

SERVICE BULLETIN

SB14-2

Compliance Will Enhance Safety

Supersedes
SB04-7 and SIL04-8
TECHNICAL PORTIONS
FAA APPROVED

SUBJECT: Inspection and Replacement of IO240 Starter and Crankshaft Cluster Gear

PURPOSE: To notify owners, operators, maintenance facilities and distributors of inspection, repair and/or replacement of starter assembly, starter motor, drive clutch assembly and crankshaft cluster gear.

COMPLIANCE: Initial inspection at starter removal, no later than the next scheduled inspection. A recurring service inspection of the crankshaft cluster gear is required at every starter removal.

MODELS

AFFECTED: All IO240 and IOF240B series engines.

I. Background Information

Continental Motors, Inc. (CMI) production released a new starter assembly for the IO240 and IOF240B series engines. Starter assembly part number (P/N 658291) supersedes starter assembly P/Ns 654046, 655551, 655957 (B & C starter P/N BC320-1), 657375, and 634464 (with gear clutch and pinion assembly P/Ns 653575 and 641500). Superseded parts are no longer available or service supported.

CAUTION: Starters installed using an unmatched or incompatible crankshaft cluster gear may result in a shortened service life, equipment failure, or damage to the engine.

In addition, if you are replacing any identified starter assembly with the starter assembly P/N 658291, you must also replace crankshaft cluster gears (P/Ns 641906 or 656762) with the matching crankshaft cluster gear P/N 656072.

NOTE: This service document does not mandate replacement if the inspection results determine the starter assembly, starter motor, drive clutch assembly, and crankshaft cluster gear continue to meet service standards.

This service document provides inspection, removal, and replacement instructions for superseded:

1. Starter Motor Assembly, part numbers:
 - a. 654046, 655551, 655957, or 657375.
 - b. 634464 (with gear clutch and pinion assemblies 653575 or 641500).
2. Crankshaft Cluster Gear, part numbers 641906 or 656762.
3. Instructions are also provided for the replacement of the crankcase needle bearing (P/N 633609-8 with a rear crankcase plug P/N 654029).

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II. Scope

Lightweight starter assemblies P/Ns 654046, 655551, 655957 (B & C starter P/N BC320-1), and 657375, are intermittent mesh units, which, upon energizing, extends a pinion gear to engage the driven gear secured to the engine crankshaft cluster gear. Earlier starter motor assembly 634464 (with gear clutch and pinion assemblies P/Ns 653575 or 641500) is a continuous mesh unit, which, upon energizing, engages a clutch internal to the clutch and gear assembly to form the power train. When de-energized, the clutch decouples the engine from the stopped starter motor.

The new starter assembly P/N 658291 and the matching crankshaft cluster gear P/N 656072 may be ordered through any CMI distributor. Consult product catalog for current replacement part numbers.

A. General Inspection Criteria

Table 1. Replacement Starter/Crankshaft Cluster Gear Matrix

If, Replacing Starter Assembly Part Number...		Then...	
654046 / 655551 / 657375 655957 (B & C starter P/N BC320-1)		1. Replace with Starter Assembly (P/N 658291) and Crankshaft Cluster Gear (P/N 656072)	
634464		1. Discard gear clutch and pinion. 2. Remove needle bearing (per Section B) 3. Replace with Starter Assembly (P/N 658291) and Crankshaft Cluster Gear (P/N 656072)	
If, Replacing Crankshaft Cluster Gear...			Then...
Part Number	or gear tooth profile is (see Figure 4)	or has unacceptable wear (see Figure 6)	
641906 656762	Non-chamfered (straight tooth)	without missing or broken gear teeth	Replace with Crankshaft Cluster Gear (P/N 656072) and Starter Assembly (P/N 658291)
		with missing or broken gear teeth	Remove Magnetos and inspect accessory drive gears for damage. Conduct a Foreign Object Contamination Inspection according to the latest revision of the Maintenance and Overhaul Manuals (M-6/M-22) ¹

1. Please contact Continental Motors Customer Service Department directly at 1 (800) 326-0089.

III. Removal Instructions

Refer to the latest revision of the IO240/IOF240B Engine Maintenance and Overhaul Manuals (M-6/M-22) for specific inspection instructions and criteria. After completing removal and inspection of the starter assembly or starter motor; if determined compliant within service limits, replace according to the engine Instructions for Continued Airworthiness and proceed to Section V, "Completing Installation," on page 8.

WARNING

Before performing any preventive maintenance, maintenance or inspections ensure that the aircraft engine Master Switch is in the OFF position, the Ignition Switch is in the OFF position, and disconnect engine electrical power, and confirm continuity between the magneto capacitor ("P" lead terminal) and aircraft ground. Stand clear of the propeller arc prior to proceeding and DO NOT stand or place equipment within the arc of the propeller.

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1. Remove the engine cowling in accordance with the aircraft manufacturer's instructions.
2. Remove the electrical connection on the starter drive assembly.

A. Removing Starter

1. Remove attaching washers, spacers, and nuts (Figure 1, items 3, 4, 5 & 6). Discard washers and spacers.
2. Remove bolts (8), lifting eye, and washers (4 & 7), from starter drive assembly housing (1) and accessory case. Replace bolts P/N 538999 with new bolts P/N 630966-4.00 (8) if removing the P/N 634464 starter motor and P/Ns 641500 or 653575 clutch assembly. Retain lifting eye and discard washers.
3. Lightly tap/bump the starter (1) by hand to break the starter gasket (2) adhesion. Carefully remove the starter and clutch, if installed, and discard the starter gasket.

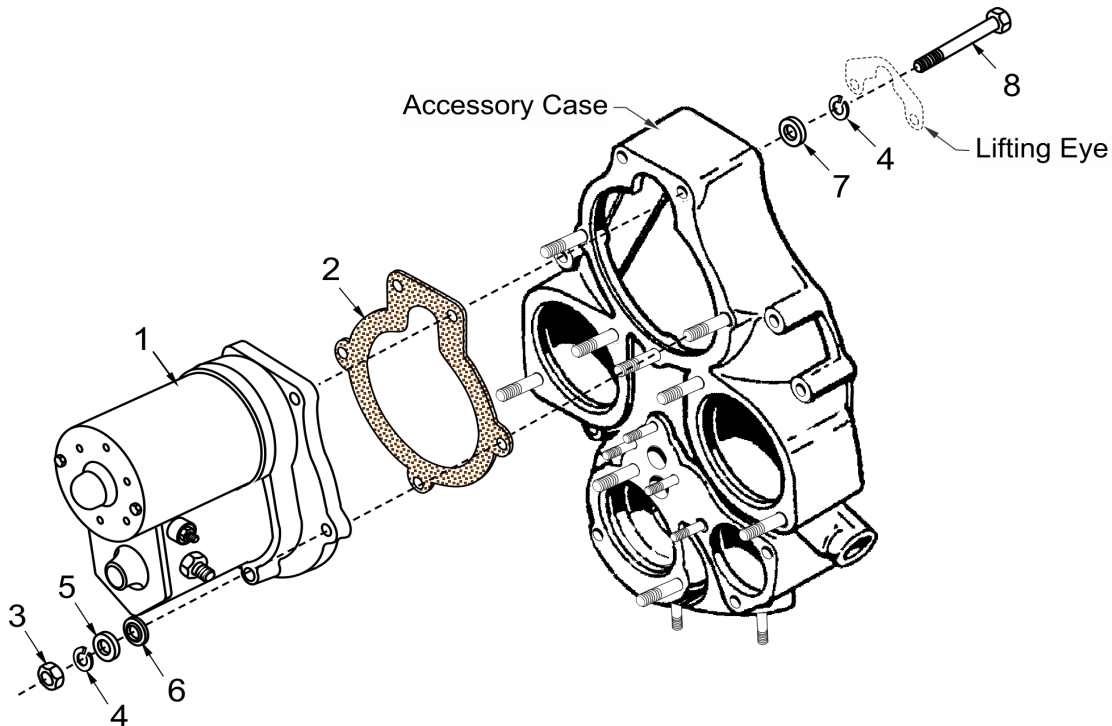


Figure 1. Removing Starter Drive Assembly (typical)

Table 2. Starter Drive Assembly

Item	Part Number	Description	Quantity
1	634464/654046/65551/ 655957/657375	Starter, ASM -12 Volt	1
2	653673	Gasket, Starter	1
3	AN315-5R	Nut, Plain .31-24	3
4	MS35338-45	Washer, Spring Lock, .3125	5
5	22535	Spacer, .33 ID x .25	3
6	538600	Washer, Seal .304 x .625 x .050, or	3
7	AN960-516	Washer, Plain .31 x .063 Thick	3
8	630699-4.00	Bolt, .31-18 x 4.00	2
(N/A)	653889	Eye-lifting, Engine	1

B. Starter Jack Adapter Preparation (if equipped)

1. Remove existing needle bearing using a 0.50 inch expandable bushing/bearing puller and slide hammer (see Figure 2 and Table 3).

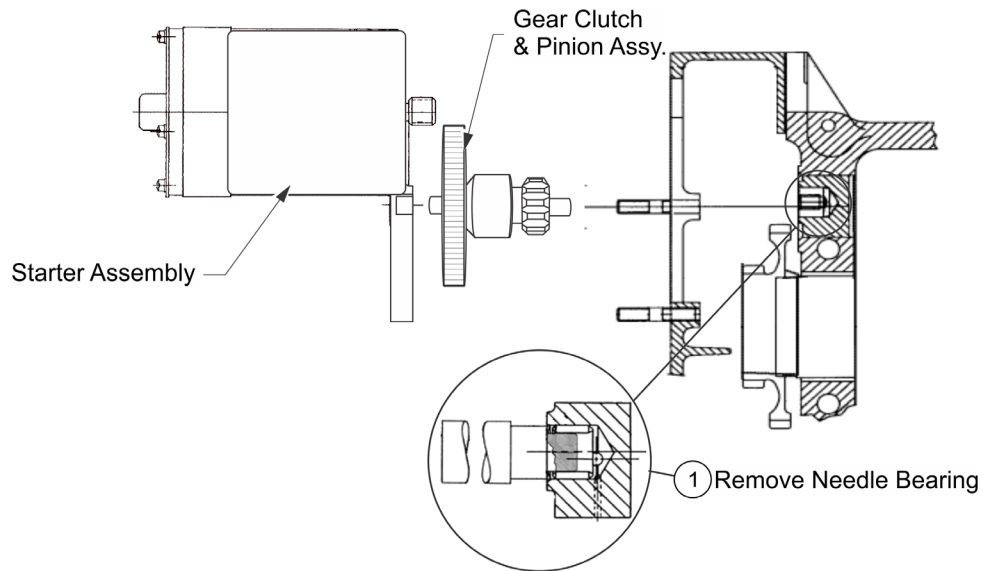


Figure 2. Remove Needle Bearing

2. Clean bearing bore with Loctite 7070 cleaner (see Table 3, item 2).
3. Screw a three-inch long 0.375-16 bolt (4) into plug (see Figure 3, item 1).
4. Coat exterior circumference of plug (1) with Loctite 222 sealant (3).
5. Tap plug (1) in bearing cavity. Ensure that plug (1) is bottomed in cavity.
6. Remove 0.375-16 bolt (4) from plug (1).

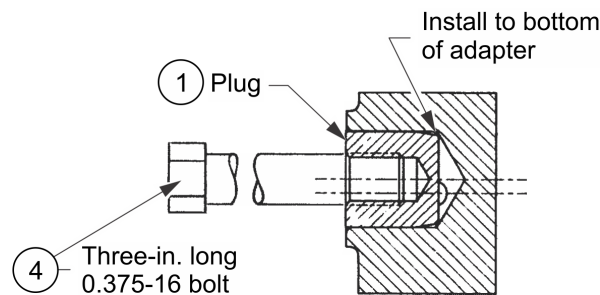


Figure 3. Install Rear Crankcase Plug

Table 3. Starter Jack Adapter

Figure	Item	Part Number	Description	Quantity
2	Remove	633609-8	Needle Bearing	1
3	1	654029	Plug, Crankcase Rear	1
N/A	2	N/A	Loctite 7070 Cleaner (not shown)	As required
N/A	3	649306	Loctite 222 Sealant (not shown)	As required
N/A	4	N/A	0.375-16 bolt	1

C. Inspecting Crankshaft Cluster Gear

Inspection of the crankshaft cluster gear is required whenever the starter drive assembly is removed.

WARNING

Before performing any preventive maintenance, maintenance or inspections ensure that the aircraft engine Master Switch is in the OFF position, the Ignition Switch is in the OFF position, disconnect engine electrical power, and confirm continuity between the magneto capacitor (“P” lead terminal) and aircraft ground. Stand clear of the propeller arc prior to proceeding and DO NOT stand or place equipment within the arc of the propeller.

1. Ensure that the ignition switch is OFF, the magnetos are grounded, and starter assembly is removed (see Section III, “Removal Instructions”).
2. With the starter assembly removed, use a flashlight (or appropriate supplemental lighting) to visually inspect the crankshaft cluster gear through the starter assembly mounting hole in the rear of the accessory case.
3. Determine the gear tooth profile of the installed crankshaft cluster gear (as shown in Figure 4). Incompatible (straight tooth) gear profiles must be replaced.



Figure 4. Chamfer Tooth Gear Profile

4. Identify the crankshaft cluster gear part number to determine if replacement is required. Any incompatible cluster gear must be replaced using the procedures contained in the IO240/IOF240B Engine Maintenance and Overhaul Manuals (M-6/M-22):
 - a. If replacing starter assembly P/Ns 654046, 655551, 655957 (B & C starter P/N BC320-1), 657375, or 634464 with starter assembly 658291; replace crankshaft cluster gear with crankshaft cluster gear 656072.
 - b. If the crankshaft cluster gear cannot be properly identified, replace with starter assembly P/N 658291 and crankshaft cluster gear 656072.
5. Examine the wear criteria on the larger of the two gears to determine either acceptable wear (Figure 5) or unacceptable wear (Figure 6) to the crankshaft cluster gear (see steps 5., a. and b.). After completely inspecting the visible gear tooth surfaces for wear, slowly rotate the engine crankshaft to examine the next section of the gear until all gear tooth surfaces have been completely inspected and the wear patterns have been reviewed against the following criteria:

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- a. **Acceptable Wear** - Figure 5 depicts normal wear patterns for the crankshaft cluster gear. This wear pattern is normal and should not be confused with damaged gear teeth as shown in Figure 6.
- 1) Visible signs of polishing to the contact surfaces of the larger gear teeth that receive initial contact from the pinion gear during start.
 - 2) The wear should be generally even and consistent around the entire circumference of the gear.



Figure 5. Acceptable Wear Criteria

- b. **Unacceptable Wear** - Figure 6 depicts unacceptable or abnormal wear of a crankshaft cluster gear.
- 1) There will be extremely rough areas with damage to the tooth surfaces and the surrounding gear areas.
 - 2) In some circumstances portions of teeth may be broken away from the gear. The most extreme cases may have whole teeth missing.
 - 3) If the damage is considered abnormal **without** complete teeth missing, replace the crankshaft cluster gear in accordance with the instructions contained in the applicable sections of the IO240/IOF240B Maintenance and Overhaul Manuals (M-6/M-22).
 - 4) If the crankshaft cluster gear is missing one or more complete teeth, please contact Continental Motors Customer Service Department directly at 1(800) 326-0089.

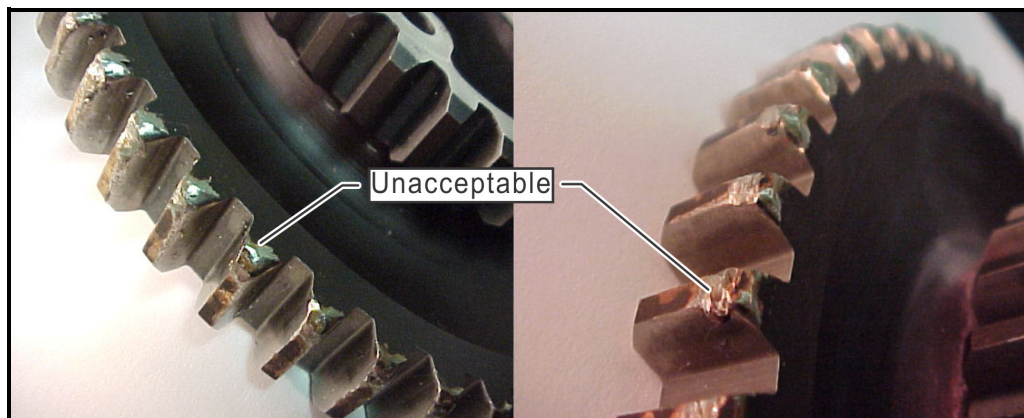


Figure 6. Unacceptable Wear Criteria

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IV. Starter Assembly Installation

If no abnormal wear, or other distress to the crankshaft cluster gear is present, install the new or serviceable starter drive assembly according to the following instructions.

1. Install a new starter gasket (Table 4, item 2) on the accessory case (see Figure 7).
2. Align starter assembly (1) with the accessory case studs and position the starter assembly so that the 3 o'clock stud extends through the housing sufficiently to install fasteners.
3. Place the washer (6), spacer (5), lock washer (4) and start the nut (3) onto the stud threads.
4. Seat the starter assembly (1) against the gasket (2) and install the remaining fasteners on the remaining case studs in a clockwise order. Do not tighten hardware at this time.
5. Secure the upper portion of the starter assembly (1) to the accessory case by installing two bolts (7), lock washers (4), lifting eye, and flat washers (6).
6. Torque nuts (3) and bolts (7) to 180-220 inch pounds of torque.
7. If a new starter lead is required, replace and install the electrical connection on the starter assembly in accordance with the aircraft manufacturer's instructions.
8. Torque electrical connection on the starter assembly to 50 inch pounds.

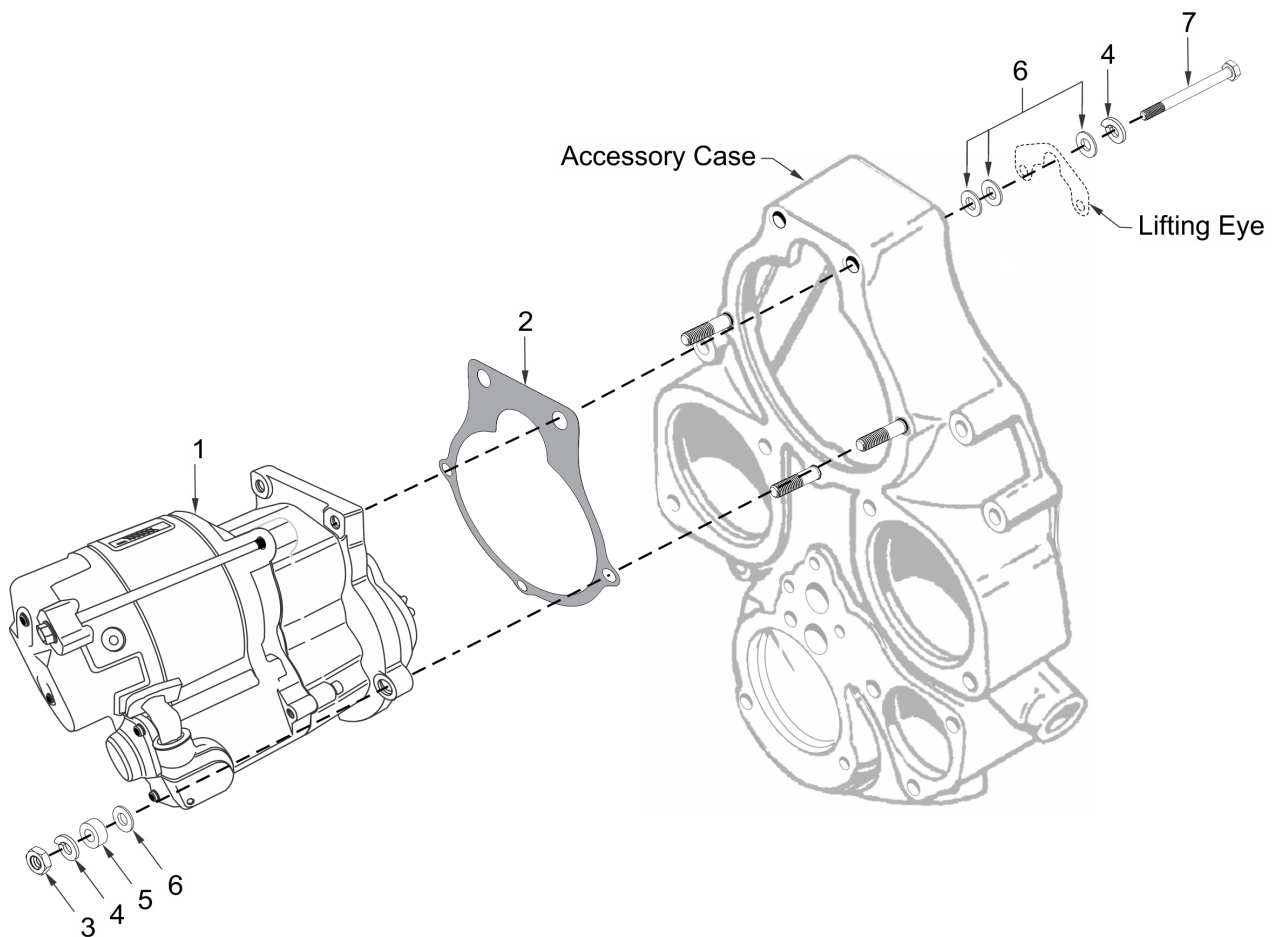


Figure 7. Installing New Starter Drive Assembly (typical)

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Table 4. Starter Drive Assembly

Item	Part Number	Description	Quantity
1	658291	Starter, ASM -12 Volt	1
2	653673	Gasket, Starter	1
3	AN315-5R	Nut, Plain .31-24	3
4	MS35338-45	Washer, Spring Lock, .3125	5
5	22535	Spacer, .33 ID x .25	3
6	AN960-516	Washer, Plain .31 x .063 Thick	9
7	MS90728-48	Bolt, .31-18 x 4.00	2
(N/A)	653889	Eye-lifting, Engine	1
Removed	538600	Washer, Seal, .304 x .625 x .050	3

V. Completing Installation

1. Install engine cowling in accordance with the aircraft manufacturer's instructions.
2. Perform a complete engine ground run up in accordance with the aircraft manufacturer's AFM/POH.
3. Visually inspect the engine for fluid leaks. Correct any discrepancies noted prior to returning the aircraft and engine to service.

VI. Log Book Entry

Make a logbook entry detailing the compliance actions taken in accordance with this bulletin (SB14-2). If performed, include removal of existing starter assembly and installation of new starter assembly and crankshaft cluster gear.