TEXTRON Lycoming

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MANDATORY SERVICE BULLETIN

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Engineering Aspects are
FAA Approved

SUBJECT: Inspection of Connecting Rods for Fretting and/or Galling and Repair of Fretting.

MODELS AFFECTED: All Textron Lycoming aircraft engines.

TIME OF COMPLIANCE: During inspection and regrinding of connection rods at overhaul.

The following procedure pertains to inspecting and grinding the crankpin bearing bore of all connecting rods listed in the charts of this publication, .010 inch over size; for the use of oversize bearings. Conclusive results in the field have dictated that all connecting rods may be reworked providing there is no fretting on the rod and cap faces and/or galling in the critical areas. In addition to the usual dimensional inspection procedures performed on connecting rods during overhaul, it is necessary to make a very thorough visual check for fretting and galling.

Fretting occurs between the connecting rod parting face and cap face due to motion between the mating surfaces. See Figure 1. If this condition exists, the connecting rod must be scrapped. During manufacturing, the contact faces of the rod and cap are ground very precisely. Fretting on this surface can induce bending in the bolt which could result in failure of the bolt and/or the connecting rod.

Galling, as shown in Figure 2, is caused by a movement between the surfaces of the bearing insert and the connecting rod during periods of high loading such as is produced during overspeed or excessive manifold pressure operation. The visual evidence produced by galling appears as if particles of metal from one contacting surface had welded to the other. The bearing insert shown in Figure 2 represents a typical case of galling; while the connecting rod bearing bore shown is an example of severe galling and indicative of imminent failure of the connecting rod.

The seriousness of galling is illustrated in Figure 3. This picture was made from an unretouched photomicrograph of an unetched section of metal removed from a cracked connecting rod. The gall mark that caused the crack can be seen on the magnified view of the bearing surface.

Inspection for galling must be accomplished on all connecting rods during overhaul. The rods and bearing inserts must be thoroughly clean and examination carried out with the aid of a 6 power magnifying glass (minimum) or bench microscope. Do not mistake stains or discoloration for galling; surface blemishes are easily removed with a fine abrasive cloth, chemical cleaner or steel wool while galling cannot be removed. Galling is a distortion in the metal and is comparable to corrosion in the manner in which it weakens the metallic structure of the connecting rod. When magnified, gall marks will have a surface appearance similar to the magnified view in Figure 3. However, the spots vary in size and shape; some have been found as small as pin heads; while in shape, they vary from circular or oval to thin, rodlike marks.

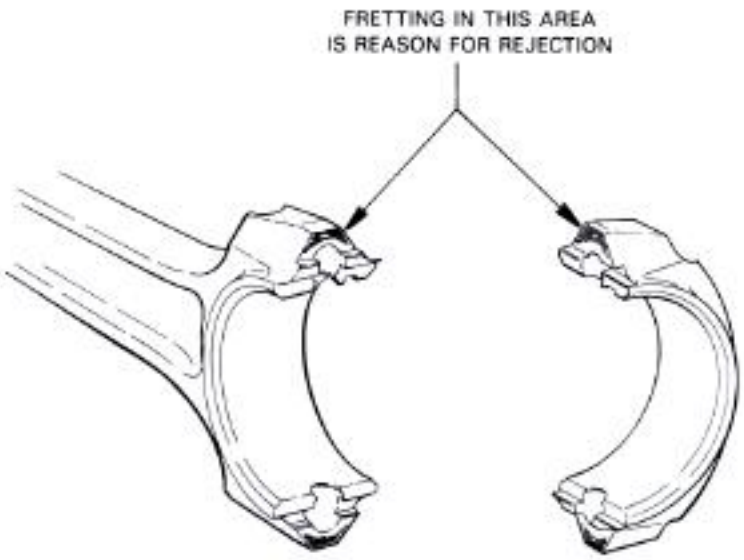

Figure 1. Connecting Rod and Cap Showing Damage by Fretting

It has been found that the location of galling determines if the rod is or is not likely to fail. Galling marks in the bearing bore are critical except for the area directly under the I-beam of the rod. Do not scrap a rod because of galling that is confined to this area; but also do not reuse a rod having gall marks in the critical area as shown in Figure 4.

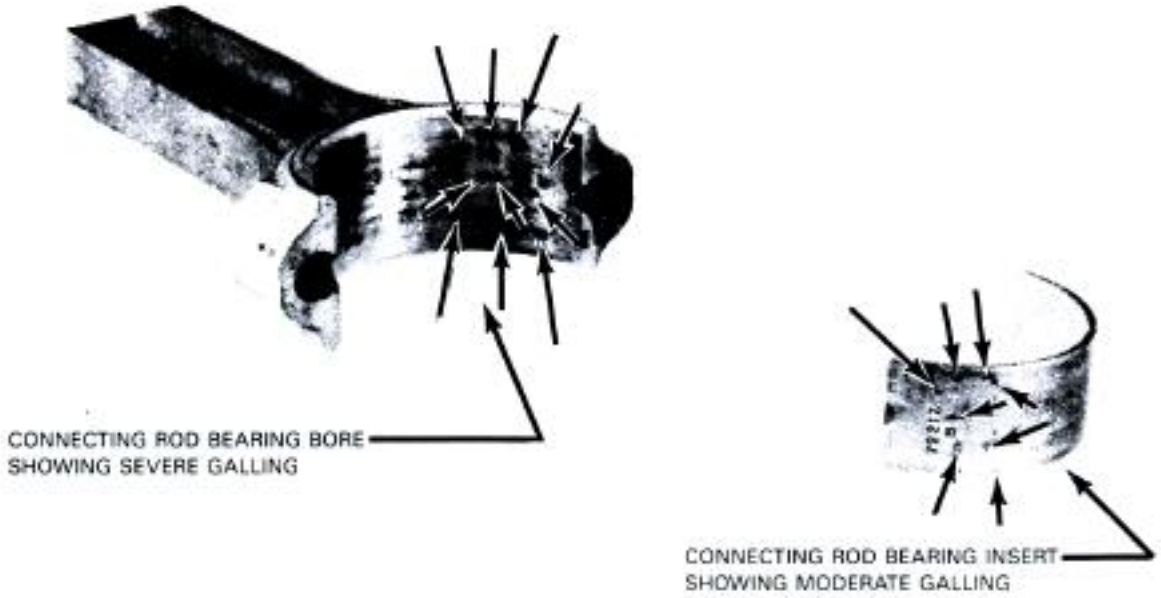

Figure 2. Bearing Insert and Connecting Rod Showing Damage by Galling

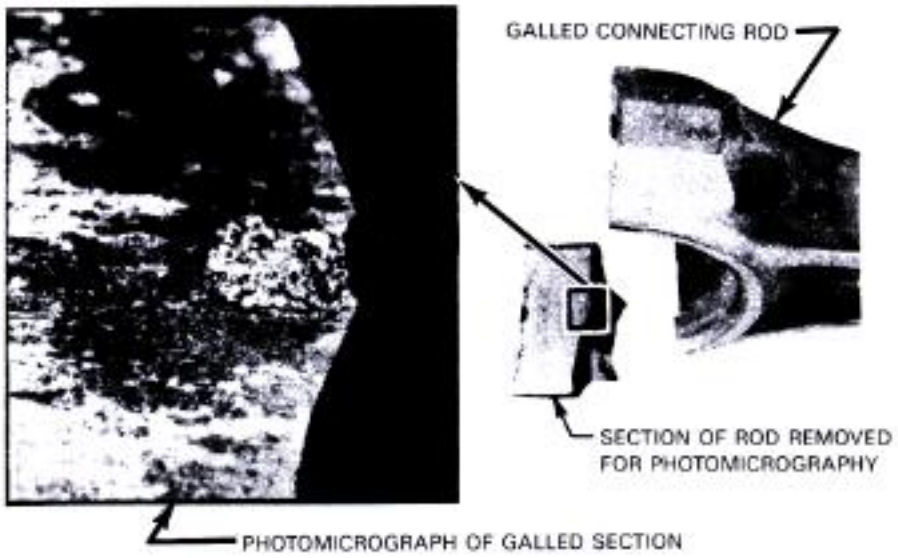

Figure 3. Photo-Micrograph of Gall Mark on Connecting Rod Surface

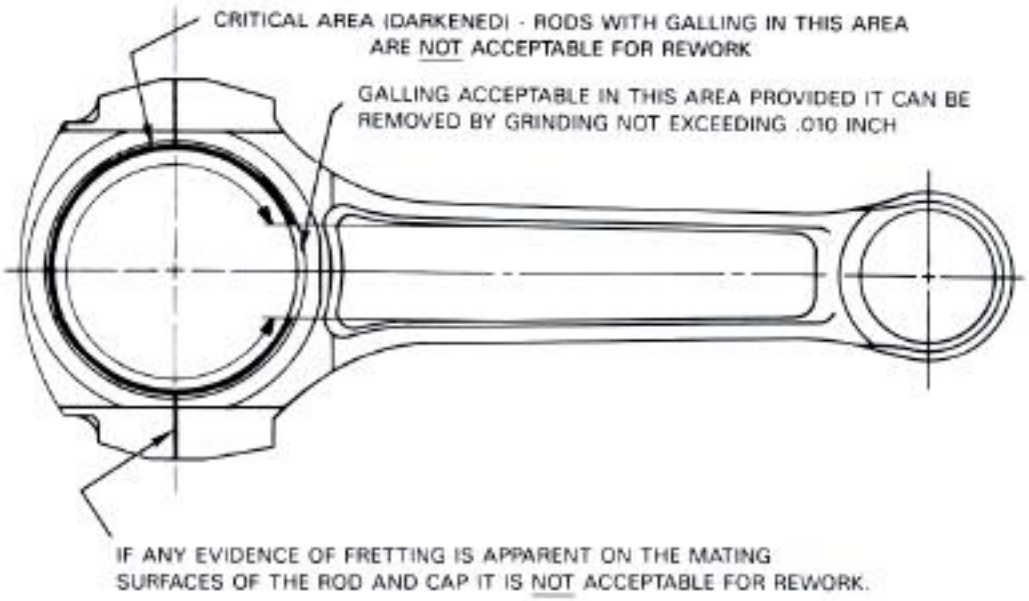

Figure 4. Diagram of Connecting Rod Showing Area of Critical Galling

1. Check connecting rod by magnetic particle method to determine if rod is suitable for reuse. (See latest edition of S.I. 1285.) If magnetic particle check indicates rod is cracked, do not reuse. If rod bore is worn or galling is evident as shown in Figure 4; and upon inspection it is found to be reworkable, it may be reworked by grinding the crankpin bore of the rod .010 inch oversize. Product improvements have made certain connecting rods obsolete and limited the repair of others. Do not reuse or perform the procedure herein described on any connecting rod unless specifically permitted in the chart found at the rear of this publication.

   a. Assemble the rod and cap using arbor ST-236 or ST-237 and applicable slave bolts (see Figure 5). The rod is placed over the

arbor with the flats perpendicular to the axis; lubricate the slave bolts and tighten each bolt to its correct torque length. (See latest edition of Service Table of Limits.) A Slave bolt is made by grinding sufficient material from the side of the bolt to provide clearance in the bearing area (see Figure 5).

b. Remove the arbor from the rod and stone both sides of rod to remove any burrs. Then secure the rod on a suitable face plate of an internal grinding machine with the crankpin bore in the center of the face plate.

NOTE

Be careful not to distort bore of rod while securing rod to face plate.

c. Proceed to grind the inside diameter of crankpin bore .010 inch o/s as indicated in Figure 6. Surface finish of the ground bore must be 80 micro-inches maximum. A grinding wheel, 2 x 1-1/8 x 5/8, Baystate A60K5V72K or equivalent is satisfactory for this purpose.

CAUTION

THE CORRECT SPINDLE SPEED FOR GRINDING THE CRANKPIN BORE IS 12, 250 RPM WITH CONNECTING ROD ROTATING AT 100 RPM. EXCESSIVE SPEED COULD CAUSE OVERSIZE CRANKPIN BORE AND ACCELERATE STONE WEAR.

d. Dimensional inspections are made with dial bore gage, and measurements are taken at a minimum of two positions 90 degrees apart in that particular plane being measured.

e. To insure proper bore size crankpin bore must not be out-of-round more than .0005 inch. Thrust faces on large end must be square with crankpin bore within .002 total indicator reading.

f. Twist between piston pin bore and crankpin bore must not exceed .007 in 10 inches.

g. Piston pin bore and crankpin bore must be parallel with each other within .005 in 10 inches.

2. If it is not necessary to grind the connecting rod bearing bore, assemble the rod and cap using arbor ST-236 ST-237. The rod is placed over the arbor with the flats perpendicular to the axis; lubricate the bolts and tighten each to its correct torque or stretch length; then remove the arbor from the rod. See latest edition of Service Table of Limits.

3. Check bearing bore diameter as described in paragraph 1-d, e, f and g. Diameter should be within limits shown for bore. See Figure 6.

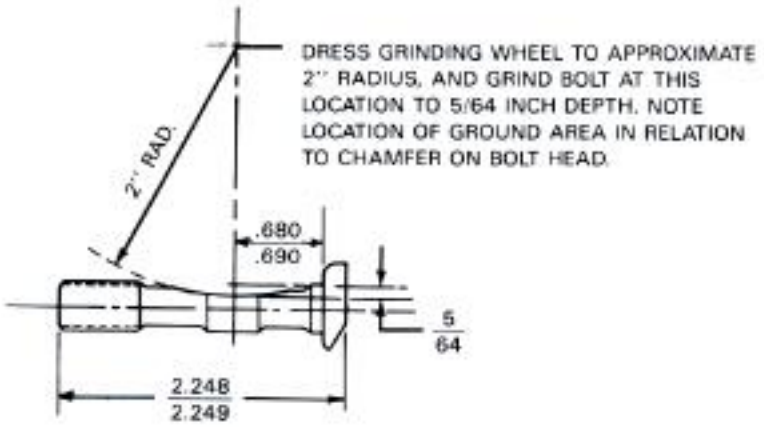

Figure 5. Method of Modifying Connecting Rod Bolt to Serve As Slave Bolt For Use With LW-10646 Rods Only

NOTE

Again check rod by magnetic particle method.

4. Identify rods that have been ground .010 inch oversize by electrochemical or acid etching the suffix P10 on the part number. See Figure 6. Depth of the etch should not exceed .0005 inch.

CAUTION

DO NOT METAL STAMP OR VIBRO-PEEN PART NUMBERS, OR ANY OTHER IDENTIFICATION ON THE CONNECTING ROD.

5. Rods that have been reground .010 o/s must be weighed and the correct weight identification letter code added to the part number on the rod. See the following charts for correct code letter. Rods should be selected for replacement by weight as described in the overhaul manual; however, rods in ''s'' weight group may be used for individual rod replacement in any group with the same part number.

CONNECTING ROD PART NUMBERS	DESCRIPTION	PERMISSIBLE REPAIR AND REPLACEMENT
75059	Phosphate coated rod.	Do not repair. Do not reuse. Replace with LW-10646 rods.
75548	Phosphate coated rod.	Do not repair. Do not reuse. Replace with 77450 rods.
77450	Tongue and grooved rod, not phosphate coated.	Grind oversize and identify as 77450-P10. Mandatory replacement for 75548.
LW-10776	Tongue and grooved rod, phosphate coated.	Grind oversize and identify as 77450-P10.
LW-10646	Tongue and grooved rod, not phosphate coated, large bore.	Grind oversize and identify as LW-10646-P10.
LW-19332	Tongue and grooved rod, not phosphate coated, large bore.	Grind oversize and identify as LW-19332-P10.

On all other connecting rods listed in the chart below and reworkable identify rework in accordance with paragraph 4.

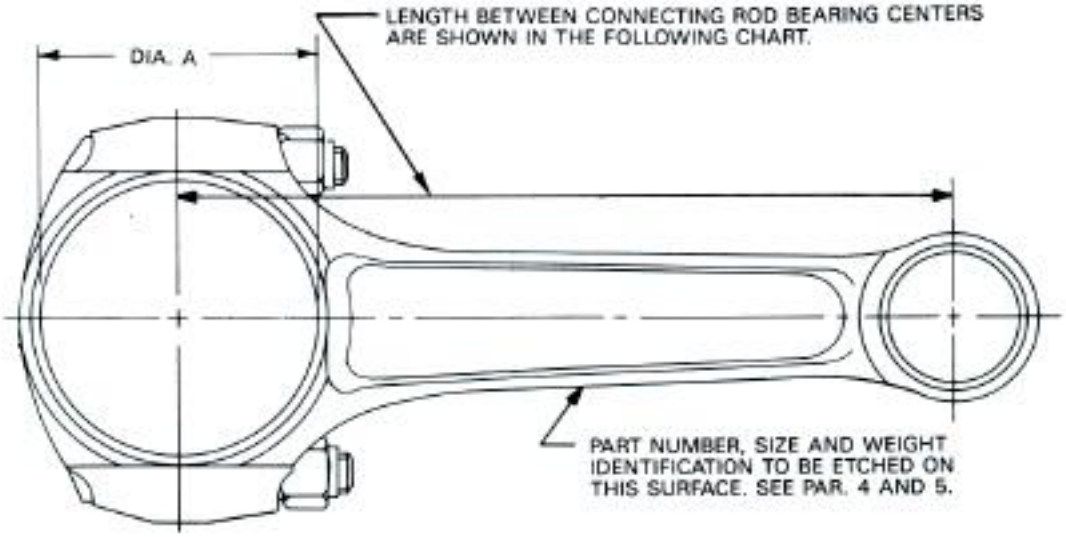

Figure 6. Diagram of Connecting Rod Bushing Bore Diameter

CONNECTING ROD WEIGHT CODES AND WEIGHT

Connecting Rod P/N	Bore Diameter "A" Standard	Bore Diameter "A" .010" o/s	** Code	*** Weight 010" o/s	Length
LW-11457, LW-11750, LW-13937	2.2870 / 2.2875	2.2970 / 2.2975	A *S E	2.121-2.160 2.161-2.180 2.181-2.220	6.7485 / 6.7515
77450 LW-13422	2.2870 / 2.2875	2.2970 / 2.2975	A *S E	2.360-2.380 2.381-2.390 2.391-2.410	6.7485 / 6.7515
78030	2.2870 / 2.2875	2.2970 / 2.2975	A *S E	1.890-1.970 1.971-2.010 2.011-2.090	6.4985 / 6.5015
78029	2.2870 / 2.2875	2.2970 / 2.2975	None	2.015-2.045	6.4985 / 6.5015
78028	2.2870 / 2.2875	2.2970 / 2.2975	None	1.965-1.995	6.4985 / 6.5015
LW-10646 LW-19332	2.4205 / 2.4210	2.4305 / 2.4310	A *S E	2.220-2.240 2.241-2.250 2.251-2.270	6.7485 / 6.7515
LW-13865	2.2870 / 2.2875	2.2970 / 2.2975	A *S E	1.924-1.975 1.976-2.001 2.002-2.053	6.7485 / 6.7515
LW-15288	2.2870 / 2.2875	2.2970 / 2.2975	A *S E	1.936-1.987 1.988-2.013 2.014-2.065	6.7485 / 6.7515

* - Rods in "s" (Service) group may be used individually.
** - Acid etched in accordance with AS478-6A or 7A1. Code letter after P/N on rod with figures .25 high.
*** - 1 Pound = 454 Grams

SPECIAL SERVICE TOOLS

Tool No.	Tool	Description
ST-236	Connecting Rod Assembly	Use with large bearing bore rods.
ST-237	Connecting Rod Assembly	Use with small bearing bore rods.

22306, 23988, 24264, 24264A, 24264B — These numbers for Textron Lycoming reference only.