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# MANDATORY

# SERVICE BULLETIN

September 12, 2016

Supplement No. 1

To

Service Bulletin No. 475C

**REASON FOR SUPPLEMENT:** Provide an alternate method of compliance to Service Bulletin No. 475C if the crankshaft gear is replaced rather than modified.

**NOTICE:** Incomplete review of all the information in this document can cause errors. Read the entire Supplement to make sure you have a complete understanding of the requirements.

The FAA has approved this supplement as an Alternate Method of Compliance to Airworthiness Directive 2004-10-14.

Remove the crankshaft gear (Figure 1) to complete the following procedures in this Supplement to ensure correct seating of the crankshaft gear:

- Crankshaft Gear Removal
- Crankshaft and Crankshaft Gear Pre-Cleaning Inspection
- Crankshaft Counterbore and Crankshaft Gear Cleaning
- Crankshaft Gear Identification and Inspection
- Crankshaft Counterbore Inspection
- Alignment Dowel Inspection
- Alignment Dowel Replacement
- Crankshaft Gear Installation

## Crankshaft Gear Removal

1. Disassemble the crankcase as per instructions in the applicable Lycoming Overhaul Manual.

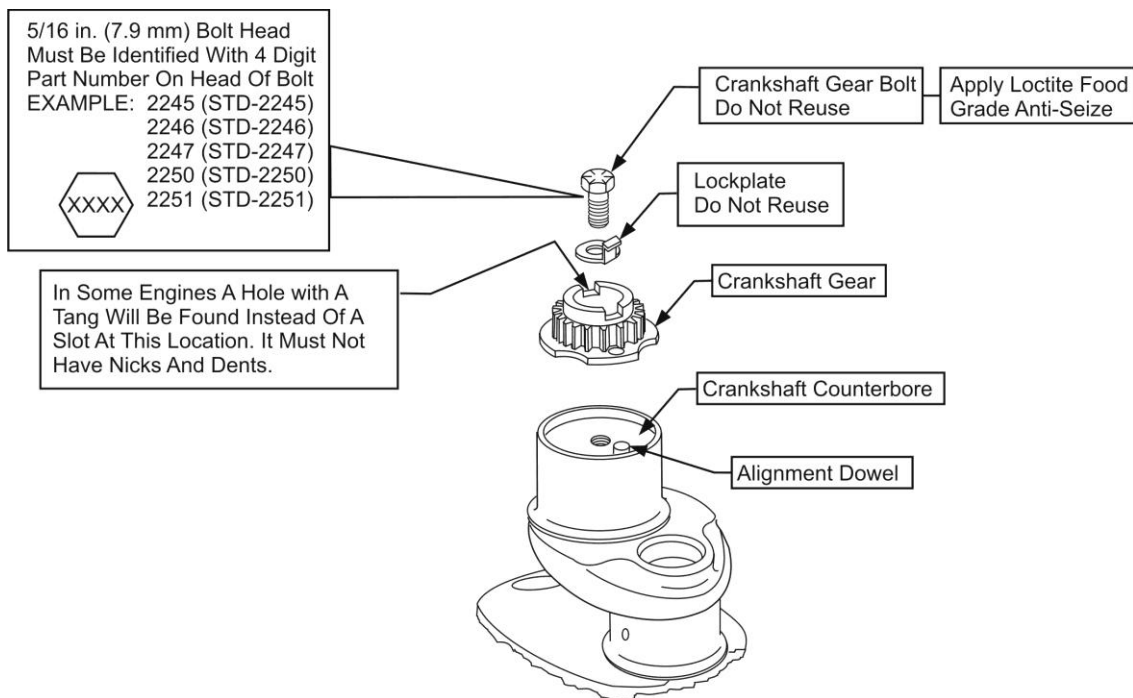
**NOTICE:** Any time the crankshaft gear bolt (Figure 1) and lockplate are removed from the crankshaft gear, the bolt and lockplate are to be discarded and replaced with a new bolt and new lockplate for the applicable crankshaft gear. The discarded bolt and lockplate are not to be re-installed on any engine.

2. Bend the tab or tabs of the lockplate down, flat against the crankshaft gear.



ISSUED			REVISED			PAGE NO.	REVISION	Sup 1 to S.B. 475C
MO	DAY	YEAR	MO	DAY	YEAR			
09	12	16	--	--	--	1 of 11	--	

- Remove the crankshaft gear bolt, lockplate, and crankshaft gear from the crankshaft (Figure 1). Discard the bolt and the lockplate.



**Figure 1**  
**Crankshaft Gear Bolt and Lockplate**

### **Crankshaft and Crankshaft Gear Pre-Cleaning Inspection**

Examine the crankshaft gear and crankshaft inner diameter and external surface for evidence of pitting and wear. These conditions are of particular importance when they occur on the involutes of the crankshaft gear teeth. Replace the crankshaft gear if there is any pitting or wear.

### **Crankshaft Counterbore and Crankshaft Gear Cleaning**

**NOTICE:** The crankshaft and crankshaft gear must be thoroughly cleaned before further inspection.

- Clean the threads of the recessed crankshaft counterbore on the crankshaft as follows:

**CAUTION:** TO PREVENT MAKING THE THREADS IN THE CRANKSHAFT COUNTERBORE TOO LARGE, USE THE CORRECTLY SIZED TAP. IF THE INCORRECT TAP IS USED, THE BORE CAN BE MADE TOO LARGE TO CORRECTLY ENGAGE THE THREADS ON THE CRANKSHAFT GEAR BOLT WHEN THE CRANKSHAFT GEAR IS INSTALLED ON THE CRANKSHAFT. IF THE BOLT THREADS ARE TOO LARGE, DISCARD THE CRANKSHAFT AND REPLACE IT WITH A NEW CRANKSHAFT.

- Use the correct sized undamaged standard threading tap from Table 1.

**Table 1**  
**Tap Thread Size**

Thread Size	
5/16 in.	1/2 in.

- Install the selected tap into the recessed crankshaft counterbore on the crankshaft.

ISSUED			REVISED			PAGE NO.	REVISION	Sup 1 to S.B. 475C
MO	DAY	YEAR	MO	DAY	YEAR	2 of 11	--	
09	12	16	--	--	--			

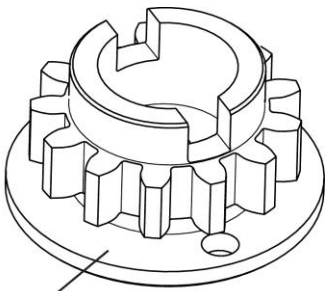
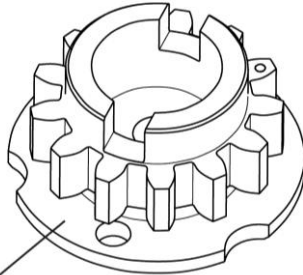
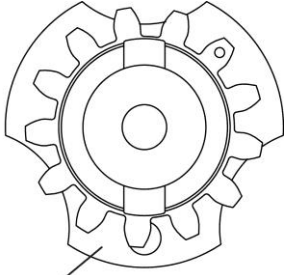
- C. Turn the tap five turns to clean the threads.
  - D. Remove the tap.
  - E. Flush the crankshaft counterbore and alignment dowel pin with mineral spirits (MIL-PRF-680) or equivalent or Stoddard's Solvent, or equivalent solvent to remove any debris.
  - F. Dry the crankshaft counterbore threads with compressed air.
  - G. Examine the threads in the crankshaft counterbore for any wear.
  - H. Make sure the tapped hole is clean and the threads are not stripped, galled, or damaged. If the threads are stripped, galled, or damaged, discard the crankshaft and replace it with a new crankshaft.
2. Clean the crankshaft gear as follows:
- A. Soak the crankshaft gear in mineral spirits (MIL-PRF-680) or equivalent or Stoddard's Solvent, or equivalent solvent.
  - B. Remove all dirt and debris from the crankshaft gear with a lint-free wipe.
  - C. Dry with compressed air.

**Crankshaft Gear Identification and Inspection**

**Crankshaft Gear Identification**

Once the crankshaft gear is removed, identify whether or not the existing crankshaft gear is the latest correct style crankshaft gear shown in Figure 4. Crankshaft gears for applicable engines currently are manufactured with three, 3/4 in. (19.05 mm) radius scallops cut into the outer diameter of the pilot flange (as shown in Figure 4) and a counterbore on the back side of the crankshaft gear.

Over the years, because of design improvements to the crankshaft gear, the pilot flange on the gear has changed from a round shape (Figure 2), then briefly to a small scallop pilot flange (Figure 3), and finally to the current configuration of a large scallop pilot flange (Figure 4). The three-scallop pilot flange enables the insertion of a feeler gage to make sure the gear is correctly seated after the gear is installed on the crankshaft. The crankshaft gear must be correctly seated to ensure correct engagement with the other gears.

		
Pilot Flange	Pilot Flange	Pilot Flange
<b>Figure 2*</b> <b>Round Pilot Flange</b>	<b>Figure 3*</b> <b>Small Scallop Pilot Flange</b>	<b>Figure 4</b> <b>Large Scallop Pilot Flange</b>
* Must be replaced with the crankshaft gear shown in Figure 4. The gear with the large scallops shown in Figure 4 is the only type of crankshaft gear that can be installed on affected Lycoming engines.		

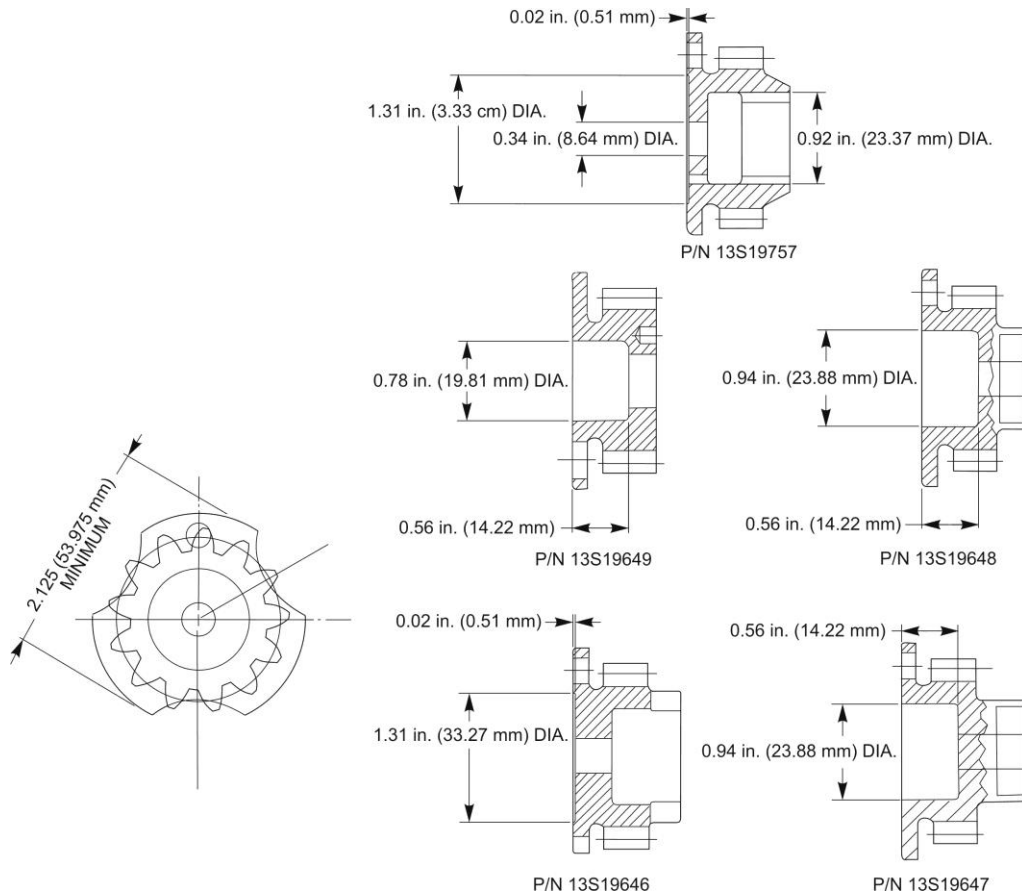
ISSUED			REVISED			PAGE NO.	REVISION	Sup 1 to S.B. 475C
MO	DAY	YEAR	MO	DAY	YEAR			
09	12	16	--	--	--	3 of 11	D	

If the crankshaft gear does not have the larger three scallops as shown in Figure 4 and looks like either crankshaft gear shown in Figure 2 or Figure 3, discard the crankshaft gear and replace it with a new crankshaft gear with the larger scallops as shown in Figure 4. Refer to Table 2 and Figure 5 to identify the correct replacement crankshaft gear.

If the crankshaft gear looks like the large scallop pilot flange-type crankshaft gear (P/Ns 13S19646 and 13S19757) shown in Figure 4, make sure the gear has the 0.02 in. (0.51 mm) cut on the underside of the gear as shown in Figure 5. Otherwise, replace with a serviceable crankshaft gear.

**Table 2**  
**Crankshaft Gear and Attaching Parts**

New Crankshaft Gear Part No.	Superseded Crankshaft Gear Part No.	Lockplate Part No.	New Bolt Part No.	Superseded Bolt Part No.	Alignment Dowel Part No.
13S19646	61155	LW-18639	STD-2246	STD-2213	STD-1065 (5/16 in. dia.) (7.938 mm dia.)
13S19647	67514	LW-18638	STD-2247	STD-2209	
13S19648	76786	LW-18638	STD-2247	STD-2209	
13S19757	72348	72353	STD-2245	STD-2234	
13S19649	LW-10284	LW-10332	STD-2251	AN8-14A	STD-2078 (3/8 in. dia.) (9.525 mm dia.)
LW-14708	-----	LW-10332	STD-2250	AN8-10A	



**Figure 5**  
**Details for Crankshaft Gears to Current Configuration**

ISSUED			REVISED			PAGE NO.	REVISION	Sup 1 to S.B. 475C
MO	DAY	YEAR	MO	DAY	YEAR			
09	12	16	--	--	--	4 of 11	--	

## **Crankshaft Gear Inspection**

**NOTICE:** Prior to inspection, the mating surface of the crankshaft gear must be clean, dry, and free of debris.

1. Examine the pilot flange diameter of the crankshaft gear for damage from galling or fretting. If the pilot flange of the crankshaft gear is damaged, replace the crankshaft gear.
2. If there is a hole or slot on the crankshaft gear, examine the slot for any nicks or dents. If nicks or dents are found, replace the crankshaft gear with a serviceable large scallop pilot flange gear (shown in Figure 4).
3. Measure the diameter of the crankshaft gear pilot flange. If the diameter of the pilot flange is less than 2.125 in. (53.975 mm) (Figure 5), do not install this gear on the crankshaft. Replace the crankshaft gear with a serviceable crankshaft gear.
4. Measure the dimensions on the crankshaft gear as per those shown in Figure 5 for the respective crankshaft gear part number in Table 2.
5. Complete a magnetic particle inspection on the crankshaft gear anytime the crankshaft gear is removed. Refer to the latest revision of Service Instruction No. SI-1285.

## **Crankshaft Counterbore Inspection**

**⚠ CAUTION:** DO NOT TRY TO REPAIR THE CRANKSHAFT COUNTERBORE THREADS IN THE FIELD. IF THIS TYPE OF REPAIR IS NECESSARY, IT IS RECOMMENDED THE CRANKSHAFT BE SENT TO THE FACTORY (THROUGH AN AUTHORIZED LYCOMING DISTRIBUTOR) WITH PAPERWORK THAT IDENTIFIES THE NECESSARY REPAIR.

1. Examine the threads in the counterbored end of the crankshaft. If the threads are galled, stripped or damaged, it is recommended the crankshaft be sent to the factory (through an authorized Lycoming Distributor) with paperwork that identifies the type of damage. Do not try to repair the threads in the field.
2. Measure the Inside Diameter (ID) of the crankshaft counterbore at the rear of the crankshaft to make sure there is a correct fit between the ID of the crankshaft and the Outside Diameter (OD) of the crankshaft gear pilot flange. The crankshaft counterbore diameter at the rear of the crankshaft must not be more than 2.126 in. (54.000 mm) when measured at any location. If the diameter is oversized, replace the crankshaft.
3. Examine the gear mounting face of the crankshaft counterbore for damage. Replace the crankshaft if damage is found.

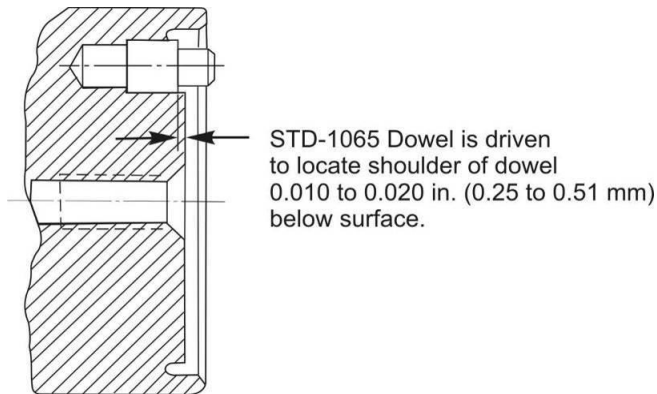
## **Alignment Dowel Inspection**

**NOTICE:** There are two basic alignment dowel part numbers, STD-1065 (Figure 6) and STD-2078 (Figure 7). Each type of alignment dowel can have oversized variations as shown in Table 3. Figure 8 shows the details of the two crankshaft alignment dowels: STD-1065 and STD-2078.

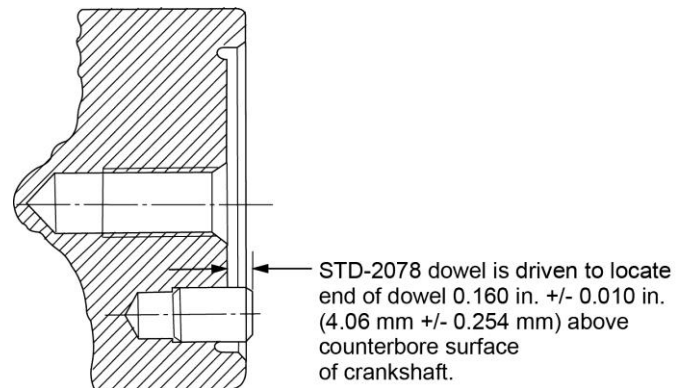
1. Examine the alignment dowel installed in the end of the crankshaft.
2. Make sure the alignment dowel is smooth and round, without nicks, cracks, or deformation.

ISSUED			REVISED			PAGE NO.	REVISION	Sup 1 to S.B. 475C
MO	DAY	YEAR	MO	DAY	YEAR			
09	12	16	--	--	--	5 of 11	D	

3. If the alignment dowel is smooth and round, make sure that it is installed correctly, by the following measurements.
  - A. Figure 6 for STD-1065-type alignment dowels, the shoulder of the alignment dowel is 0.010 to 0.020 in. (0.25 to 0.51 mm) below the surface of the crankshaft.
  - B. Figure 7 for alignment dowels STD-2078 shows that the end of the alignment dowel is 0.160 ± 0.010 in. (4.06 ± 0.254 mm) above the counterbore surface of the crankshaft.
4. Measure the diameter of the alignment dowel (Dimension A) shown in Figure 8 and determine if the measurement conforms to the values in Table 3 for the different alignment dowel part numbers.
5. If the alignment dowel is out of tolerance, out of round, or damaged, replace the alignment dowel with a new one as per instructions in the section “Alignment Dowel Replacement.”



**Figure 6**  
**Section Through Crankshaft Counterbore End of Crankshaft Showing Driven Height of STD-1065 Alignment Dowel**



**Figure 7**  
**Section Through Crankshaft Counterbore End of Crankshaft Showing Driven Height of STD-2078 Alignment Dowel**

### **Alignment Dowel Replacement**

1. Use a center punch to mark the center of the exposed surface of the installed alignment dowel.
2. Mark a 1/8 in. (3.18 mm) drill bit to limit the depth of the drilled hole to 0.6 in. (15.14 mm).

**⚠ CAUTION:** USE CARE NOT TO DRILL DEEPER THAN THE MARKED DEPTH LIMIT OF THE DRILL. DO NOT LET THE DRILL MAKE CONTACT WITH THE REAR OF THE CRANKSHAFT.

3. Drill a 1/8 in. (3.18 mm) diameter hole through the center of the installed alignment dowel.
4. Fill the new drilled hole with oil.
5. Put a piece of 1/8 in. (3.18 mm) diameter drill rod in the drilled hole.
6. Use a hammer or mallet to hit the end of the drill rod.
7. Hydraulic pressure from the oil will push out the alignment dowel from the crankshaft.
8. Remove and discard the alignment dowel.
9. Examine the bottom of the alignment dowel hole to make sure that the drill bit did not make contact with the bottom of the hole. If the drill bit made contact with the bottom of the hole, it is recommended the crankshaft be sent to the factory for evaluation.
10. Refer to Table 3 for the correct type and size of replacement alignment dowel.

ISSUED			REVISED			PAGE NO.	REVISION	Sup 1 to S.B. 475C
MO	DAY	YEAR	MO	DAY	YEAR			
09	12	16	--	--	--	6 of 11	--	

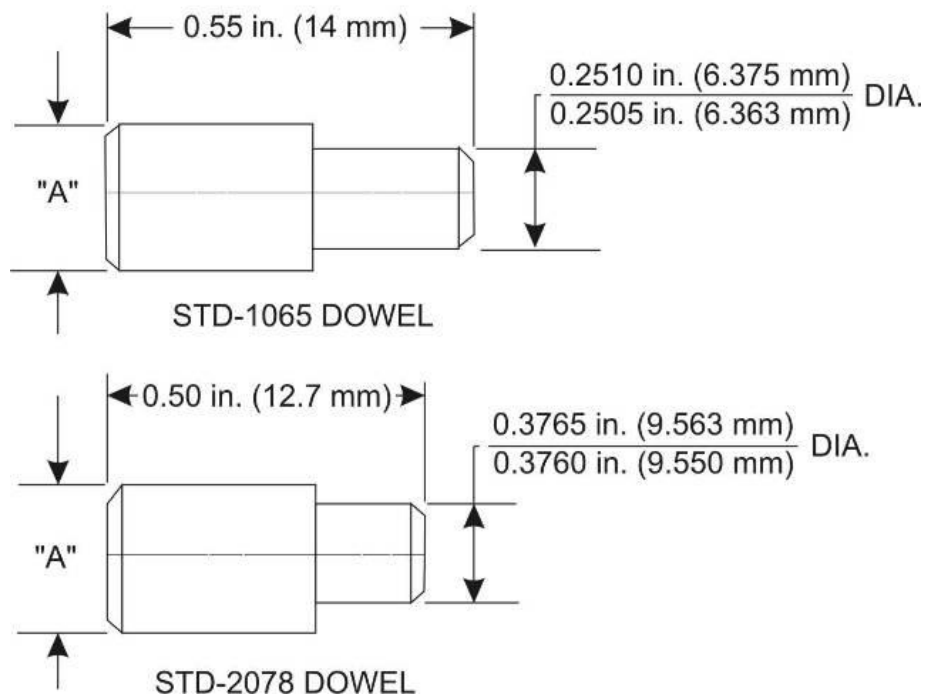
11. Press the replacement alignment dowel into the alignment dowel hole, refer to Figure 6 or 7 for the correct driven height of the applicable alignment dowel.

**Table 3**  
**Alignment Dowels and Alignment Dowel Holes**

Alignment Dowel Part No.	Size Code on Alignment Dowel	Diameter of Alignment Dowel "A" (Figure 8)		Diameter of Alignment Dowel Hole in Crankshaft	
		in.	mm	in.	mm
STD-1065*	None	0.3095 to 0.3100	7.861 to 7.874	0.3085 to 0.3095	7.836 to 7.871
STD-1065-P02	P02	0.3115 to 0.3120	7.921 to 7.925	0.3105 to 0.3115	7.887 to 7.925
STD-1065-P05	P05	0.3145 to 0.3150	7.988 to 8.001	0.3135 to 0.3145	7.963 to 7.988
STD-1065-P10	P10	0.3195 to 0.3200	8.115 to 8.128	0.3185 to 0.3195	8.090 to 8.115
STD-2078**	None	0.3760 to 0.3765	9.550 to 9.563	0.3750 to 0.3760	9.525 to 9.550
STD-2078-P02	P02	0.3780 to 0.3785	9.601 to 9.614	0.3770 to 0.3780	9.576 to 9.601
STD-2078-P05	P05	0.3810 to 0.3815	9.677 to 9.690	0.3800 to 0.3810	9.652 to 9.677
STD-2078-P10	P10	0.3860 to 0.3865	9.804 to 9.817	0.3850 to 0.3860	9.779 to 9.804

\* Refer to Figures 6 and 8.

\*\*Refer to Figures 7 and 8.



**Figure 8**  
**Details of Crankshaft Alignment Dowel**

ISSUED			REVISED			PAGE NO.	REVISION	Sup 1 to S.B. 475C
MO	DAY	YEAR	MO	DAY	YEAR			
09	12	16	--	--	--	7 of 11	D	

## Criteria for Crankshaft Gear Replacement

In summary, a crankshaft gear must be replaced with a serviceable crankshaft gear if any of the following are found during the crankshaft gear identification and inspection.

- If the pilot flange diameter is less than 2.125 in. (53.975 mm) or is not in compliance with dimensions shown in Figure 5
- If the crankshaft gear looks like the gear shown in either Figure 2 or 3 and does not have the larger scallops as shown in Figure 4 (the larger scallops enable the shim check)
- Damaged counterbore face of the crankshaft gear
- If the crankshaft gear has a hole or slot and there are any nicks or dents on the hole or slot
- Nicks or deformities on the slot and teeth of the crankshaft gear
- Pitting or wear
- Crankshaft gear that fails magnetic particle inspection
- Clearance between the mating surfaces of the crankshaft gear and crankshaft counterbore (There must not be any clearance when the crankshaft gear is installed.)

## Crankshaft Gear Installation

1. Make sure the mating surfaces of the crankshaft gear and crankshaft counterbore are clean and dry and that there is no debris.
2. Install the crankshaft gear on the alignment dowel in the crankshaft counterbore end as shown in Figure 1.

**⚠ CAUTION:** DURING CRANKSHAFT ASSEMBLY, ALWAYS INSTALL A NEW CRANKSHAFT GEAR BOLT AND NEW LOCKPLATE. PER FAA DIRECTIVE, DO NOT RE-INSTALL A CRANKSHAFT GEAR BOLT OR LOCKPLATE (THAT HAD BEEN IN SERVICE) ON ANY ENGINE.

3. Refer to Table 2 to identify the correct part number for the new crankshaft gear bolt and new lockplate for the applicable crankshaft gear part number.
4. Make sure that the threads on the new crankshaft gear bolt (Figure 1) and the threads in the counterbored end of the crankshaft are clean and dry and that there is no debris.
5. Apply a small amount of Loctite Food Grade Anti-Seize, (Table 4), to the bottom three or four threads of the new crankshaft gear bolt. Wipe away any excess anti-seize.

**Table 4**  
**Loctite Food Grade Anti-Seize**

Original Loctite Manufacturer's P/N	Legacy #	Package Size		New Loctite Manufacturer's P/N
209749	51168	8 oz.	227 g	1167237
234271	51170	2 lb.	907 g	1169241
234274	51171	40 lb.	18 kg	1170163

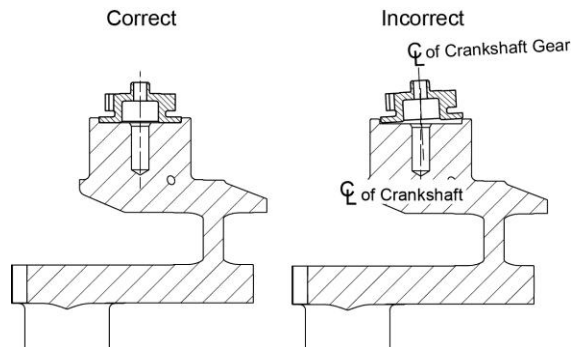
**NOTICE:** Do not bend the tab on the lockplate yet.

6. Install the new lockplate and new crankshaft gear bolt with the part number on the top of the bolt head.
7. Initially torque the crankshaft gear bolt (regardless of size) to 125 in.-lb (14.12 Nm) torque. Do not bend the lockplate at this time.

ISSUED			REVISED			PAGE NO.	REVISION	Sup 1 to S.B. 475C
MO	DAY	YEAR	MO	DAY	YEAR	8 of 11	--	
09	12	16	--	--	--			



**⚠ CAUTION:** FOR CORRECT ENGINE OPERATION, THE CRANKSHAFT GEAR MUST BE INSTALLED CORRECTLY WITH NO GAP BETWEEN THE MATING SURFACES OF THE COUNTERBORED-END OF THE CRANKSHAFT AND THE CRANKSHAFT GEAR PILOT FLANGE (FIGURE 9).



**Figure 9**  
**Crankshaft Gear Position**

8. With a hammer and brass drift, tap lightly around the pilot flange of the crankshaft gear and listen for sharp solid sounds from the hammer blows that would indicate that the gear is seated against the crankshaft.
9. Make sure the crankshaft gear seats firmly and is perpendicular (not at a slanted angle) to the crankshaft as shown in Figure 9:
  - A. Try to put a pointed 0.001 in. (0.025 mm) feeler gage or shim stock between the crankshaft gear pilot flange and crankshaft counterbore at each of the three scallops on the crankshaft gear pilot flange. The feeler gage must NOT fit between the two surfaces at any location. There must not be any clearance between the crankshaft and crankshaft gear pilot flange.
  - B. If clearance is found, remove the crankshaft gear bolt, lockplate, and crankshaft gear.
  - C. Make sure the mating surfaces of the crankshaft gear and crankshaft counterbore are clean and dry and that there is no debris.
  - D. Reinstall the crankshaft gear, lockplate, and crankshaft gear bolt. Repeat the initial torque and seating check above.
  - E. Try again to put a pointed 0.001 in. (0.025 mm) feeler gage or shim stock between the crankshaft gear pilot flange and crankshaft counterbore at each of the three scallops on the crankshaft gear pilot flange.
  - F. If there is still clearance, replace the crankshaft gear.
  - G. If there was no clearance, the crankshaft gear is seated correctly. Complete the final torque of the crankshaft gear bolt.
    - Final torque the 5/16 in. crankshaft gear bolt to 204 in.-lb (23.05 Nm).
    - Final torque the 1/2 in. crankshaft gear bolt to 660 in.-lb (74.57 Nm).

**⚠ CAUTION:** IN THE NEXT STEP, DO NOT BEND TABS OVER THE CORNERS OF THE CRANKSHAFT GEAR BOLT HEAD UNTIL AFTER THE BOLT IS FINAL TORQUED. DO NOT DECREASE THE TORQUE ON THE CRANKSHAFT GEAR BOLT TO ALIGN THE LOCKPLATE TABS.

9. If necessary, turn the crankshaft gear bolt up to one additional hex to align the flats of the bolt head with the tabs on the lockplate. Bend the tabs on the lockplate onto the flats of the crankshaft gear bolt to hold the bolt securely in place.

ISSUED			REVISED			PAGE NO.	REVISION	Sup 1 to S.B. 475C
MO	DAY	YEAR	MO	DAY	YEAR			
09	12	16	--	--	--	9 of 11	D	



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SEP 06 2016

Ms. Bernadette Koontz  
Technical Publications Supervisor  
Lycoming Engines  
652 Oliver Street  
Williamsport, PA 17701

Subject: Request for Alternate Method of Compliance (AMOC) to Airworthiness  
Directive (AD) 2004-10-14 (AMOC Log # 15-104)

References:

- 1 - FAA AD 2004-10-14
- 2 - Lycoming Service Bulletin (SB) No.SB-475C, Supplement 1

Dear Ms. Koontz:

The Federal Aviation Administration (FAA) has received your email dated November 20, 2015 requesting an AMOC to paragraph (f), (g), and (h) of AD 2004-10-14 to allow operators to use the information in Lycoming Engines Service Bulletin (SB) 475C, Supplement No. 1 as an alternate method of complying with AD 2004-10-14.

SB-475C Supplement No. 1 was created to allow replacement of a crankshaft gear instead of reworking the population of engines identified in AD 2004-10-14, and referenced Lycoming SB-475C, dated January 30, 2003. The FAA understands that SB-475C Supplement No. 1 does not supersede SB-475C but offers another method to service a damaged crankshaft gear. The draft of SB-475C Supplement No. 1 also added details for clarification of inspections.

Except for repair steps 3a thru 3d, most of the steps in SB-475C are carried over in SB-475C, Supplement No. 1, and expounded upon with more detail and organized into a more logical structure for clarity.

Lycoming is requesting a Global AMOC to AD , paragraph (f), (g), and (h) which clarifies and agrees with AD 2004-10-14 but does not affect the population of the Lycoming engine models in AD2004-10-14, the amount of work required by AD 2004-10-14, or this AD's level of safety.


ISSUED			REVISED			PAGE NO.	REVISION
MO	DAY	YEAR	MO	DAY	YEAR	10 of 11	--
09	12	16	--	--	--		

In accordance with FAA Order 8110.103A, the following conditions apply:

1. All provisions of 2004-10-14 that have not been specifically referenced above remain fully applicable and must be complied with accordingly.
2. This approval is transferable with engine(s) to other operators.
3. Before using this AMOC, notify your appropriate principal inspector, or lacking a principal inspector, the manager of the local flight standards district office/certificate holding district office.
4. The NYACO will revoke this AMOC if the NYACO later determines that this AMOC does not provide an acceptable level of safety.

Should you have any questions, please contact this office or Norman Perenson at telephone number 516-228-7337, fax 516-794-5531, or email at [norman.perenson@faa.gov](mailto:norman.perenson@faa.gov).

Sincerely,

  
 for Raymond H. Reinhardt  
 Acting Manager, New York  
 Aircraft Certification Office

cc: James Delisio, ANE-171 (PDF Copy)

ISSUED			REVISED			PAGE NO.	REVISION	Sup 1 to S.B. 475C
MO	DAY	YEAR	MO	DAY	YEAR			
09	12	16	--	--	--	11 of 11	D	