

THE WARNER AIRCRAFT CORPORATION  
20263 Hoover Avenue  
Detroit 5, Michigan

January 2, 1945

SERVICE LETTER NO. A-17

To all owners of Warner Engines,  
All authorized Warner Aircraft  
Service Representatives.

Subject: I. Replacement of S-506 Cylinder Hold-Down Stud and Nut N-511 with S-911 Stud and N-910 Nut.  
II. Replacement of Gasket between Cylinder Barrel and Crankcase with an "O" Type Ring.

Introduction:

In addition to the cylinder attaching stud inspection procedure outlined in Service Letter No. A-15, it has been found advisable by the Civil Aeronautics Administration and this company to make recommendations for the replacement of all cylinder attaching studs with stronger studs and to eliminate the gasket between the cylinder barrel and the crankcase by the use of an "O" type ring instead.

Stud failures may result on engines which have a gasket between the cylinder barrel and the crankcase. This is due to the fact that material for cylinder base gaskets is no longer available which will not take a permanent set under the operating conditions of heat and pressure. With the S-506 cylinder base stud installed and the nut N-511 properly tightened down with a maximum torque of 225 inch pounds, a high stress is not imposed in the stud and under operating loads the initial tension in the stud is not exceeded by the load imposed on it by the cylinder barrel. Therefore, the stud under operating conditions remains at a constant unfluctuating stress. However, when the cylinder base gasket begins to take a permanent set or to become thinner due to the load, this reduces the initial tension in the stud imposed by the nut, and allows the operating loads from the cylinder to exceed the initial tension, thus imposing a fluctuating load on the stud which subsequently causes fatigue failure.

To remove the cause of this condition, it is recommended that the fibre cylinder base gaskets no longer be used and that "O" type rings be used in their place which allows the cylinder barrel to be tightened down firmly against the crankcase with no intervening elastic member which can take a permanent set. It is also recommended that the cylinder base studs which have been used with the fibre gaskets, and may have been already subjected to incipient cracks due to the repeated stress fluctuation, should therefore also be replaced with the heavier stud, S-911.

This change-over can be accomplished by the installation of the new studs and "O" rings and by the modification of the cylinder pads on the crankcases which can be returned to the Warner Aircraft or sent to any qualified machine shop, or through the use of a hand-counterboring tool which shall be available for sale to authorized service stations.

It is recommended that this change-over be made on all models of Warner engines at the time of the next major overhaul, or before, if there is evidence of stud failure.

After the change-over is completed, the letter "A" should be stamped as a suffix to the serial number on the engine name plate.

I. Replacement of S-506 Cylinder Hold-Down Stud and N-511 Nut with S-911 Stud and N-910 Nut.

(1) The crankcase cylinder pads may be fitted with 8 or 10 studs and the later Super-Scarab and Model 165 Engines have one stud S-776 which is longer and is set deeper into the crankcase than the S-506 stud. It can be identified by the longer boss in the crankcase. If this stud is used, it will always be in the position shown in Figure #1. The rest of the studs will be S-506. At the time of major overhaul, if it is found that the engine is equipped with cylinder base gaskets, it is recommended that all of the cylinder base studs be removed.

(2) Care should be exercised when removing the studs to determine the pitch diameter size of the stud removed from each hole unless it is known that all of the studs in the engine are standard and have not been replaced with oversize pitch diameter studs. After this is determined, the following table should be used when ordering the S-911 oversize studs to replace the S-506 and the long S-923 oversize studs to replace the long S-776 stud.

TABLE I

Stud Removed		Replace With			Drill and Tap
Part No.	Pitch Dia.	Part No.	Color Nut End	Pitch Dia.	
S-506	.3509 - .3529	S-911 +.003	Green	.3539 - .3559	Drill or ream 11/32
S-506 + .005	.3559 - .3579	S-911 +.008	Blue	.3589 - .3609	Drill or ream 11/32
Stripped or Damaged Thd.	-----	S-911 +.062		.4081 - .4101	Drill 25/64 Tap 7/16-20 P.D.- .4050 - .4063
S-506 + .062	.4081 - .4101	S-911 +.065	Green	.4111 - .4131	Drill or ream 25/64
S-776	.3509 - .3529	S-923 +.003	Green	.3539 - .3559	Drill or ream 11/32
S-776 + .005	.3559 - .3579	S-923 +.008	Blue	.3589 - .3609	Drill or ream 11/32
Stripped or Damaged Thd.	-----	S-923 +.062		.4081 - .4101	Drill 25/64 Tap 7/16-20 P.D.- .4050 - .4063
S-776 + .062	.4081 - .4101	S-923 +.065	Green	.4111 - .4131	Drill or ream 25/64

(3) When installing an oversize stud into the 3/8-24 tapped hole, the minor diameter of the hole should be cleaned up with an 11/32 drill or reamer in a tee-handled tap wrench and the chips then cleaned out with a standard pitch diameter 3/8-24 tap. If the 3/8-24 thread is stripped, damaged or too large for a +.008 stud, it shall be necessary to use a +.062 stud with a 7/16-20 thread by drilling out the old thread and tapping with a ground tap having a pitch diameter shown in Table I. Engines already having +.062 studs installed should have the minor diameter cleaned up with a 25/64 drill or reamer and have chips removed with a standard 7/16-20 tap.

- (4) All of the replacement studs have a  $3/8$  - 24 thread on the nut end and must use a special nut, N-910. No other nut may be substituted. The reason for this is that the engine was originally equipped with an N-511 nut which is made from  $1/2$ " hex stock and is tapped with a  $5/16$  - 24 thread. The stud failures which occurred using this nut always originated in the root diameter of the  $5/16$  - 24 thread. Therefore, the replacement studs use a  $3/8$  - 24 thread on the nut end which increases the size and strength of the stud. The standard hex size for a  $3/8$  - 24 thread is  $9/16$ . However, there is not sufficient clearance for this hex size to be used on the cylinder base flange, and therefore a special nut has been made with the  $1/2$ " hex size, but tapped out to a  $3/8$  - 24 thread. As a precautionary measure to insure against any attempt to use a standard nut on the pitch diameter of the nut end of the stud has been made .005 oversize and the replacement nut, N-910, is also .005 oversize on the pitch diameter which would cause interference if a standard size nut should be tried. The larger thread also requires a  $3/8$  - 24 palnut, Warner Part No. N-924.
- (5) Due to the fact that both ends of the replacement stud have a  $3/8$  - 24 thread with the exception of the S-506 + .062 and S-776 + .062 which have a  $7/16$  - 20 thread, the stud end or the end which must be screwed into the crankcase has been identified with a  $1/8$ " diameter countersink in the center of the stud end as shown in Figure 2. Extreme care must be exercised to insure the countersunk end of the stud is screwed into the aluminum, and after the studs are installed, an inspection should be made of the protruding ends of all of the studs to make certain that no countersink appears on them.
- (6) After the proper studs have been selected, they should be set into the crankcase with a minimum torque of 50 inch pounds and a maximum torque of 275 inch pounds. If the torque exceeds this maximum, the pitch diameter may be reduced by etching as outlined in Service Letter A-15 or the pitch diameter of the tapped hole may be increased by the use of an oversize pitch diameter tap. All studs must be set to a height of  $23/32$  from the face of the crankcase as shown in Figure #3.
- (7) Before the cylinder barrel can be installed on these larger studs, the stud holes in the flange must be enlarged by using an "X" (.397) drill which has been carefully ground. Care must be exercised that the drill does not wobble when enlarging the holes.
- (8) When assembling the cylinder barrel, a maximum torque of 275 inch pounds should not be exceeded when installing the nut, N-910, and a maximum torque of 250 inch pounds should not be exceeded for subsequent checking of the nut for tightness.

## II. Replacement of Gasket between Cylinder Barrel and Crankcase with an "O" Type Ring.

- (1) To modify the crankcase for use with an "C" type ring, it is necessary that the crankcase be assembled on the bench with the crankcase bolts sufficiently tight to line up the front and rear halves of the crankcase and hold them tightly together. A hand-operated counterboring tool, Warner Part #FA-11127 is available for sale to authorized service stations to modify Warner Engines, Models Scarab Jr. and Scarab, in service for use with "C" Ring #11195 as shown in Figure No. 4. Counterboring tool,

Warner Part #FA-11177 is also available for modifying other Warner Engines, Models Super-Scarab Ser. 40, 50, and 50A and Model 165 in service for use with "O" Ring #8566, Figure No. 5.

- (2) While the crankcase remachined in service will have counterbores as shown in Figures 4 and 5, crankcases received from the factory may have countersinks instead. In either case, however, the "O" rings specified will fit properly.

$\frac{1}{8}$  DIA. C'SINK  
INDICATES STUD  
END TO BE SET INTO  
C'CASE.

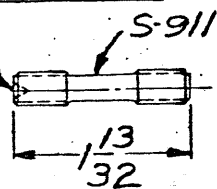


FIG. 2-a

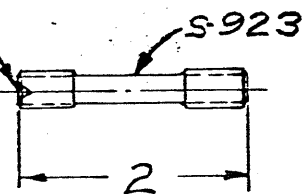


FIG. 2-b

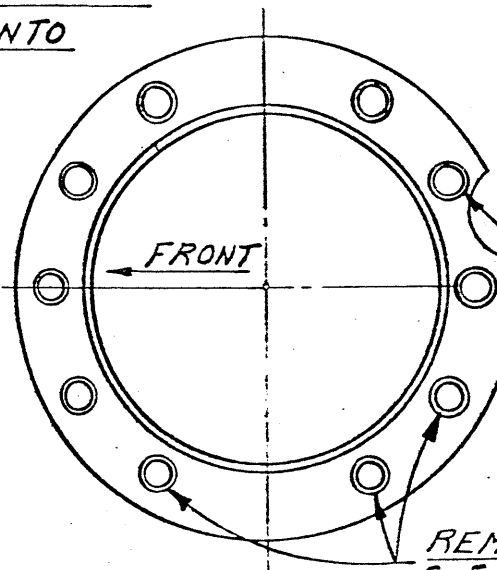


FIG. -1

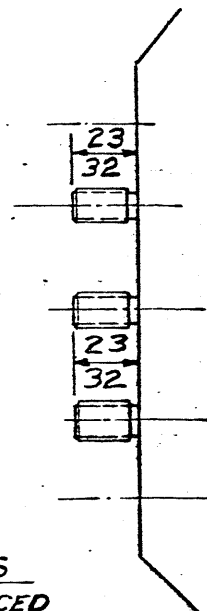
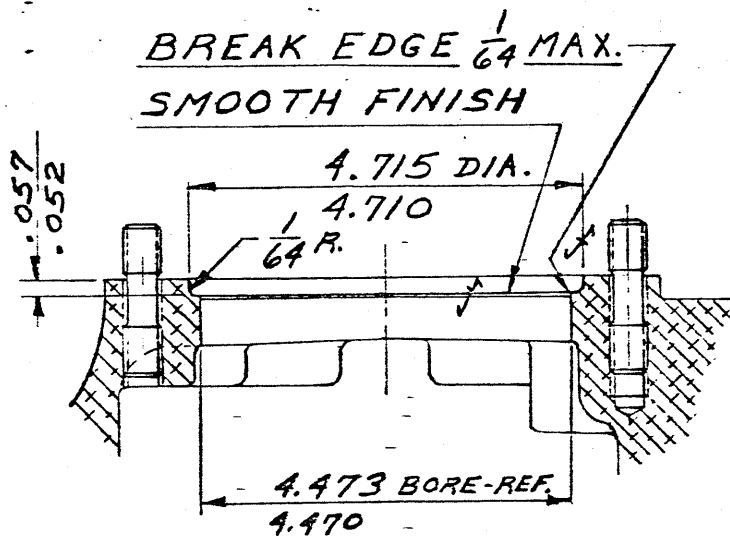


FIG. -3



DIMENSIONS OF C'BORE  
TO BE CUT ON WARNER

4  $\frac{1}{4}$  BORE ENGINES.

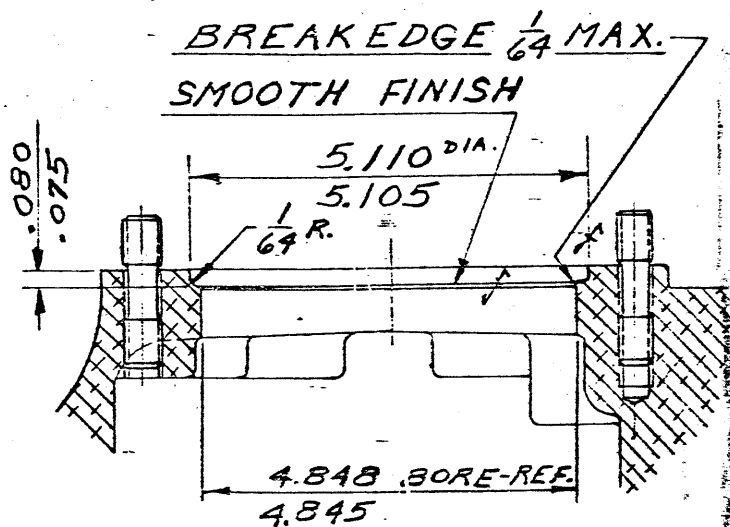
FOR USE WITH 4  $\frac{1}{4}$  I.D. X  $\frac{1}{16}$

"O" RING-WARNER PART #11195.

WARNER TOOL # FA-11127

MAY BE USED.

FIG. - 4



DIMENSIONS OF C'BORE  
TO BE CUT ON WARNER

4  $\frac{5}{8}$  BORE ENGINE.

FOR USE WITH 4  $\frac{5}{8}$  I.D. BY  $\frac{3}{32}$

"O" RING-WARNER PART #8566.

WARNER TOOL # FA-11177

MAY BE USED.

FIG. -5