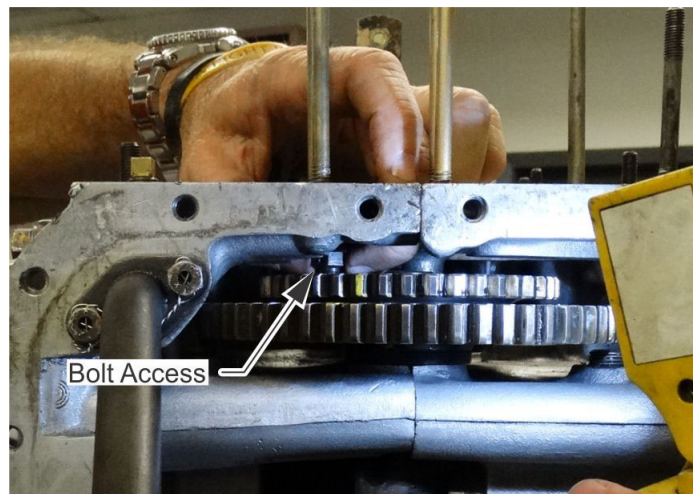


Figure 19. Install Camshaft Screws through the Fuel Pump Mount Opening

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CAUTION: Inspect and ensure there is a minimum 0.030" clearance between the camshaft gear (P/N 656818) and the oil gallery plug.

- k. Measure the clearance between the oil gallery plug and the camshaft gear using a feeler gauge (see Figure 20). Ensure the minimum clearance is 0.030" or greater. If the clearance is less than 0.030":
 - 1) Remove the safety wire and the rear crankcase tie bolt (P/N 627433) according to the instructions in the primary ICA (if it is blocking access to the oil gallery plug).
 - 2) Remove the half-height alignment screw and remove the camshaft gear.
 - 3) Remove the oil gallery plug, clean the sealant residue from the crankcase and plug threads.
 - 4) Install the oil gallery plug (according to the instructions in the primary ICA) to the maximum allowable torque specified in M-0, "Standard Practice Maintenance Manual, Appendix B" and verify required minimum clearance (0.030" or greater) is met.
 - 5) Install and torque the crankcase tie bolt (P/N 627433) according to the instructions in the primary ICA.
 - 6) Reinstall the half-height alignment screw and camshaft gear (step j.. above).

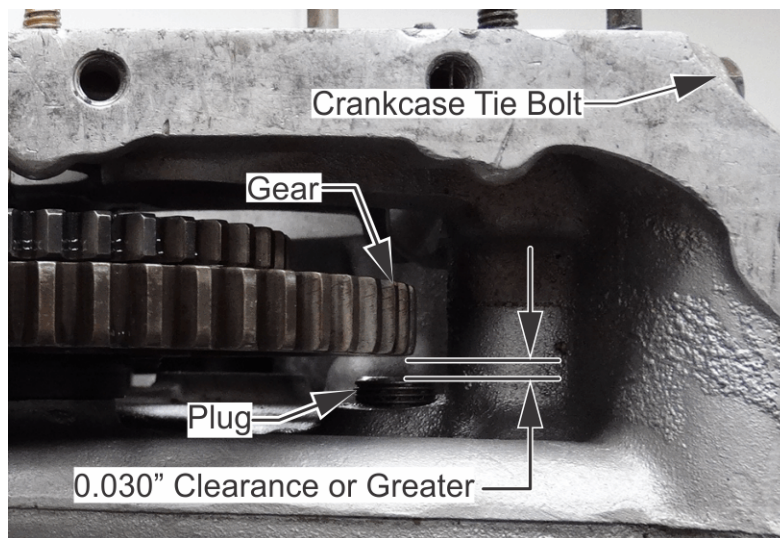


Figure 20. Lower Rear Oil Gallery (Control) Plug, Sandcast 1-3-5 Crankcase Half

NOTE: Lubricate the threads of any removed screws or bolts with clean 50 weight aviation engine oil.

- l. Insert new camshaft gear screws through the fuel pump mount opening and install in an alternating cross pattern, finger tight. Remove the half-height alignment screw and install the last camshaft gear screw, finger tight.
- m. Verify crankshaft to camshaft timing alignment. Verify alignment of the previous gear marks before torquing screws.
- n. Verify gears are evenly seated before applying torque.

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- o. Pre-torque the screws to 140 in. lbs. nominal in an alternating cross pattern.
- p. Apply final torque to the camshaft gear screws according to the value specified in M-0, “Standard Practice Maintenance Manual, Appendix B.”

WARNING

Wear eye protection when cutting safety wire to avoid injury from flying debris.

CAUTION: Prevent safety wire, nuts, washers, dirt, etc. from entering the engine.

2. Using 0.032” safety wire, safety wire crankshaft gear screws according to instructions in M-0, “Standard Practice Maintenance Manual, Table 3-7 (wire size), and Appendix C-3 (method).
3. Proceed with engine assembly and reinstall any engine components that were removed in accordance with the applicable Maintenance or Overhaul Manual.
4. Install engine in aircraft in accordance with the primary ICA.
5. Document replacement of camshaft gear as compliance with CSB05-8C in the engine log book.
6. Perform a complete engine ground run up in accordance with the aircraft manufacturer’s AFM/POH.

VIII. CUSTOMER SERVICE

Visit the Continental Motors web site at www.continentalmotors.aero to obtain copies of Continental Motors Warranty Policies.

Contact Continental Motors Technical Services at one of the numbers listed below if you have any questions concerning the technical content of this Service Document.

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CONTINENTAL MOTORS® AIRCRAFT ENGINE
CRITICAL SERVICE BULLETIN

COMPLIANCE NECESSARY TO MAINTAIN SAFETY

CATEGORY 2
CSB05-8D

Supersedes CSB05-8C
TECHNICAL PORTIONS
FAA APPROVED

SUBJECT: Camshaft Gear (P/N 656818)

PURPOSE: To eliminate the possibility of camshaft gear tooth fracture, resulting in power loss or in-flight shutdown, and to inspect and remove from service P/Ns 631845, 655430, 655516, or 656031 and replace with camshaft gear, P/N 656818. This Service Document initially announced the release of improved camshaft gear P/N 656818 in 2005. It now clarifies part number superseding action and amplifies camshaft gear replacement instructions.

COMPLIANCE: Inspect at next 100-hour or Annual inspection (whichever is applicable based on type of operation or inspection requirements) or next maintenance event when the camshaft gear is made available (whichever comes first). Continue with recurring inspections every 100-hour/Annual inspection until superseded gears are replaced with camshaft gear, P/N 656818 no later than next overhaul.

MODELS

AFFECTED: Continental Motors (CMI) aviation gasoline (AvGas) engines - O-470-U, IO-470-U, V, VO; IO-520-A, B, BA, BB, C, CB, D, E, F, J, K, L, M, MB, N, NB, P, R; L/TSIO-520-ALL; LIO-520-P; IO-550-A, B, C, D, E, F, G, L, N, P, R; IOF-550-B, C, D, E, F, L, N, P, R; TSIO-550-A, B, C, E; TSIOL-550-A, B, C (see Section II for detail)

I. GENERAL INFORMATION

In 2005, camshaft gear, part number (P/N 656818), was released as a product improvement for the above listed engines. Service Bulletin SB05-8 was written to identify not only the availability of the new part (P/N 656818), but also provided a required Permold crankcase repair to eliminate interference with the new thicker camshaft gear.

Service Document revision CSB05-8D adds the O-470-U engine specification to the MODELS AFFECTED and camshaft gear configuration (reference CMI Service Document SIL18-05, "*O-470-U Camshaft Gear Configuration*").

Service Bulletin SB05-8 (originally issued 09 AUG 2005) and subsequent revision SB05-8A recommended the new camshaft gear (P/N 656818) be incorporated at the next engine overhaul or whenever replacement of the camshaft gear was required. Service Bulletin SB97-6B, "Mandatory Replacement Parts" (revised 18 NOV 2009) listed the camshaft gear (P/Ns 631845, 655430, 655516, or 656031) as a mandatory replacement item at overhaul with P/N 656818. This was also incorporated in the original M-0, "Standard Practice Maintenance Manual" (issued April 2016).

NOTE: Recommended TBO calendar limit for the affected engines is 12 years. Since the original SB05-8 recommending gear replacement was issued in 2005, and the gear was added to the list of MANDATORY REPLACEMENT PARTS in 2009, gear replacement and crankcase repairs should have occurred through attrition.

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II. SCOPE

Inspect the camshaft gear on all engines currently configured with camshaft gear P/Ns 631845, 655430, 655516, or 656031. Inspect at next 100-hour/Annual inspection or next maintenance event when the camshaft gear is made available. Continue with recurring inspections every 100-hour/Annual inspection until superseded gears are replaced with camshaft gear, P/N 656818 no later than next overhaul (see Section VI, “TERMINATING ACTION (PERMOLD CRANKCASE)” or Section VII, “TERMINATING ACTION (SANDCAST CRANKCASE)”). Inspection is required for all engines manufactured prior to 09 August 2005 that have not had the camshaft gear replaced with P/N 656818.

III. SAFETY INTENT

To eliminate the possibility of camshaft gear tooth fracture, resulting in power loss or in-flight shutdown, and to inspect and remove from service P/Ns 631845, 655430, 655516, or 656031 and replace with camshaft gear, P/N 656818.

IV. CONFIGURATION DESCRIPTION

Inspect camshaft gear, P/Ns 631845, 655430, 655516, or 656031 at next 100-hour/Annual inspection or next maintenance event when the camshaft gear is made available. Continue with recurring inspections every 100-hour/Annual inspection until superseded gears are replaced with camshaft gear, P/N 656818 no later than next overhaul.

In order to replace the camshaft gear as a terminating action for the inspection:

1. The crankcase halves may be **split** (as occurs at engine overhaul or major inspection). If this is done, the crankcase for the Permold engine must be modified with the required clearance cut to the 1-3-5 crankcase half in accordance with Section VI, B. or with the crankcase assembly **intact** with the special tools and radial grinder fixture specified in Section VI, C.,

-OR-
2. The camshaft gear may be replaced in a Permold engine **without splitting** the crankcase halves using the methods and techniques in Section VI, C.,

-OR-
3. The camshaft gear may be replaced in a Sandcast engine **without splitting** the crankcase halves using the methods and techniques in Section VII.

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V. RECURRENT GEAR INSPECTION

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.

1. Remove the starter adapter according to instructions in the primary ICA to gain visual access to identify the camshaft gear.
2. Determine the camshaft gear part number. Manually rotate the crankshaft until the camshaft gear part number becomes clearly visible and the part number can be identified. The camshaft gear part number is visible through the starter adapter mounting pad opening (reference Figure 1).
3. If the camshaft gear part number cannot be determined, measure the gear face width at the circumference. Camshaft gear part number 656818 will measure 0.500". All previous part numbers, measure the gear face width as 0.440" at the circumference. The new camshaft gear face is 0.060" wider at the circumference.
4. If the camshaft gear part number is identified as P/N 656818, record compliance with Service Document CSB05-8D in the engine log book.



Figure 1. Camshaft Gear Part Number Location, typical
(part number is visible through the starter adapter mounting pad opening)

5. If the camshaft gear is identified as P/N 631845, 655430, 655516, or 656031, perform an inspection of the gear and gear teeth through the starter adapter mounting pad opening according to instructions in M-0, "Standard Practice Maintenance Manual", Chapter 11, sections on "Visual Inspection" and "Gear Tooth Inspection". Additionally:

CAUTION: DO NOT contaminate the oil system with excess cleaning solvent. Use a solvent dampened, clean lint free cloth to remove oil from camshaft gear surfaces and gear teeth.

- a. Clean the camshaft gear of all oil and rotate the crankshaft through two complete revolutions while inspecting all visible camshaft gear surfaces for physical damage, fractures, or cracks. Use supplemental lighting and magnification (10X power) as

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required to perform inspection. Pay particular attention to the gear tooth root and fillets (see Figure 2).

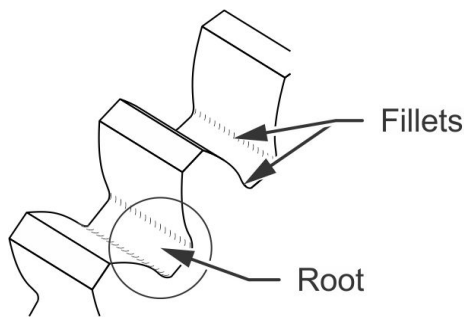


Figure 2. Camshaft Gear Inspection Surfaces, typical

- b. If fractures or cracks are suspect, remove and replace the gear with P/N 656818 according to instructions for either Permold Crankcase (Section VI), Sandcast Crankcase (Section VII), or the standard disassembly and replacement instructions specified in the primary ICA prior to further flight.
- 6. If camshaft gears 631845, 655430, 655516, or 656031 exhibit no evidence of fractures or cracks, document the 100-hour inspection in the engine log book.
- 7. Install the starter adapter (and any parts removed to facilitate inspection) according to instructions in the primary ICA.

VI. TERMINATING ACTION (PERMOLD CRANKCASE)

A. Permold Crankcase Clearance Cut Inspection

Inspect the applicable Permold crankcase according to the following steps below:

1. Inspect the needle bearing boss in the center of the starter adapter mounting pad. If a clearance cut (Figure 3) is present or if a clearance of 0.030" (or greater with the camshaft and gear installed) is provided under all conditions, the crankcase meets the clearance requirement.

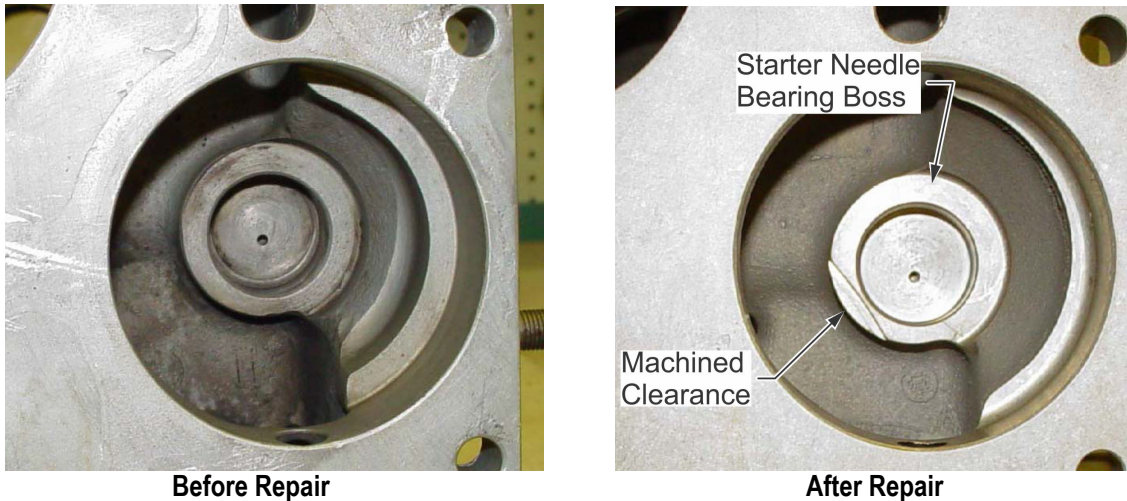


Figure 3. 1-3-5 Permold Crankcase Half, Boss Clearance Cut Repair

2. If no clearance cut is present, or if, (with the camshaft and gear installed) the clearance is less than 0.030" under all conditions, the 1-3-5 crankcase half must be machined according to the following instructions by either:
 - a. sending the 1-3-5 crankcase half to be machined in accordance with instructions in section B. "Option 1, Permold Crankcase Repair, at Overhaul", *or by*
 - b. replacing the camshaft gear in Permold engines without splitting the crankcase (see C. "Option 2, Permold Crankcase Repair, in Service").

B. Option 1, Permold Crankcase Repair, at Overhaul

Instructions below pertain to machining the crankcase and replacing the camshaft gear in Permold engines during engine overhaul.

1. Measure and mark 3.100"- 3.105" from the camshaft bore centerline radius to the starter needle bearing boss (see Figure 4).
2. Cut a radius clearance cut in the outside edge of the starter drive needle bearing boss at a depth of 2.100 - 2.110" (see Figure 5) from the crankcase accessory mounting face.

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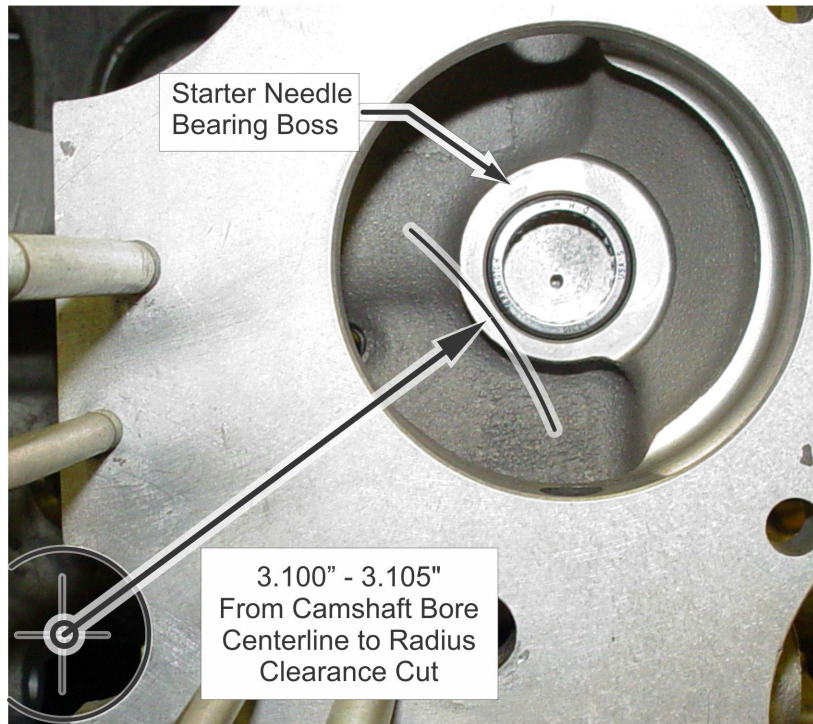


Figure 4. Radius Clearance Cut, Distance from Camshaft Bore Centerline, Permold Crankcase

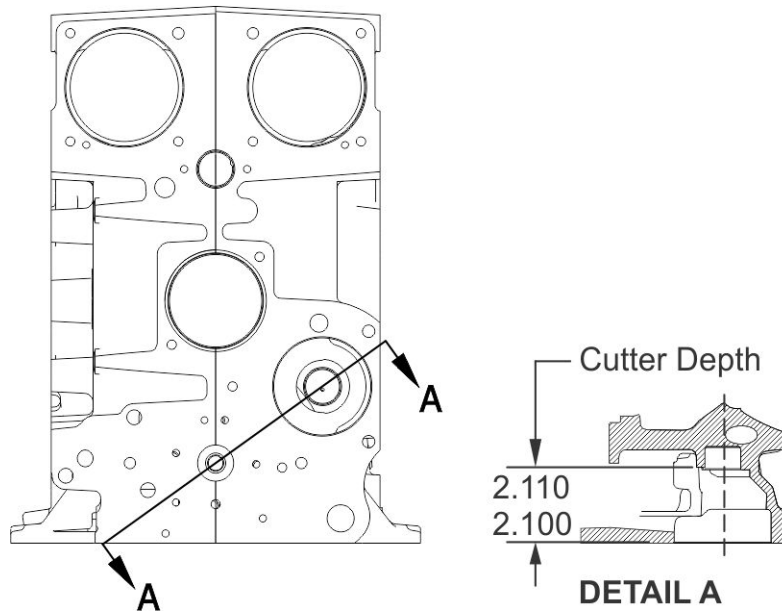


Figure 5. Overhead View of Radius Cut Depth, Permold Crankcase

3. Upon completion of crankcase repair, proceed with overhaul instructions according to the primary ICA, replacing the camshaft gear with P/N 656818.

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C. Option 2, Permold Crankcase Repair, in Service

The instructions below pertain to replacing the camshaft gear in Permold engines without splitting the crankcase.

Special Tools and Supplies

- Continental Motors Radial Grinder Fixture Assembly¹
 - Pencil Die-Grinder (i.e. 5530007545JP)²
 - Carbide Burr Bit (M41209, Cylindrical, Double Cut)²
- 3" x 3" x 8" Open Cell Reticulated Foam Block / Sponge²
- W-9 Cap Plug (P/N 626972-9)²
- De-burring Tool²
- Scotch-Brite® Scuff Pad, Ultra Fine (or equivalent)²

CAUTION: Machine a crankcase radius clearance cut to provide adequate clearance for the new camshaft gear, P/N 656818 (see Section VI, B.1.). Installing the new camshaft gear, (P/N 656818) in an unmodified Permold crankcase may result in damage to the gear and crankcase.

Camshaft gear (P/N 656818), gear face is 0.060" wider at the circumference than the replaced camshaft gear (P/Ns 631845, 655430, 655516, or 656031). Permold crankcases may require repair to the starter adapter bearing boss (needle bearing, see Figure 2). The following procedures were performed by securing the Permold engine to an engine test (nose) stand. Reference the principal ICA for the engine, accessories, and oil sump removal procedures.

1. Remove camshaft gears 631845, 655430, 655516, or 656031, and reassemble the camshaft assembly with camshaft gear P/N 656818 according to the following procedure:

WARNING

Ensure timing marks align throughout the entire camshaft gear replacement procedure.

- a. Rotate the crankshaft until the timing marks on the crankshaft gear and camshaft gear align.
- b. With the crankshaft gear and camshaft gear in the timed position, mark the crankshaft gear and camshaft gear alignment and mark the bolt closest to the starter adapter mount opening to ensure correct alignment of the replacement camshaft gear.

WARNING

Wear eye protection when cutting safety wire to avoid injury from flying debris.

CAUTION: Prevent safety wire, nuts, washers, dirt, etc. from entering the engine.

1. Fabricate locally using supplied drawings
2. Commercially available from AERO Accessories

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- c. Cut and discard safety wire from the four screws securing the camshaft gear to the camshaft.

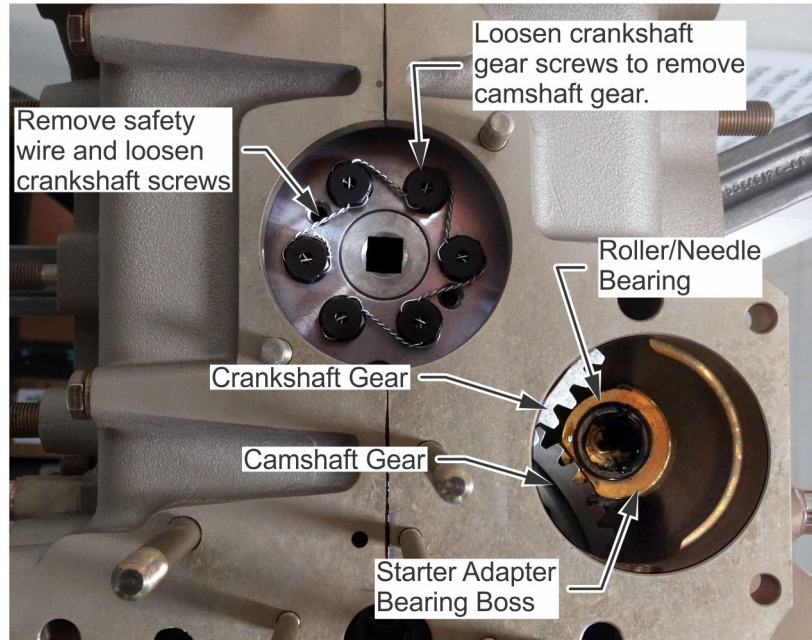


Figure 6. Camshaft Gear Access Locations, Crankcase, typical

- d. Carefully rotate the camshaft and remove the screws securing the camshaft gear to the camshaft. Screws must be removed one at a time. Discard the camshaft gear screws.
- e. Cut and discard safety wire from the crankshaft gear screws (see Figure 6).
- f. Loosen, but do not fully remove, the crankshaft gear screws to allow the large crankshaft gear to be raised in order to remove the camshaft gear through the oil sump area.
- g. Remove the camshaft gear through the oil sump area.

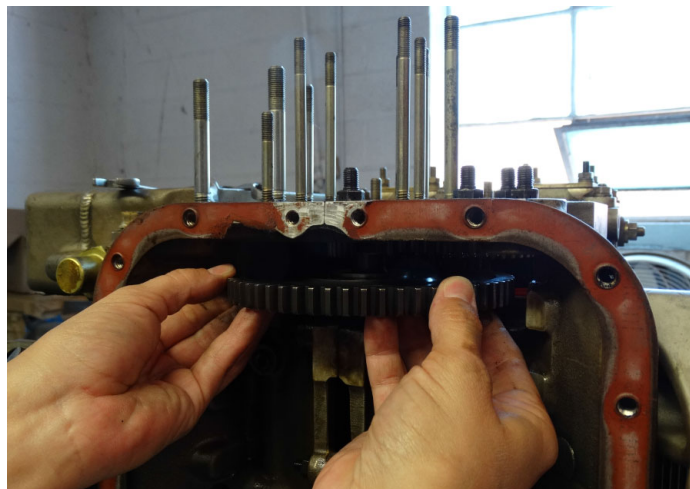


Figure 7. Remove Camshaft Gear through Oil Sump Area

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2. Prepare Permold crankcase for clearance cut repair. Protect the crankcase against contamination from debris and metal shavings:
 - a. Insert a reticulated foam block (or equivalent material) to protect the inner crankcase from debris or metal shavings.
 - b. Use a long, modified-tipped vacuum and thoroughly suction debris or metal shavings from the crankcase gear work area.

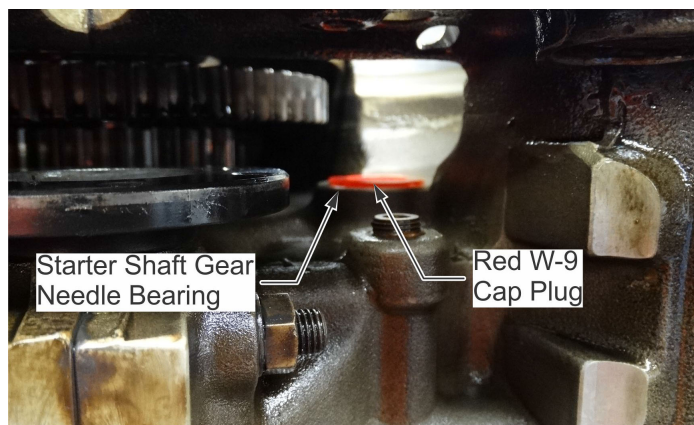


Figure 8. Cap the Starter Shaft Gear Needle Bearing

- c. Place a W-9 Cap Plug (CMI P/N 626972-9) into the starter shaft gear needle bearing (located in the crankcase through the Starter Adapter Mount pad, see Figure 8) to protect the needle bearing from debris or metal shavings. Coat the mating surface of the cap plug with Super Molyshield grease to help capture grinding debris.
- d. Assemble the Radial Grinder Fixture Assembly according to the instructions in Figure 9.

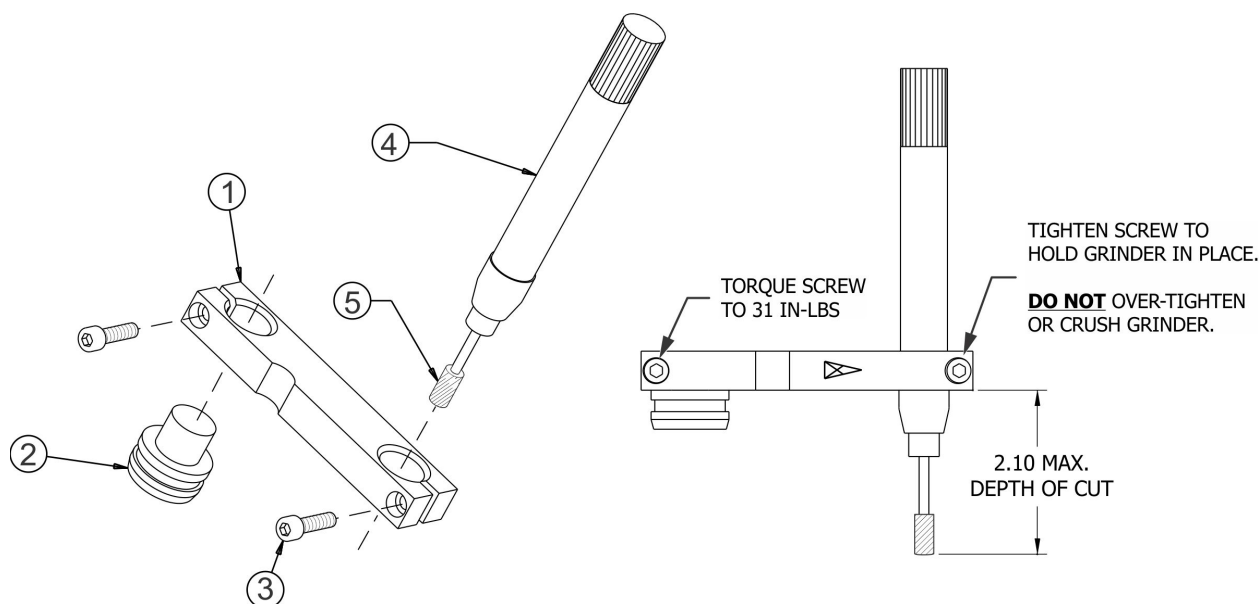


Figure 9. Fixture Assembly, Radial Grinder

- | | | | |
|---|---|---|---|
| 1 | Fixture, Radial Grinder | 4 | Pencil Die Grinder, with vertical air discharge, Jupiter Pneumatic P/N 5530007545JP |
| 2 | Bushing, Radial Grinder Fixture | 5 | M41209 Carbide Burr, Cylindrical, Double Cut, SA51EM 1/4HD x 3/16CL x 1/8SD |
| 3 | Hexagon Socket Head Cap Screw, ANSI B18.3 - 10-32 UNF-0.75 HS HCS | | |

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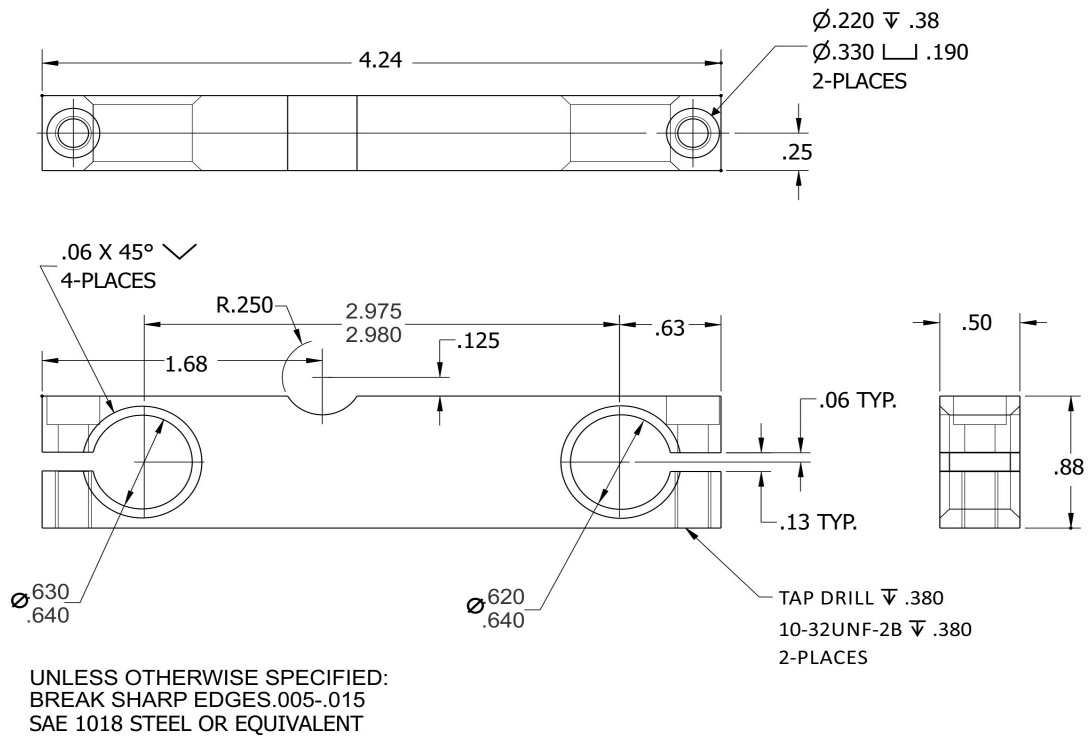


Figure 10. Fixture, Radial Grinder

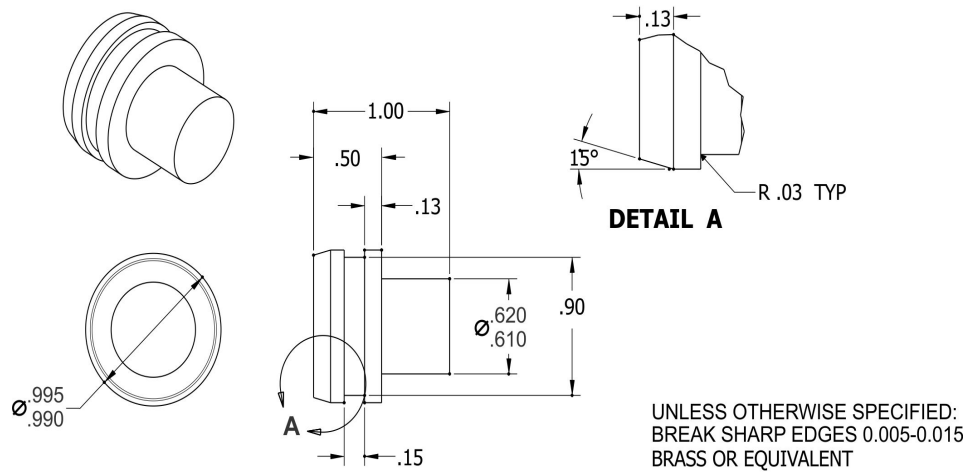


Figure 11. Bushing, Radial Grinder

- e. Insert the radial grinder assembly (bushing) into the camshaft gear boss as shown in Figure 12.

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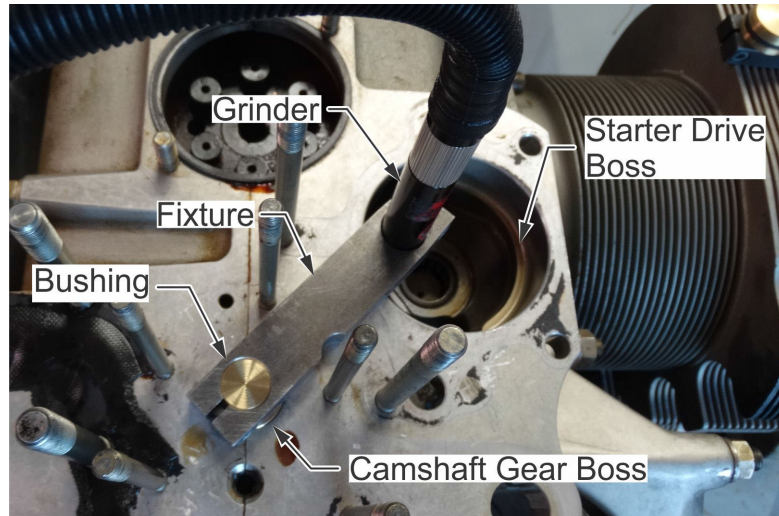


Figure 12. Clearance Cut, Setup

- f. Loosen the screw holding the grinder in place and carefully lower the grinder and burr bit over the clearance cut area (starter drive needle bearing boss).

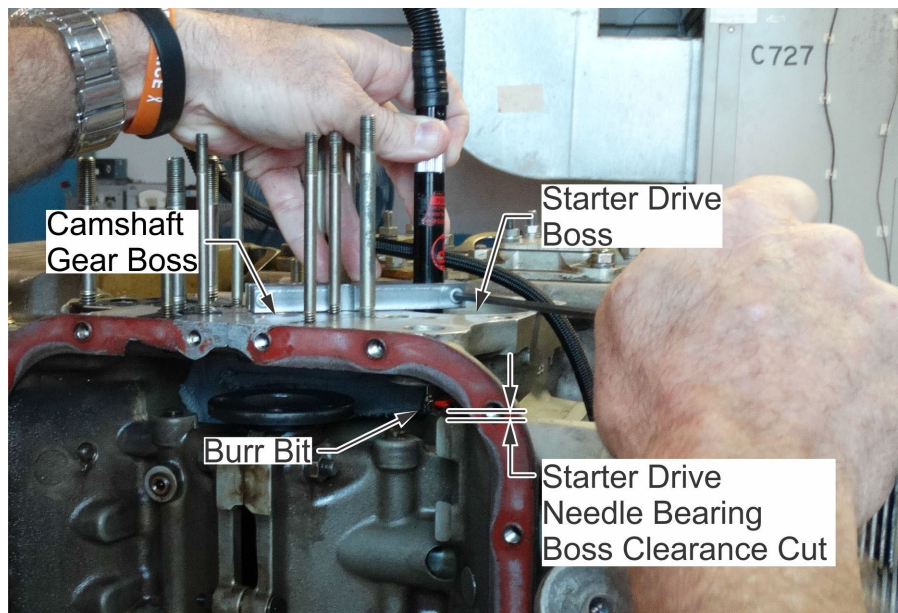


Figure 13. Clearance Cut, Setup (sump view)

CAUTION: DO NOT over-tighten the set screw securing the pencil die grinder to the radial grinder fixture. Damage to the grinder and jamming the grinder motor may occur.

- g. Set the cutting height of the radial grinder fixture assembly flush with the surface of the starter drive needle bearing boss and secure the grinder with the set screw. Cut the bearing boss clearance by removing no more than 0.010" (max.) with each cut.
- h. Continue adjusting cut depth of the pencil die grinder until clearance of 0.030" (or greater with the camshaft and gear installed) is provided under all conditions.

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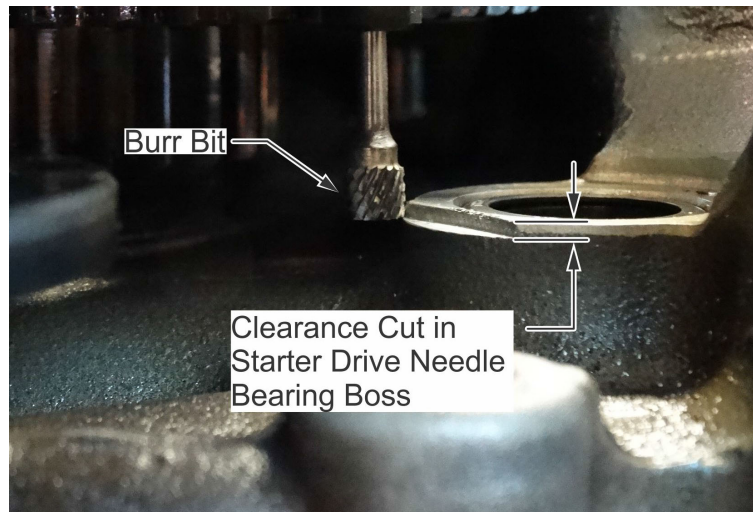


Figure 14. Clearance Cut, Setup

CAUTION: Inspect and ensure there is a minimum 0.030" clearance between the camshaft gear and the starter drive needle bearing boss

- i. Inspect the clearance cut surface and remove all nicks, burrs or sharp edges using a de-burring tool and Scotch-Brite® ultra fine scuff pad.
- j. Vacuum and thoroughly clean all debris or metal shavings from the crankcase gear work area.
- k. Remove cap plug and verify needle bearing has no debris, damage, or contamination.
- l. Transfer the markings from the old camshaft gear to the new camshaft gear to aid in the camshaft gear bolt hole alignment.
- m. Carefully insert camshaft gear P/N 656818 and seat into position over the camshaft.
- n. Ensure camshaft and crankshaft gear timing marks are correctly aligned.

NOTE: Lubricate the threads of all replaced crankshaft gear bolts and camshaft gear screws with clean 50 weight aviation engine oil.

- o. Install new camshaft gear screws in an alternating cross pattern, finger tight.
- p. Remove and install new crankshaft gear bolts (one bolt at a time) in an alternating cross pattern, finger tight.
- q. Verify crankshaft to camshaft timing alignment before torquing screws.
- r. Verify gears are evenly seated before applying torque.
- s. Pre-torque the camshaft and crankshaft gear screws 140 in. lbs. nominal in an alternating cross pattern.
- t. Final torque the camshaft and crankshaft gear screws to the value specified in M-0, "Standard Practice Maintenance Manual, Appendix B."

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WARNING

Wear eye protection when cutting safety wire to avoid injury from flying debris.

CAUTION: Prevent safety wire, nuts, washers, dirt, etc. from entering the engine.

- u. Using 0.032” safety wire, safety wire camshaft gear bolts and crankshaft gear screws according to instructions in M-0, “Standard Practice Maintenance Manual, Table 3-7 (wire size), and Appendix C-3 (method).
3. Proceed with engine assembly and reinstall any engine components that were removed in accordance with the applicable Maintenance or Overhaul Manual.
4. Install engine in aircraft in accordance with the primary ICA.
5. Document compliance with CSB05-8D in the engine log book.
6. Perform a complete engine ground run up in accordance with the aircraft manufacturer’s AFM/POH.

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VII. TERMINATING ACTION (SANDCAST CRANKCASE)

The instructions below pertain to replacing the camshaft gear in Sandcast engines without splitting the crankcase. The following procedures were performed by securing the engine to an engine test (nose) stand. Reference the principal ICA for the engine and sump removal procedures.

CAUTION: Camshaft gear (P/N 656818) is 0.060" wider at the circumference than the replaced camshaft gears (P/Ns 631845, 655430, 655516, or 656031). For engines with a Sandcast crankcase, the assembler must inspect and sustain a minimum clearance (0.030" or greater) between the camshaft gear (P/N 656818) and the oil gallery plug at the rear crankcase below the starter adapter (see step k. and Figure 20)).

1. Replace camshaft gears 631845, 655430, 655516, or 656031, and reassemble the camshaft assembly with camshaft gear P/N 656818 according to the following procedure (typical for cluster gear configuration):
 - a. Rotate the crankshaft until the timing marks on the crankshaft gear and camshaft gear align.
 - b. With the crankshaft gear and camshaft gear (and cluster gear where applicable) in the timed position, mark the crankshaft gear and camshaft gear alignment (see Figure 15) and mark the bolt closest to the starter adapter mount opening to ensure correct alignment of the replacement camshaft gear.

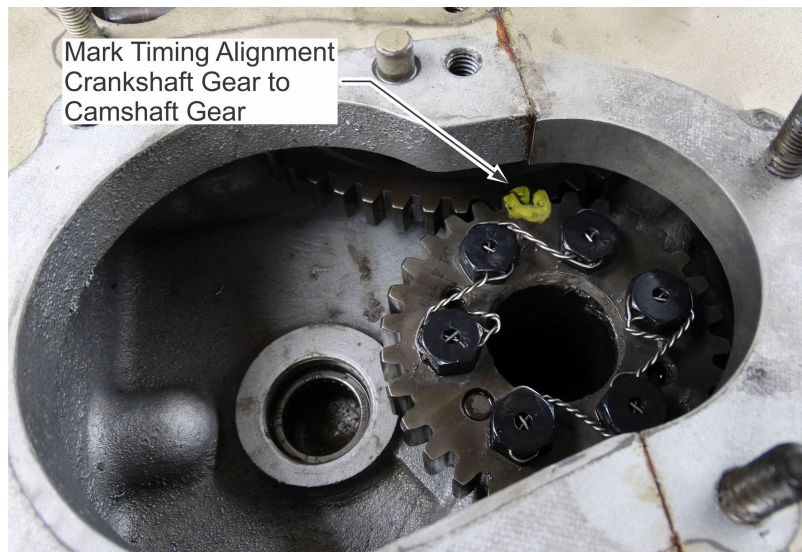


Figure 15. Camshaft Gear Timing Alignment Marked, Sandcast Crankcase

WARNING

Wear eye protection when cutting safety wire to avoid injury from flying debris.

CAUTION: Prevent safety wire, nuts, washers, dirt, etc. from entering the engine.

- c. Cut and remove safety wire from the four screws securing the camshaft gear to the camshaft (or cluster gear where applicable).

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- d. Carefully rotate the camshaft and remove the unmarked screws securing the camshaft gear to the camshaft (and cluster gear where applicable). Screws must be removed (one at a time) through the fuel pump mount opening. Do not remove the last screw (marked) at this time.

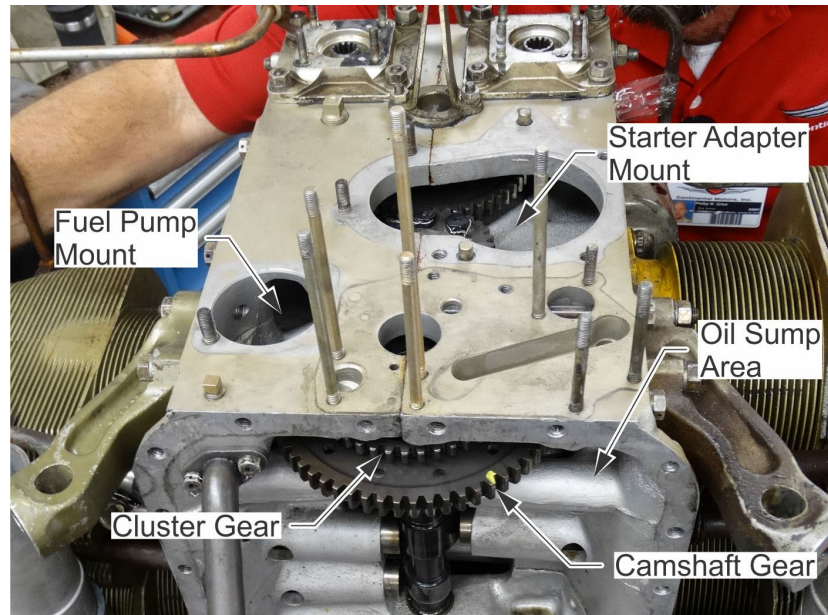


Figure 16. Camshaft Gear Access Points, Sandcast Crankcase

- e. Before removing the last screw (previously marked in step 1.. b.. above), insert and finger tighten a temporary half-height alignment screw, securing the camshaft gear to the camshaft and cluster gear (where applicable). Remove the fourth (marked) camshaft gear screw. Discard and replace all removed screws.
- f. Align and mark the crankshaft gear and camshaft gear 180 degrees from the timing marks (see Figure 18). Remove the half-height alignment screw and remove camshaft gear through the oil sump area.

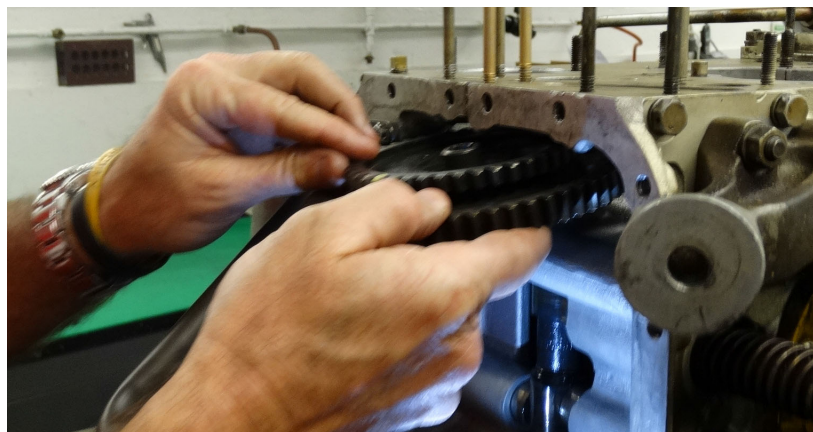


Figure 17. Remove Camshaft Gear and Cluster Gear (where applicable) through Oil Sump Area

CAUTION: Avoid applying direct pressure to the gear teeth.

- g. Carefully separate the two gears (and position for removal) from each other with a soft metal pry-bar (preferable brass). Remove both gears through the oil sump area.

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- h. Transfer the markings from the old camshaft gear to the new camshaft gear to aid in the camshaft gear bolt hole alignment. Clean the cluster gear and fit the new camshaft gear, carefully align the mounting holes on the cluster gear and camshaft gear.

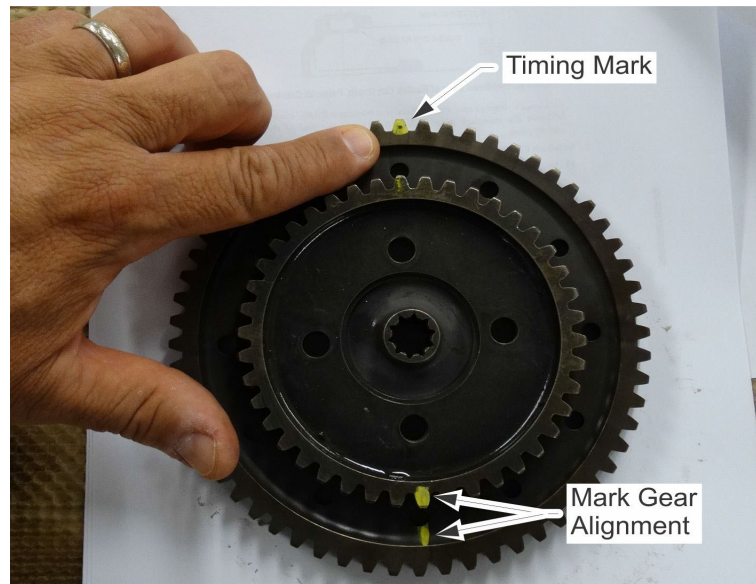


Figure 18. Transfer Gear Alignment Marks

- i. Insert both gears and carefully seat into position on the camshaft. Ensure the marking on both gears remain aligned and timing marks are correctly aligned.
- j. Verify gears mate and seat evenly. Install the half-height alignment screw, finger tight. Do not torque at this time.

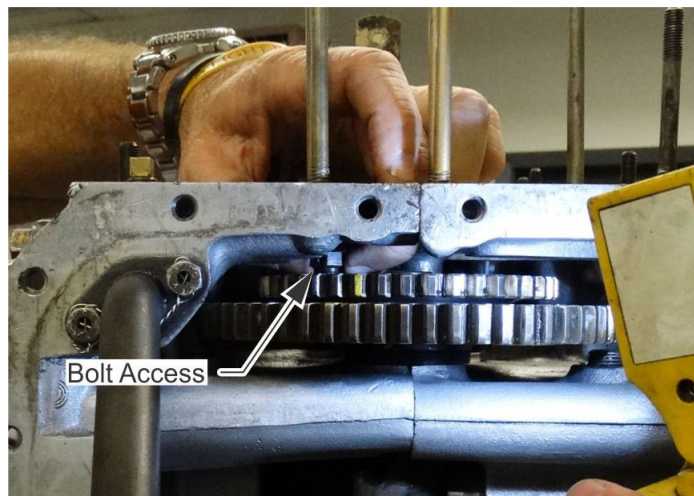


Figure 19. Install Camshaft Screws through the Fuel Pump Mount Opening

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CAUTION: Inspect and ensure there is a minimum 0.030" clearance between the camshaft gear (P/N 656818) and the oil gallery plug.

- k. Measure the clearance between the oil gallery plug and the camshaft gear using a feeler gauge (see Figure 20). Ensure the minimum clearance is 0.030" or greater. If the clearance is less than 0.030":
 - 1) Remove the safety wire and the rear crankcase tie bolt (P/N 627433) according to the instructions in the primary ICA (if it is blocking access to the oil gallery plug).
 - 2) Remove the half-height alignment screw and remove the camshaft gear.
 - 3) Remove the oil gallery plug, clean the sealant residue from the crankcase and plug threads.
 - 4) Install the oil gallery plug (according to the instructions in the primary ICA) to the maximum allowable torque specified in M-0, "Standard Practice Maintenance Manual, Appendix B" and verify required minimum clearance (0.030" or greater) is met.
 - 5) Install and torque the crankcase tie bolt (P/N 627433) according to the instructions in the primary ICA.
 - 6) Reinstall the half-height alignment screw and camshaft gear (step j.. above).

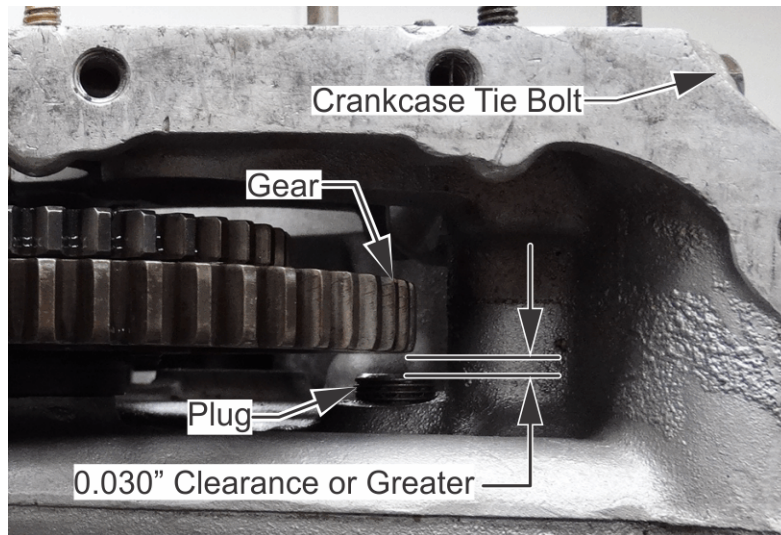


Figure 20. Lower Rear Oil Gallery (Control) Plug, Sandcast 1-3-5 Crankcase Half

NOTE: Lubricate the threads of any removed screws or bolts with clean 50 weight aviation engine oil.

- l. Insert new camshaft gear screws through the fuel pump mount opening and install in an alternating cross pattern, finger tight. Remove the half-height alignment screw and install the last camshaft gear screw, finger tight.
- m. Verify crankshaft to camshaft timing alignment. Verify alignment of the previous gear marks before torquing screws.
- n. Verify gears are evenly seated before applying torque.

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- o. Pre-torque the screws to 140 in. lbs. nominal in an alternating cross pattern.
- p. Apply final torque to the camshaft gear screws according to the value specified in M-0, “Standard Practice Maintenance Manual, Appendix B.”

WARNING

Wear eye protection when cutting safety wire to avoid injury from flying debris.

CAUTION: Prevent safety wire, nuts, washers, dirt, etc. from entering the engine.

2. Using 0.032” safety wire, safety wire crankshaft gear screws according to instructions in M-0, “Standard Practice Maintenance Manual, Table 3-7 (wire size), and Appendix C-3 (method).
3. Proceed with engine assembly and reinstall any engine components that were removed in accordance with the applicable Maintenance or Overhaul Manual.
4. Install engine in aircraft in accordance with the primary ICA.
5. Document replacement of camshaft gear as compliance with CSB05-8D in the engine log book.
6. Perform a complete engine ground run up in accordance with the aircraft manufacturer’s AFM/POH.

VIII. CUSTOMER SERVICE

Visit the Continental Motors web site at www.continentalmotors.aero to obtain copies of Continental Motors Warranty Policies.

Contact Continental Motors Technical Services at one of the numbers listed below if you have any questions concerning the technical content of this Service Document.

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