

The Warner Aircraft Corp.  
20263 Hoover Ave.  
Detroit, Mich.

Service Letter A-7

Service Memorandum to owners of airplanes powered by Warner Super-Scarab 145  
HP engines.

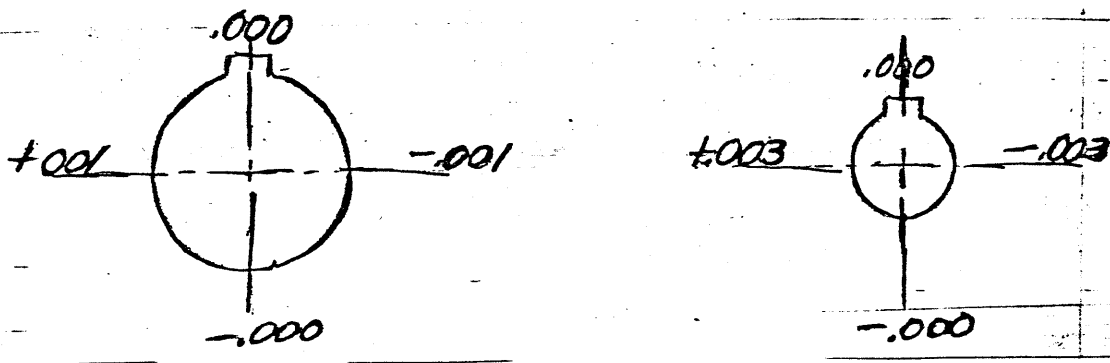
1. On July 20, 1937, we issued our Service Letter A-5 requesting that the propellers be installed at right angles to the crankshaft throw and that the propeller hubs be relapped in order to help eliminate a propeller resonance period at cruising R.P.M. Since that time a great deal of research work has been conducted by this Corporation in regard to resonance conditions which may exist in the motor mount-engine-propeller combinations. Special attention has been paid to the determination of the natural motor mount frequencies with a view of avoiding resonance conditions in the flying range. Although these efforts have been very successful, there still occurs an occasional crankshaft failure. A very careful study is being made of these infrequent failures.
2. It is believed advisable to call this matter to the owner's attention at this time and to suggest the service and inspection procedure outlined below until further studies reveal the reasons of the occasional failures and lead to their elimination or until crankshafts with S.A.E. 20 splines, similar to the shaft used in our 165 HP engines, can be made available.
3. It is suggested that the propeller and hub be removed from the crankshaft at every 25 hours to determine if a fatigue crack has started. A fatigue crack is likely to start under the rear end of the propeller hub or at the four holes in the crankshaft for the thrust bearing retaining nut lockwire. It is recommended that this nut be removed for the inspection.
4. The shaft should be cleaned thoroughly for the inspection. If the shaft is oxidized or looks suspicious, it should be washed with gasoline and the section to be inspected should be etched with a weak nitric acid solution (that is, one part of nitric acid to ten parts of water). This solution can be purchased for a few cents ready-mixed at any drug store and is best applied to the shaft by means of some cotton wrapped around a wooden stick. After the acid has been left on the shaft long enough to cause a dulling of the surface, it should be washed off thoroughly with hot water to stop the action of the acid. After carefully inspecting the etched section, oil thoroughly to prevent rusting. If there is any doubt regarding the condition of the crankshaft, it should be magnafluxed.
5. It is recommended that wherever available, magnetic inspection be applied to the shaft in place of etching with acid.. This magnetic inspection can be made on the airplane without disassembling the engine by licensees of the Magnaflux Corp. The following overhaul stations are licensees of the Magnaflux Corp.:

Aircraft Industries, Inc. Glendale, Calif.  
Booth Henning, Inc. Dallas, Texas.  
Caldwell Wright Airport, Caldwell, N.J.  
Cincinnati Aircraft Service, Cincinnati, Ohio  
Engine Air Service, Inc. Garden City, N.Y.  
C. Floey Co., Garden City, N.Y.  
Hangar Six, Inc. Houston, Texas.  
Johnson Flying Service, Missoula, Montana  
Northwest Air Service, Inc. Seattle, Wash.  
Pacific Airmotive Corp, Los Angeles, Calif.  
San Francisco, Calif.  
Parks Air College, Inc. East St. Louis, Ill.  
Snyder Aircraft Corp., Chicago, Ill.  
Southern Air Services, Inc. Memphis, Tenn.  
Spartan School of Aeronautics, Tulsa, Okla.  
General Airmotive Corp, Cleveland, Ohio.

6. This magnetic inspection can either be done with a small coil operating on alternating current or with battery current and two special nuts for the attachment of the electrodes. The Earner Aircraft Corp. will gladly furnish the necessary information to all licensees of the Magnaflux Corp.
7. If the crankshaft shows any signs of galling from the propeller hub it should be relapped using a small amount of fine grain grinding compound (Clover No. 1A or equivalent). Lap the surfaces together by periodically oscillating the propeller and relieving the load to obtain a good fit. After lapping, check the fit by using pencil lines axially along the taper. remount the propeller, oscillating it several times and remove to check fit. When both bearing surfaces show a good fit, apply a very small amount of the lapping compound to the small front end of the crankshaft and lap a slight amount more, using only oil on the larger rear bearing surface. Clean all surfaces thoroughly. Re-install the key and after oiling the shaft and hub thoroughly, mount the propeller. It is advisable to ascertain, that the keyway in the hub is deep enough so that the hub assembly does not ride on top of the key in the shaft. This has been found to be the cause of a failure in at least one instance.
8. It is important that the results of each 25 hour inspection of the crankshaft be noted in the engine log book for future reference of the Civil Aeronautics Authority Inspectors.
9. At all time during the operation of the airplane particular attention should be paid to the following factors which introduce fatigue stresses in the propeller end of the crankshaft.
  - a) The propeller should be periodically checked to determine that it is in balance and track and is properly mounted on the crankshaft.
  - b) The motor mount must be kept in the same condition as when it left the factory. If the ship is equipped with a rubber motor mount it is so designed that the unavoidable resonance points fall outside of the operating range. Deterioration of the rubber mount will cause the rate of deflection of the rubber to change so that the motor mount resonance may creep into the operating range. A motor mount resonance point can be detected by seeing and/or feeling vibration at a given R.P.M. which vibration decreases as the engine is raised or lowered. Whenever the resonance range with rubber

motor mounts has changed, new rubber bushings must be installed on the motor mount.

- c) For cruising, the engine should always be operated at a speed at which it operated smoothest and at which the least vibration is felt and/or seen.
- d) If your airplane has been involved in an accident which may have bent the crankshaft, it should be checked with a dial indicator at the small and large ends of the taper. For this purpose a dial indicator should be mounted on a rod which is securely fastened to a thrust bearing cover attaching stud. For a crankshaft checked without ball bearings on a surface plate, the allowable runout at the small end is .004" if the checking procedure outlined on page 21 of the third edition of the Warner Engine handbook is followed. When the engine is installed in the airplane slightly higher readings may be observed due to the eccentricity limits of the ball bearings. When in doubt, make a rough sketch of the large and small ends of the taper in relation to the keyway as seen from the front and submit it to the Warner Aircraft Corp. for comments. To clarify this matter, a sample sketch is shown below:



At no time should a crankshaft, which is found to be bent, be straightened.

- e) If, at any time, there is a noticeable roughness in the engine, the cause of the roughness should be ascertained and corrected.
10. The Warner Aircraft Corporation is undertaking these steps for the best interests of its customers and to insure the greatest safety for them. Whenever the development and studies have progressed further and definite conclusions or developments are available, the Warner Aircraft Corp. will immediately convey this information to its customers.
11. In order to get our records on Super-Scarab engines up to date, we would appreciate it is all the owers will fill out the enclosed questionnaires.

The Warner Aircraft Corp.  
20263 Hoover Ave.  
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November 2, 1939