



Service Instruction

ENGINE COMPONENTS, INC.

S.I. No.: 96-5

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Title: CONTINUING AIRWORTHINESS INSTRUCTIONS FOR AEL235, AEL320 AND AEL360 CRANKSHAFTS

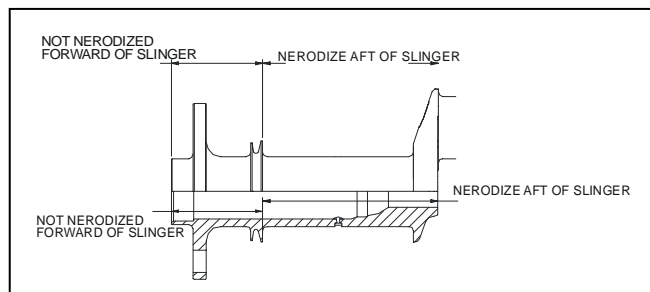
Issued: 02/25/97

Revision: 7 (10/18/06)

Technical Portions are FAA DER Approved.

- 1.0 MODELS AFFECTED:** All Lycoming 235, 320 and 360 engines using Engine Components, Inc.'s (ECi®) AEL235, AEL320 and AEL360 Series crankshafts.
- 2.0 PARTS APPROVED:** ECi manufactures crankshafts as replacement parts for Lycoming 235, 320 and 360 series engines that do not use counterweights. These crankshafts were tested to all the requirements in FAR 33.43, 33.45 and 33.49 to demonstrate airworthiness of the design and fabrication, and have been approved for manufacture under FAA PMA issued to Airmotive Engineering Corp., (AEC) a subsidiary of ECi.

3.0 DESIGN: ECi crankshafts are manufactured from forgings made from vacuum arc re-melt (VAR) alloy steel. The crankshafts are machined and ground to specified dimensions, and a final nitriding process, known as Nerodize[®], is added for additional corrosion protection. Only the inside bore of the front main journal from the slinger aft is Nerodize processed. The lack of hard surfacing of the front of the crankshaft minimizes the possibility of surface cracks from minor propeller strikes. See picture above for the locations where the Nerodize process is applied.



The major design distinction between these two series is the stroke. For the 235 and 320 series, the stroke is 3.875" and for the 360 series, the stroke is 4.375".

4.0 INSPECTION AND REPAIR: ECi crankshafts may be repaired using the same procedures specified for Lycoming crankshafts except ECi recommends against polishing the journals undersize without re-nitriding, but this procedure is acceptable. Crankshaft repairs include the requirement for non-destructive crack detection prior to being released to service. The accepted procedure is an inspection for cracks using magnetic particle inspection. Magnetic particle inspection (MPI) should be accomplished only by an appropriately rated FAA-Certificated Repair Station (FAR Part 145) and by technicians rated to at least ASNT Level I or equivalent (ref. MIL-STD-410 for qualification requirements) using equipment with calibration traceable to NIST.

Crankshaft journals that are worn or otherwise unserviceable may be repaired by regrinding and renitriding. Specific conditions which require this repair are:

- Journals which are scored or worn beyond serviceable limits;
- Journals damaged by corrosion pits;
- Any condition which might impair the integrity of the nitride.

For engines undergoing major overhaul, all crankshaft journals should be within new limits, either for standard size or one of the approved undersize dimensions. All regrinding and renitriding must be followed by MPI. **NO** indications of heat cracks, fatigue cracks or subsurface heat damage are permitted in any journal surface, fillet or thrust area after grinding and renitriding.



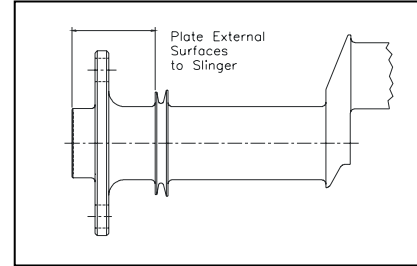
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Whenever the crankshaft is reground, renitriding is required. This is a major repair, and must be accomplished by personnel with special equipment and training, and must be accomplished by a properly rated FAA Approved Repair Station (FAR Part 145) to be returned to service in an airplane engine. Bent crankshaft flanges may be straightened following the procedures outlined in the latest revision of Lycoming S.B. 201.



The front main bore of the crankshaft has been machined to a relatively smooth surface. Any time the crankshaft is reground and renitrided, the seal surface, flange and pilot must be plated using Cadmium (QQP-416) or other FAA approved procedures. Baking immediately after plating to prevent hydrogen embrittlement is required.

The Airmotive Engineering Corp./Engine Components, Inc. crankshafts have different manufacturers and part numbers from the OEM, and the FAA has not issued any Airworthiness Directives that apply to AEC/ECi crankshafts. Because of different manufacturing processes, the inside diameter of the front main journal is not as susceptible to corrosion, but careful inspection for corrosion during overhaul is advised (see Lycoming Service Bulletin 505 (latest revision)).

The crankshaft journals are manufactured to the tolerances provided in the table below. Service limits are provided in the table also, and regrinding may be accomplished to any undersize that bearings are available for up to M10 (typically M03, M06 and M10).

Journal Tolerances

Part Number	Engine Type	Mains -New-	Main Service Limits	Crankpin -New-	Crankpin Service Limits
AEL23501	ALL 235 Engines	2.375"- 2.374"	2.373"	2.125"- 2.1235"	2.122"
AEL32101, 32102, 32103, 32104	All 320 Engines	2.376"- 2.375"	2.373"	2.125"- 2.1235"	2.122"
AEL36001, 36002, 36003, 36011, 36012, 36201	O/LO-360, IO-360-B, HIO-360A1A, B1A	2.376"- 2.375"	2.373"	2.125"- 2.1235"	2.122"
AEL36101, 36111, 36102	IO-360 A, C, etc.	2.376"- 2.375"	2.373"	2.250"- 2.2485"	2.247"

ECi crankshaft runout tolerances should be checked in the same manner and to the same tolerances specified for Lycoming crankshafts in the Lycoming service data.

ECi crankshafts are balanced to very tight balance specifications during manufacture. Any further balancing of the crankshaft that results in the removal of metal from any surface requires that the crankshaft be renitrided.

Lycoming Service Instruction 1098 (Latest Revision) is referenced for Propeller Flange Bushing Location. Lycoming Service Bulletin No. 475 (Latest Revision) is referenced for crankshaft gear installation and dowel hole rework and dowel installation.

An installation eligibility listing for the crankshafts is attached to this Service Instruction. Some installation changes to a basic crankshaft machining can be achieved through assembly options that include propeller flange bushings and gear dowels. However, there may be subtle differences in some crankshafts that would prevent changes to the installation eligibility. Contact ECi Customer Service for assistance.

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Crankshaft Assembly Part Number	Installation Eligibility, Lycoming Engines	Type
AEL23501-1	O-235-C1B, C2A, C2B, C2C, E2A, F2A, F2B, G2A, H2C, J2A, K2A, K2B, K2C, L2A, L2C, N2A, N2C, P2A	Fixed Pitch
AEL23501-2	O-235-C1, C1A, C1B, C1C, F1B, M1	Fixed Pitch
AEL23501-3	O-235-C1, C1A, C1B	Constant Speed
AEL32101-1	O-320-A2A, A2B, A2C, A2D, B2A, B2B, B2C, C2A, C2B, C2C, D2A, D2B, D2C, D3G, E2A, E2B, E2C, E3D, E3H IO-320-E2A, E2B AEIO-320-E2A, E2B	Fixed Pitch
AEL32101-2	O-320-A1A, A1B, A3A, A3B, A3C, B1A, B1B, B3B, B3C, D1A, D1C, D1D, D1F, E1A, E1C, E1F, E1J, E3D IO-320-B1A, D1A, D1B, E1A, E1B AIO-320-A1B, B1B, C1B AEIO-320-D1B, E1A, E1B	Constant Speed
AEL32101-3	IO-320-B1A, B1C, C1A	Constant Speed
AEL32101-4	O-320-D2C, D2G, D2J, E2F	Fixed Pitch
AEL32102-1	LIO-320-B1A, C1A	Constant Speed
AEL32103-1	O-320-D2F, D2G, D2J, E2D, E2F, E2G, E2H	Fixed Pitch
AEL32103-2	O-320-A2A, A2B, A2C, A2D, B2A, B2B, B2C, C2A, C2B, D2A, D2B, D2C, D3G, E2A, E2B, E2C, E3D, E3H IO-320-E2A, E2B AEIO-320-E2A, E2B	Fixed Pitch
AEL32104-1	O-320-H2AD	Fixed Pitch
AEL32104-2	O-320-H3AD	Constant Speed
AEL36001-1	O-360-A4A, A4M IO-360-B4A AEIO-360-B4A	Fixed Pitch, Solid Mains
AEL36001-2	O-360-A4G, A4J, A4K A4N, A4P, C4F, C4P	Fixed Pitch, Solid Mains
AEL36011-1	O-360-A4AD	Fixed Pitch, Solid Mains
AEL36011-2	O-360-A5AD	Fixed Pitch, Solid Mains
AEL36002-1	O-360-A1A, A1C, A1D, A1G, A1H, C1A, C1B, C1C, C1E, C1F IO-360-B1A, B1B, B1C, B1E, B1F AEIO-360-H1A	Constant Speed
AEL36002-2	O-360-A2A, A2D, A2E, A2F, B2A, B2B, C2A, C2B, C2C, C2D, C2E, D2A, D2B, D2C VO-360-A1A, A1B, B1A IVO-360-A1A	Fixed Pitch
AEL36002-3	O-360-A3A IO-360-B2F AEIO-360-B2F	Fixed Pitch



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AEL36002-4	O-360-C2D HO-360-B1A, B1B HIO-360-A1A, B1A, C1A, C1B	Helicopter
AEL36002-5	O-360-C2C	Fixed Pitch
AEL36002-6	O-360-C1G	Constant Speed
AEL36002-7	O-360-J2A	Fixed Speed
AEL36012-1	O-360-A1AD, A1LD	Constant Speed
AEL36012-2	O-360-A3AD	Fixed Pitch
AEL36003-1	LO-360-A2D	Fixed Pitch, L.H. Rotation
AEL36101-1	O-360-B2C IO-360-A1A, A1B, A1C, A1D, C1C, C1F, D1A AEIO-360-A1D, A1E, A2A, A2B, A2C AIO-360-A2A, A2B	Constant Speed
AEL36101-2	IO-360-A2A, A2B, A2C AIO-360-A2A, A2B AEIO-360-A2A, A2B, A2C	Fixed Pitch
AEL36101-3	HIO-360-C1A, C1B	Helicopter
AEL36111-1	IO-360-C1CD	Constant Speed
AEL36111-2	HIO-360-E1AD, E1BD	Helicopter
AEL36102-1	LHIO-360-C1A	Helicopter, L.H Rotation
AEL36201-1	HIO-360-D1A	Helicopter