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# MANDATORY

# SERVICE BULLETIN

DATE: September 24, 2021

Service Bulletin No. 645  
 Engineering Aspects are  
 FAA Approved

SUBJECT: Small End Connecting Rod Bushing Inspection  
 MODELS AFFECTED: Engines with a serial number listed in Table 1 of this Service Bulletin  
 TIME OF COMPLIANCE: Within the next 10 hours of engine operation

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

This Service Bulletin contains required action to inspect, remove, and replace connecting rods that could contain bushings that do not meet Lycoming Engine's specifications.

Table 1 identifies engines subject to inspection under this service bulletin in order to confirm these engines have connecting rod bushings installed that meet Lycoming Engine's specifications.

**Table 1**  
**Affected Lycoming Engines**

Engine Model	Serial Number	Engine Model	Serial Number	Engine Model	Serial Number
O-320-D2J	L-20425-39E	IO-360-A3B6	L-35292-51E	O-540-J3C5D	RL-25394-40E
O-320-D2J	RL-8518-39E	IO-360-B4A	RL-30693-51E	IO-540-AB1A5	RL-24884-48E
O-320-D2J	RL-9741-39E	IO-360-L2A	L-35600-51E	IO-540-AB1A5	RL-28287-48E
O-320-D2J	RL-19910-39E	IO-360-L2A	RL-28343-51E	IO-540-AE1A5	RL-14907-48E
O-320-E2D	RL-19277-27E	IO-360-L2A	RL-28383-51E	IO-540-AE1A5	RL-18668-48E
O-320-E2D	RL-23958-27E	IO-360-L2A	RL-30748-51E	IO-540-AF1A5	RL-28296-48E
O-360-A1H6	L-41287-36E	IO-360-L2A	RL-30797-51E	IO-540-J4A5	RL-28311-48E
O-360-A4M	L-22132-36E	IO-360-L2A	RL-30906-51E	IO-540-K1B5	L-28286-48E
O-360-A4M	RL-20381-36E	IO-360-L2A	RL-31215-51E	IO-540-K1G5	RL-14906-48E
O-360-A4M	RL-22581-36E	IO-360-L2A	RL-35954-51E	IO-540-K1G5	RL-17567-48E
O-360-A4M	RL-23122-36E	IO-360-M1A	L-27956-51E	IO-540-K1G5	RL-28297-48E
O-360-A4M	RL-24386-36E	IO-360-M1A	L-31908-51E	IO-540-K1G5D	RL-21803-48E
O-360-C4P	RL-42881-36E	IO-360-M1A	RL-11619-51E	IO-540-V4A5	L-27678-48E
O-360-F1A6	L-13043-36E	LO-360-A1H6	L-1027-71E	TIO-540-A2C	RL-13765-61A
O-360-F1A6	RL-42850-36E	AEIO-360-A1B6	RL-36174-51E	TIO-540-AJ1A	RL-12015-61E
O-360-J2A	RL-42346-36E	AEIO-360-A1B6	RL-36179-51E	TIO-540-AJ1A	RL-7503-61E
IO-360-A1B6	RL-28449-51E	IO-390-A1A6	RL-721-80E	TIO-540-AK1A	RL-7502-61A
IO-360-A1B6	RL-30545-51E	IO-390-A3A6	RL-710-80E	TIO-540-AK1A	RL-7600-61A
IO-360-A1B6	RL-30746-51E	O-540-A1D5	RL-20028-40E	TIO-540-J2B	RL-13870-61A
IO-360-A3B6	L-27155-51E	O-540-E4C5	RL-26051-40E	IO-580-B1A	RL-228-79E

**WARNING:** YOU MUST COMPLETE THE "REQUIRED ACTION" IN THIS SERVICE BULLETIN TO ENSURE THAT YOUR CONNECTING ROD BUSHINGS ARE PROPERLY SEATED. IF A CONNECTING ROD BUSHING BECOMES UNSEATED, THE CONNECTING ROD CAN FAIL, CAUSING AN UNCOMMANDED AND COMPLETE LOSS OF POWER WHICH COULD LEAD TO DEATH OR SERIOUS INJURY.



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## Required Action

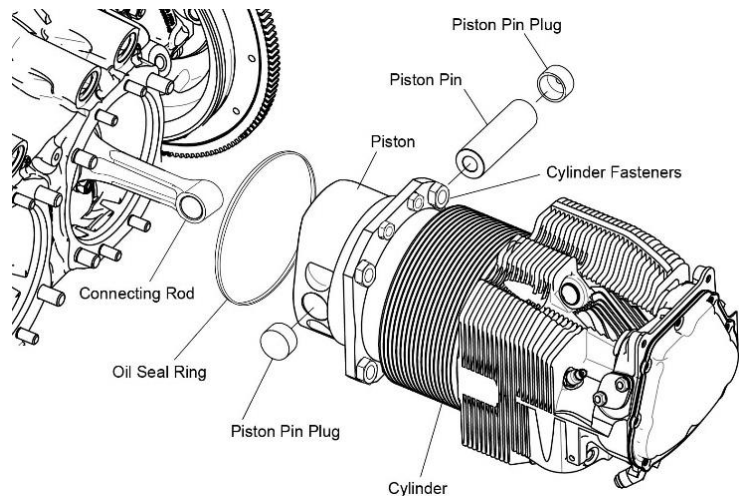
1. Identify and quarantine affected engines (Table 1):
2. As you complete the remaining “Required Action” steps, complete the fillable form attached to this Service Bulletin.
3. Complete the “Connecting Rod Inspection” in this Service Bulletin on all affected engines in Table 1.
4. Complete this inspection on each cylinder, one at a time. Reinstall the cylinder and torque the cylinder base fasteners to the proper torque before moving on to the next cylinder.

## Connecting Rod Inspection

1. For engines with serial numbers identified in Table 1:

**NOTICE:** A silicone rocker box cover gasket can be reused if it is not damaged.

- A. Remove the rocker box cover, rocker box cover gasket, rockers, pushrods, and shroud tubes per instructions in the applicable Lycoming Engines’ manual. Discard a cork rocker box gasket and shroud tube O-rings.
- B. Remove the cylinder fasteners at the base of each engine cylinder (Figure 1) to pull the cylinder out just enough to enable removal of the piston plugs and piston pin in the next step. **Do not pull the cylinder completely past the piston rings since it could require additional work and parts replacement.**



**Figure 1**  
**Cylinder, Piston Pin Plugs, Piston Pin, and Piston**

**NOTICE:** A plastic drift and lightweight hammer can be used if the piston pin plugs are difficult to remove.

- C. Support the cylinder and piston and remove the piston pin plugs and piston pin from the connecting rod.
- D. Remove the cylinder and piston as a unit from the connecting rod.
- E. Remove the oil seal ring (Figure 1) from the cylinder base and install it on the two studs in the crankcase to support the connecting rod as shown in Figure 2.



**Figure 2**  
**Oil Seal Ring Installed on the Crankcase Studs**

- F. Complete the “Connecting Rod Bushing Press-Out Verification Procedure” in this Service Bulletin.

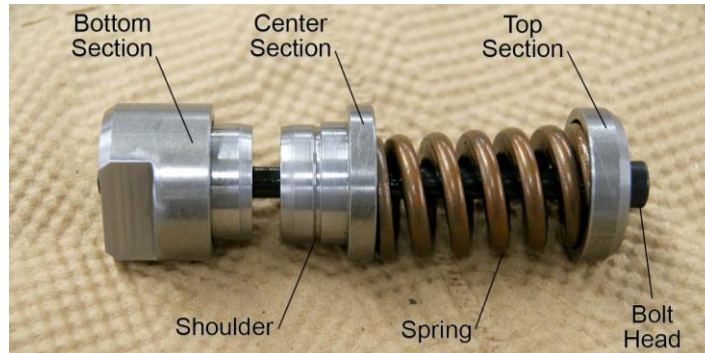
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## Connecting Rod Bushing Press-Out Verification Procedure

**NOTICE:** A crescent wrench, 1/4-inch Allen socket, 1/4-inch or 3/8-inch ratchet, and extensions as necessary are required to complete this procedure.

ST-531 Tools already in the field may be used for this Service Bulletin provided the tool has been stored and protected from damage and corrosion, as other engine service tools require. Complete a visual inspection for damage or corrosion before using. Replace any ST-531 Tool that is damaged, corroded, or has been used for any purpose other than inspecting connecting rods before using to comply with this Service Bulletin. Replacement ST-531 Tools can be purchased or rented by contacting any Authorized Lycoming Distributor.

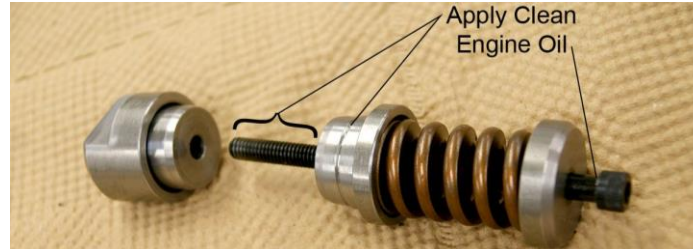
1. Remove the bottom section from the ST-531, Connecting Rod Bushing Press-Out Verification Tool (Figure 3) (available from Lycoming Engines).



**Figure 3**

### **ST-531, Connecting Rod Bushing Press-Out Verification Tool**

2. Apply a coating of clean engine oil to the threads of the bolt, the shoulder on the center section, and under the head of the bolt of the ST-531 (Figure 4).



**Figure 4**

### **ST-531 Lubrication Points**

3. Install the tool in the piston end of the connecting rod (Figure 5) and reinstall the bottom section.
4. Hold the bottom section of the ST-531 and turn the bolt head until finger-tight (Figure 6).



**Figure 5**

### **ST-531 Installed in the Connecting Rod**



**Figure 6**

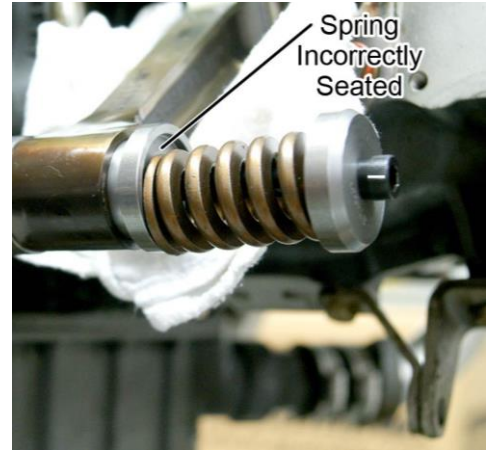
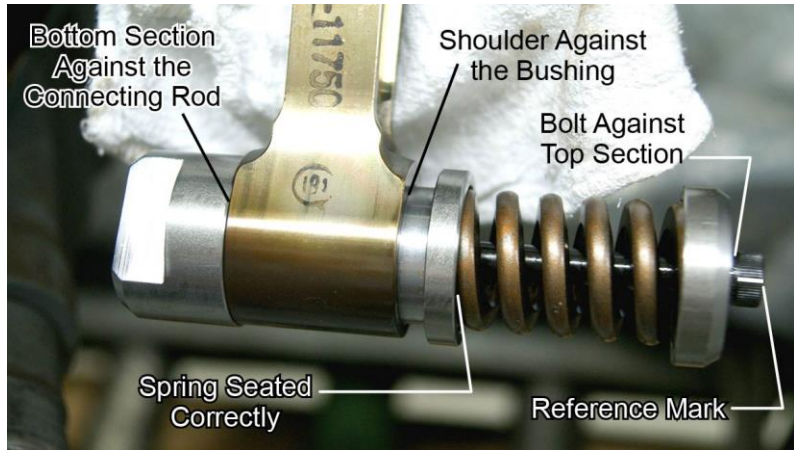
### **Turn the Bolt Head of the ST-531**

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5. Make sure:

- The bottom section of the tool is in contact with the connecting rod
- The shoulder of the center section of the tool is in contact with the connecting rod bushing
- The head of the bolt is in contact with the top section of the tool
- The spring is seated correctly in the tool as shown in Figure 7. Figure 8 shows **incorrect** seating of the spring.



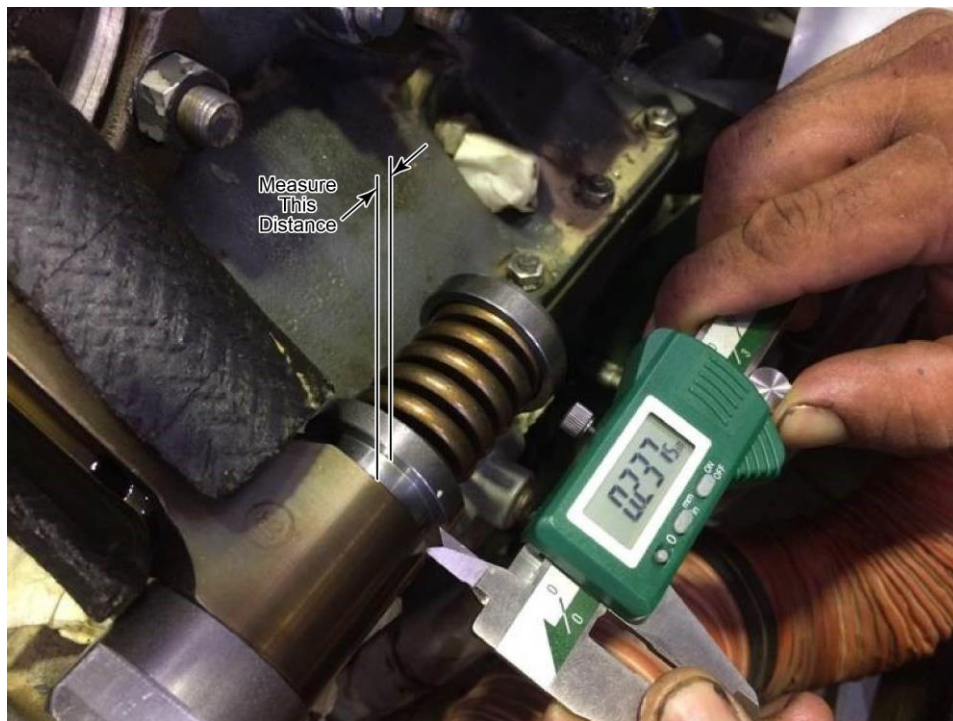
**Figure 7**

**ST-531 Correctly Installed in the Connecting Rod**

**Figure 8**

**Spring Incorrectly Seated in the Tool**

6. Use a marker to make a reference mark on the bolt head (Figure 7) to ensure an accurate count of the required number of turns during the procedure.
7. Measure the distance from the collar on the center section of the ST-531 to the edge of the connecting rod (Figure 9).

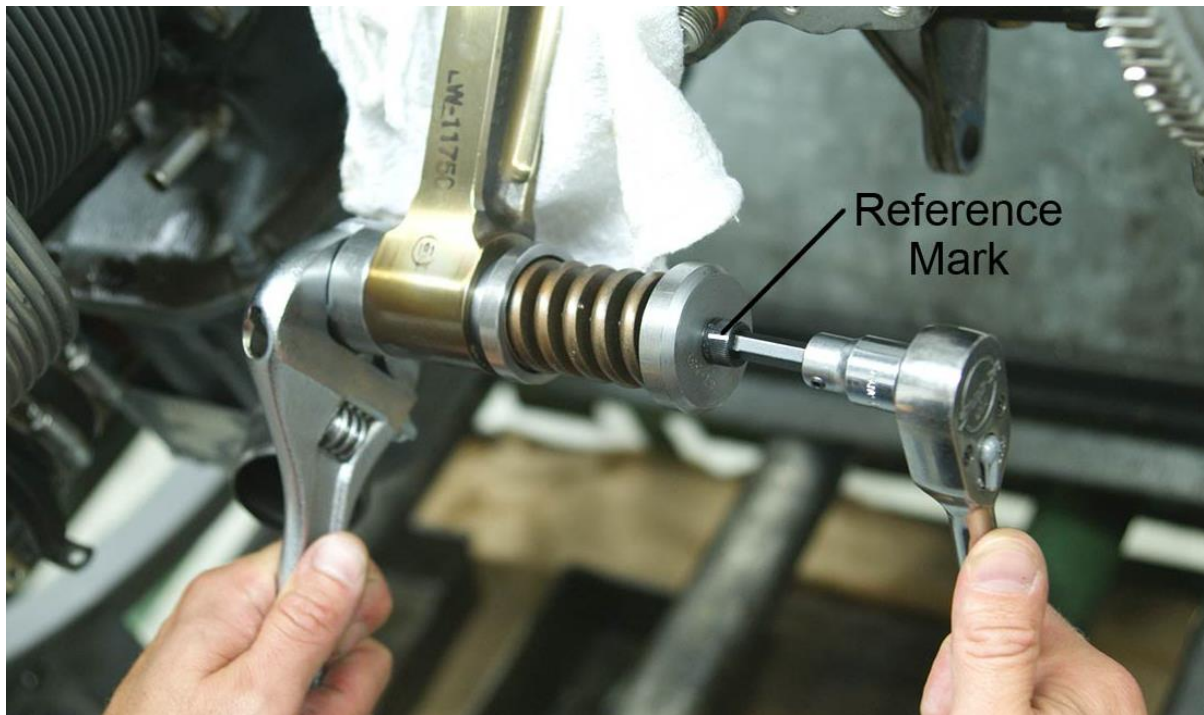


**Figure 9**

**Measure this Distance with the Bolt Finger-Tight**

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8. Use a wrench to hold the bottom section of ST-531 and turn the bolt with the ratchet and 1/4-inch Allen socket clockwise six full turns (Figure 10). **Do not exceed 6 turns.**

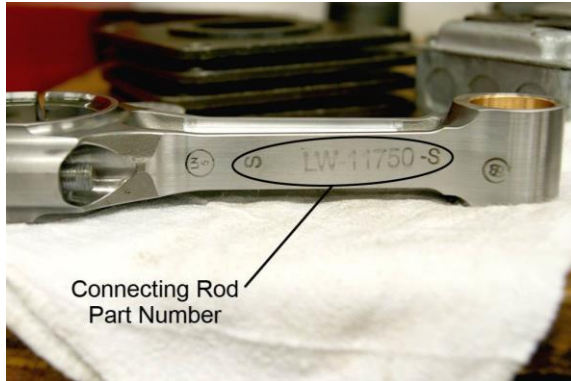


**Figure 10**  
**Turn the Bolt 6 Turns**

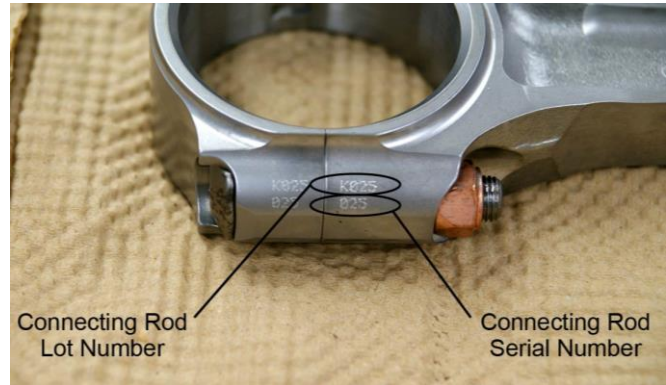
9. Re-measure the distance from the collar on the center section of the ST-531 to the edge of the connecting rod (Figure 9).
10. If the collar to connecting rod measurement has changed after turning the bolt six full turns, the connecting rod bushing has moved.
11. Turn the bolt counter-clockwise until the bottom section can be removed from the ST-531 and the tool can be removed from the connecting rod.
  - A. If the connecting rod bushing has moved:
    - (1) Order new parts as necessary. Refer to the “Parts Required Table” in the “Parts Required for Reassembly” section of this Service Bulletin.
    - (2) Remove the connecting rod assembly from the affected engine per the “Connecting Rod Removal” procedure in this Service Bulletin.
    - (3) Do not remove the bushing completely from the connecting rod assembly. Send the entire connecting rod assembly (with bushing partially installed) to Lycoming Engines, through an Authorized Lycoming Distributor.
    - (4) Install the replacement connecting rod with new connecting rod bearings per instructions in the “Connecting Rod Installation” procedure in this Service Bulletin.
    - (5) Reinstall the piston, piston pin, piston pin plugs, and cylinder per instructions in the applicable Lycoming Engines’ manual using new seals and gaskets identified in the Gasket Kit – Cylinder Only table in this Service Bulletin. Use new hardware where specified in this Service Bulletin.

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- (6) Record the results of the “Connecting Rod Bushing Press-Out Verification Procedure” and the part number (Figure 11), lot number, and serial number (Figure 12) of each connecting rod on the fillable form attached to this Service Bulletin.



**Figure 11**  
**Connecting Rod Part Number**



**Figure 12**  
**Connecting Rod Lot Number and Serial Number**

B. If the connecting rod bushing has not moved:

- (1) Order new parts as necessary. Refer to the “Parts Required Table” in the Parts Required for Reassembly section of this Service Bulletin.
- (2) Reinstall the piston, piston pin, piston pin plugs, and cylinder per instructions in the applicable Lycoming Engines’ manual using new seals and gaskets identified in the Gasket Kit – Cylinder Only table in this Service Bulletin. Use new hardware where specified in this Service Bulletin.
- (3) Record the results of the “Connecting Rod Bushing Press-Out Verification Procedure” and the part number (Figure 11), lot number, and serial number (Figure 12) of each connecting rod on the fillable form attached to this Service Bulletin.

**NOTICE:** Since the piston rings and piston were not removed, it will not be necessary to complete an engine break-in to seat the piston rings.

12. Record compliance with this Service Bulletin and results of the Connecting Rod Bushing Press-Out Verification Procedure in the engine maintenance records
13. Complete an engine run-up and leak check.
14. Correct any leaks before returning the engine to service.

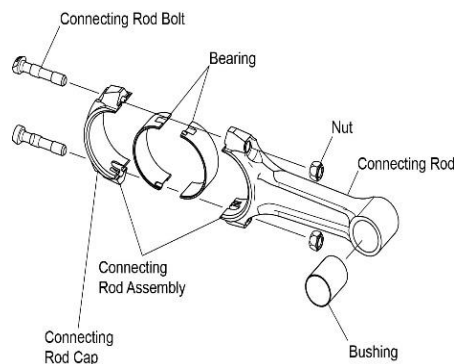
### **Connecting Rod Removal**

**NOTICE:** If the two bolts in the connecting rod cap cannot easily be removed, use a soft (plastic head) mallet and gently tap on the end of the two bolts after removing the nuts.

1. Remove and discard the two nuts (Figure 13) and the two bolts that attach the connecting rod cap to the connecting rod.

**CAUTION:** DO NOT RE-USE THE CONNECTING ROD BEARINGS, BOLTS, AND NUTS.

2. Remove the connecting rod cap and connecting rod.
3. Remove and discard the two connecting rod bearings.



**Figure 13**  
**Connecting Rod Parts**

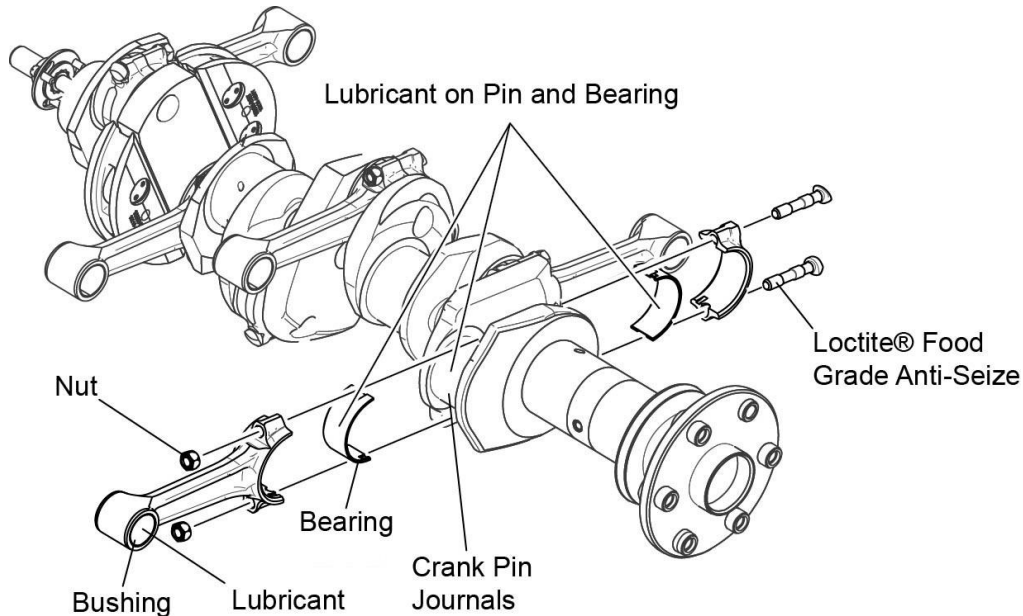
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## Connecting Rod Installation

**NOTICE:** Each connecting rod is identified by a letter (A, E, S, etc.) as a designation for weight class. All of the connecting rods installed on the crankshaft must be of the same weight class, except “S” weight rods (service rods) can be used with either “A” or “E” weight rods depending on parts availability.

1. Ensure that all of the connecting rod assemblies in the engine have the same weight class letter.
2. Apply specified lubricant to the connecting rod and bearing inserts (per the latest revision of Service Instruction No. SI-1059) where shown in Figure 14. Different lubricants are used on the various areas on the connecting rod and bearing surfaces.



**Figure 14**  
**Connecting Rod Assembly Lubrication**

**NOTICE:** Any time either the connecting rod bolt and/or nut pairs are removed from a Lycoming engine, replace **both** the bolt and nut pairs with new “Service Use Only” hardware regardless of apparent condition.

3. Refer to the latest revision of Service Instruction No. SI 1458 to identify the correct part numbers (P/Ns) for the new connecting rods bolts and nuts.
4. Make sure the new connecting rod bolt and new nut pairs are clean, free of dirt and debris and that the threads are not damaged.
5. Install the new lubricated matched set bearing pair on each connecting rod, one bearing on the connecting rod and the other bearing on the connecting rod cap. Ensure that the tang of each bearing fits and seats within the slot of the connecting rod as well as the connecting rod cap.

**NOTICE:** Do not install standard size connecting rod bolts in connecting rods with oversize bolt holes.

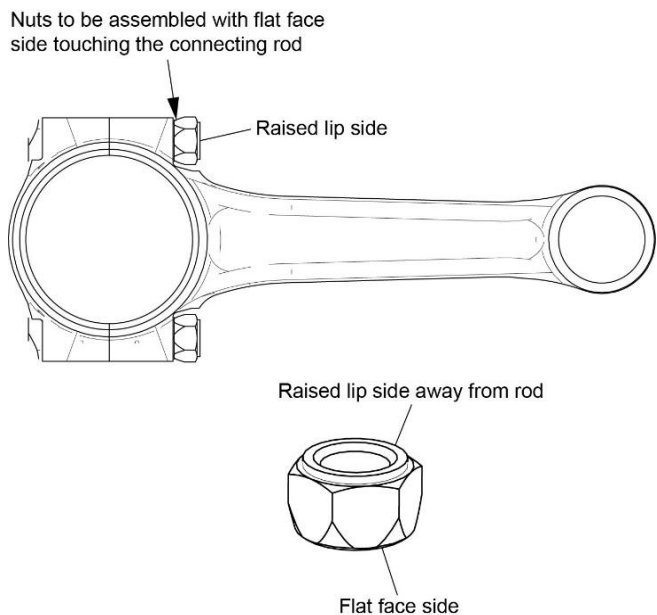
6. Apply engine oil mixture (mixture of 15% pre-lubricant (STP or equivalent) and 85% SAE No. 50 mineral base aviation grade lubricating oil) to the crank pin journal.
7. Install the connecting rod bolts in the connecting rod cap.

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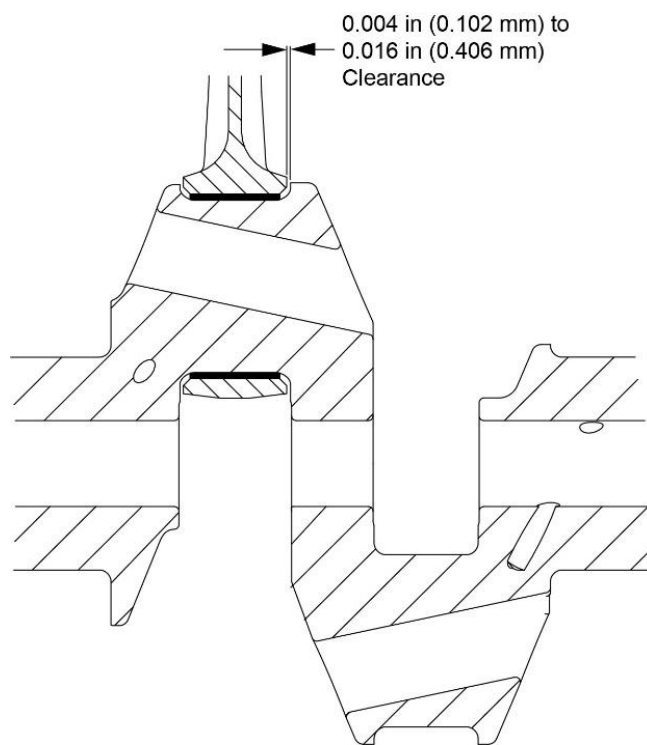
8. Apply Loctite® Food-Grade Anti-Seize Lubricant or equivalent to the bottom two or three threads of the new connecting rod bolts (Figure 14). Wipe away excess lubricant with a clean, lint-free cloth.
9. Install the connecting rod cap (with the bearing installed) on the back side of the respective crank pin on the crankshaft (where the numbers on the connecting rods and bearing locks point down - toward the oil sump.)

**⚠ CAUTION:** ENSURE THE NEW NUT ON EACH NEW CONNECTING ROD BOLT IS INSTALLED CORRECTLY. EACH CONNECTING ROD NUT HAS TWO DIFFERENT SURFACES, ONE SURFACE IS FLAT AND THE OTHER HAS A RAISED LIP. BE SURE TO INSTALL EACH NUT ON THE CONNECTING ROD BOLT WITH THE FLAT FACE TOUCHING THE ROD. THE RAISED LIP SURFACE IS AWAY FROM THE ROD. THE CONNECTING ROD BOLT CANNOT BE TIGHTENED CORRECTLY IF THE NUT ON THE CONNECTING ROD IS INSTALLED INCORRECTLY.

10. Install the connecting rod on the crank pin journal aligned with the connecting rod cap.
11. Install a new nut on each new connecting rod bolt where the flat face of the nut touches the connecting rod as shown in Figure 15.



**Figure 15**  
**Connecting Rod Nut Installation**



**Figure 16**  
**Connecting Rod Clearance**

**NOTICE:** It will be necessary to use an ST-488, Stretch Bolt Micrometer and Set Master to ensure correct connecting rod bolt stretch when applicable.

12. Torque the connecting rod bolts per the torque values in the latest revision of Service Instruction No. SI-1458. (Stretch bolts require an initial torque and are then torqued to the correct stretched length.)
13. Measure the side clearance between the connecting rod and crankshaft with a feeler gage where shown in Figure 16. The clearance is to be 0.004 to 0.016 in (0.102 to 0.406 mm).

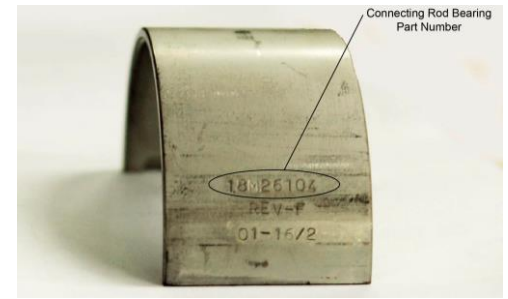
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**Parts Required for Reassembly**

**Parts Required Table**

Gasket Kit – Cylinder Only	Refer to the Gasket Kit – Cylinder Only table
Replacement connecting rod (includes connecting rod bolts and nuts)	For each connecting rod removed and returned to Lycoming Engines through an Authorized Lycoming Distributor, refer to the Replacement Connecting Rod Assemblies table
Connecting rod bearings	For each connecting rod removed, order the same P/N bearings as removed (refer to Figure 17 for connecting rod bearing P/N location)



**Figure 17  
Connecting Rod Bearing  
Part Number**

**Replacement Connecting Rod Assemblies**

LW-13865-S	LW-11750-S
78030-S	LW-19332-S

**Gasket Kit – Cylinder Only**

<b>Kit Part Number</b>	<b>Applicable Overhaul Gasket Kit</b>
LW-12038	Four Cylinder Parallel Valve Head Engines – O-320 O-360-A, -C, -F, -J; IO-360-B, -L; LO-360-A
05K22949	Four Cylinder Parallel Valve Head Engine – IO-360-M1A
LW-12039	Four Cylinder Angle Valve Head Engines – IO-360-A; AEIO-360-A
05K26565	Kit – Gasket Kit – Cylinder Only IO-390 Series
LW-12032	Six Cylinder Parallel Valve Head Engines – O-540-A, -E, -J; IO-540-J, -V
LW-12033	Six Cylinder Angle Valve Head Top Exhaust Engines – TIO-540-A, -J
LW-12034	Six Cylinder Angle Valve Head Down Exhaust Engines – IO-540-A, -K; IO-580
LW-12035	Six Cylinder Angle Valve Head Engines – TIO-540-AJ1A

**Warranty**

Lycoming will provide warranty coverage for completion of Mandatory Service Bulletin No. 645 for 12 months from the date of this publication. File a warranty claim for labor, parts, and standard shipping. Please refer to your Lycoming Engine’s Limited Warranty for procedures, details, and limitations related to your warranty. Information is available online at [www.lycoming.com/Warranty](http://www.lycoming.com/Warranty). Contact an Authorized Lycoming Distributor for assistance in filing a warranty claim and to order all necessary parts.

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## Connecting Rod Data Collection Form

Please fill out the following form and submit your data to the Lycoming Engines Product support Team.

Engine Model Number:	
Engine Serial Number:	
Total time since overhaul:	
Total time since last oil change:	

### Owner Information (please fill out all fields, enter N/A if a field is not applicable)

Name	
Company	
Address	
City	
State	
Postal Code	
Country	
Telephone #	
Email Address	

### Maintenance Provider Information (please fill out all fields, enter N/A if a field is not applicable)

Name	
Company	
Address	
City	
State	
Postal Code	
Country	
Telephone #	
Email Address	

### Connecting Rod #1 Information

Part Number	
Serial Number	
Lot Number	

**Did the #1 connecting rod bushing have any signs of movement when the cylinder was removed?**

No (The bushing has no signs of movement)

Yes (The bushing has signs of movement)

If Yes, the connecting rod assembly requires replacement. Contact Lycoming Engines Technical Support.

**Did the bushing move during the Connecting Rod Bushing Press-Out Verification Procedure?**

No. The bushing remained in the proper location

Yes. The bushing moved out of position.

If Yes, the connecting rod assembly requires replacement. Contact Lycoming Engines Technical Support.

### Connecting Rod #2 Information

Part Number	
Serial Number	
Lot Number	

**Did the #2 connecting rod bushing have any signs of movement when the cylinder was removed?**

No (The bushing has no signs of movement)

Yes (The bushing has signs of movement)

If Yes, the connecting rod assembly requires replacement. Contact Lycoming Engines Technical Support.

**Did the bushing move during the Connecting Rod Bushing Press-Out Verification Procedure?**

No. The bushing remained in the proper location

Yes. The bushing moved out of position.

If Yes, the connecting rod assembly requires replacement. Contact Lycoming Engines Technical Support.

### Connecting Rod #3 Information

Part Number	
Serial Number	
Lot Number	

**Did the #3 connecting rod bushing have any signs of movement when the cylinder was removed?**

No (The bushing has no signs of movement)

Yes (The bushing has signs of movement)

If Yes, the connecting rod assembly requires replacement. Contact Lycoming Engines Technical Support.

**Did the bushing move during the Connecting Rod Bushing Press-Out Verification Procedure?**

No. The bushing remained in the proper location

Yes. The bushing moved out of position.

If Yes, the connecting rod assembly requires replacement. Contact Lycoming Engines Technical Support.

### Connecting Rod #4 Information

Part Number	
Serial Number	
Lot Number	

**Did the #4 connecting rod bushing have any signs of movement when the cylinder was removed?**

No (The bushing has no signs of movement)

Yes (The bushing has signs of movement)

If Yes, the connecting rod assembly requires replacement. Contact Lycoming Engines Technical Support.

**Did the bushing move during the Connecting Rod Bushing Press-Out Verification Procedure?**

No. The bushing remained in the proper location

Yes. The bushing moved out of position.

If Yes, the connecting rod assembly requires replacement. Contact Lycoming Engines Technical Support.

### Connecting Rod #5 Information

Part Number	
Serial Number	
Lot Number	

**Did the #5 connecting rod bushing have any signs of movement when the cylinder was removed?**

No (The bushing has no signs of movement)

Yes (The bushing has signs of movement)

If Yes, the connecting rod assembly requires replacement. Contact Lycoming Engines Technical Support.

**Did the bushing move during the Connecting Rod Bushing Press-Out Verification Procedure?**

No. The bushing remained in the proper location

Yes. The bushing moved out of position.

If Yes, the connecting rod assembly requires replacement. Contact Lycoming Engines Technical Support.

### Connecting Rod #6 Information

Part Number	
Serial Number	
Lot Number	

**Did the #6 connecting rod bushing have any signs of movement when the cylinder was removed?**

No (The bushing has no signs of movement)

Yes (The bushing has signs of movement)

If Yes, the connecting rod assembly requires replacement. Contact Lycoming Engines Technical Support.

**Did the bushing move during the Connecting Rod Bushing Press-Out Verification Procedure?**

No. The bushing remained in the proper location

Yes. The bushing moved out of position.

If Yes, the connecting rod assembly requires replacement. Contact Lycoming Engines Technical Support.



**Additional Comments**

**After completing this form, save a copy for your records and send a copy for data collection to [SB645@lycoming.com](mailto:SB645@lycoming.com)**

**Thank you for your cooperation in filling out and submitting this data collection form.**