GRUMMAN AMERICAN AVIATION CORPORATION
PO BOX 2206, SAVANNAH, GEORGIA 31402
(912) 964-1454 TELEX NO 54-6470

SERVICE LETTER

SERVICE LETTER NO. 76-2
"FAA DOA EA-4 APPROVED"

DATE: February 16, 1976

SUBJECT: VENDOR SERVICE PUBLICATIONS

SERIALS AFFECTED: All Model AA-1, AA-1A, AA-1B, AA-5, AA-5A and AA-5B.

TIME OF COMPLIANCE: As indicated in each publication.

Attached for your service information files, are copies of vendor service publications covering the items listed below. It is recommended that compliance with these publications be made as called out in the individual service bulletin, letter or instruction.

ITEM 1. Lycoming Service Bulletin No. 369B, Engine Inspection After Overspeed or Overboost.

ITEM 2. Lycoming Service Bulletin No. 385C, Oil Pump Impeller and Drive Replacement.

ITEM 3. Lycoming Service Letter No. L179A, Factory Policy for Prorated Engine Replacement.

ITEM 4. Lycoming Service Letter No. L185, The Use of Higher Octane Aviation Fuel, 100 LL Blue or 100 Green, for Engines Rated for 80/87 Octane Fuel.

ITEM 5. Lycoming Service Instruction No. 1009V, Recommended Overhaul Periods.

ITEM 6. Lycoming Service Instruction No. 1042J, Factory Approved Spark Plugs.

ITEM 7. Lycoming Service Instruction No. 1070G, Specified Fuel.

GRUMMAN AMERICAN AVIATION CORPORATION

REB:jmz

Distribution (01)

AVCO LYCOMING DIVISION
WILLIAMSPORT, PENNSYLVANIA 17701

Service Bulletin

L

DATE: December 12, 1975

Service Bulletin No. 369B
(Supersedes Service Bulletin No. 369A)
Engineering Aspects are
FAA (DEER) Approved

SUBJECT: Engine Inspection After Overspeed or Overboost

MODELS AFFECTED: All Avco Lycoming aircraft engines.

TIME OF COMPLIANCE: Part I : Following overspeed.
Part II: Following overboost.

PART I - OVERSPEED

As shown in the following Chart I, every Avco Lycoming aircraft engine is rated at a specified speed, above which it may not be operated safely. To operate above the rated speed of the engine, even momentarily, can cause accelerated wear of stressed parts and if the overspeed is high enough, serious damage or engine failure can result. Consequently, the continued use of an engine after momentary overspeed has occurred is at the discretion of and the responsibility of the operator.

WARNING

THE ENGINE MUST NOT BE OPERATED ABOVE SPECIFIED MAXIMUM CONTINUOUS RPM; TO DO SO WILL RESULT IN ABNORMAL WEAR ON BEARINGS, COUNTERWEIGHT ROLLERS AND OTHER ENGINE PARTS, CONCLUDING IN EVENTUAL ENGINE FAILURE.

However, since instances of inadvertent overspeed do occur, the information contained in this bulletin is furnished as obligatory recommendations to be followed after an instance of overspeed has occurred. When this happens, record the event in the engine log book along with the corrective action and inspections complied with; then proceed with the following: Find the specified engine speed in the column to the right of the engine model in the following Chart I.

NOTE

A few models have a take-off rating in addition to the continuous rating. On these engines, if overspeed does not exceed the take-off rating for longer than five minutes it may be disregarded. Also, for these engines the take-off rating may be considered to be the maximum rated speed when considering any momentary event of overspeed.

After locating the rated speed in Chart I, find the column for it in Chart II; then determine the percentage of overspeed from the values shown in the applicable column. For example, if the rated speed of the engine was found to be 2800 rpm and the overspeed was 2900 rpm; then from the 2800 column it can be determined the percentage of overspeed is less than 5%. In the lower portion of the chart, across from "2800" and down from "5% or less" locate the number "2" indicating that the instructions in Note 2 should be followed before the engine is returned to service.

CHART I - SPECIFIED RATED ENGINE RPM

Engine Models	SPECIFIED ENGINE SPEED	
	For Continuous Operation	5 Minutes Only During Take-Off
O-235-C1, -C1B, -C2A, -C2B, -E, -F, -G, -J	2800	
-C1A	2450	
-C2C, -H2C	2600	2800
O-290-D, -D2	2600	2800
O-320-A, -B, -C, -D; -E series rated at 150 hp; IO-320; LIO-320-B, -C; AIO-320-A, -B, -C; AEIO-320-E	2700	
O-320-E2A, -E2C, -E2F; AEIO-320-E2A rated at 140 hp	2450	
O-340-A, -B	2700	
O-360-A, -B, -C1, -C2A, -C2B, -C2C, -C2E, -D; IO-360; AIO-360; VO-360; IVO-360; HO-360-A1A; AEIO-360	2700	
O-360-C2D	2700	2900
HO-360-B; HIO-360-A, -B, -C	2900	
HIO-360-D1A	3200	
TO-360-A; LTO-360-A; TIO-360-A	2575	
O-435-A, -C	2550	
GO-435-C2	3100	3400
VO-435-A	3200	3400
VO-435-B; TVO-435	3200	
GO-480-B	3000	3400
GO-480-C, -D, -F, -G, -H; IGO-480	3100	3400
GSO-480; IGSO-480	3200	3400
O-540-A, -B, -D; IO-540-A, -B, -C, -E, -G, -J, -P; HIO-540-A; TIO-540; LTIO-540; AEIO-540-C	2575	
O-540-J (lightweight engine)	2400	
O-540-E, -G, -H; IO-540-D, -K, -L, -M, -N, -R, -S; AEIO-540-D, -N	2700	
VO-540-A	3200	3300
VO-540-B; IVO-540; TIVO-540	3200	
IGO-540	3000	3400
IGSO-540	3200	3400
TIO-541-A1A	2575	
TIO-541-E	2900	
TIGO-541	3200	
IO-720	2650	

CHART II - INSPECTION REQUIREMENTS IN EVENT OF OVERSPEED

Engine Overspeed in Excess of Max. Rated RPM	ENGINE RPM													
	2400	2450	2550	2575	2600	2650	2700	2800	2900	3000	3100	3200	3300	3400
2%	2450	2500	2600	2625	2650	2700	2755	2855	2960	3060	3160	3265	3365	3470
5%	2520	2570	2675	2705	2730	2780	2835	2940	3045	3150	3255	3360	3465	3570
10%	2640	2695	2800	2830	2860	2915	2970	3080	3190	3300	3410	3520	3630	3740

Category of Engine Models and Inspection Requirements
(Numbers Refer to Notes in Body of Text)

	FIXED WING INSTALLATIONS												ROTARY WING INSTALLATIONS			
	DIRECT DRIVE (Normally Aspirated)				DIRECT DRIVE (Turbocharged)				GEARED DRIVE (Supercharged and Turbocharged Models)							
Specified Engine Speed	2% or less	5% or less	between 5-10%	over 10%	2% or less	5% or less	between 5-10%	over 10%	2% or less	5% or less	between 5-10%	over 10%	2% or less	5% or less	between 5-10%	over 10%
2400	1	2	6	7												
2450	1	2	6	7												
2550	1	2	6	7												
2575	1	2	3, 6	7	1	2	3, 5, 6	7					1	2	3, 6	7
2600	1	2	6	7												
2650	1	2	6	7												
2700	1	2	6	7									1	2	3, 6	7
2800	1	2	6	7												
2900					1	2	5, 6	7					1	2	3, 6	7
3000									1	2, 4	4, 6	7				
3100									1	2, 4	4, 6	7				
3200									1	2, 4	4, 5, 6	7	1	2	3, 6	7

NOTES

1. Determine cause for overspeed and correct it. No inspection is required because the amount of overstress induced by momentary or short duration period of overspeed is not conclusive. However, if not corrected, continued operation with even this small amount of overspeed will reduce the service life of the engine.

2. Perform the following inspections:

   a. Drain the lubricating system and remove all oil screens and filters and inspect for metal contamination.

   b. Perform a differential pressure check on all cylinders to determine the sealing quality of the rings and valves. See Service Instruction No. 1191 for procedure.

   c. Using a boroscope or equivalent instrument, examine the walls of each cylinder for scoring which could be caused by stuck or broken piston rings.

NOTES (CONT.)

3. Disassemble both magnetos and inspect all components for damage; recondition or replace parts as required, reassemble and test in accordance with the applicable Bendix magneto overhaul instruction manual. Also inspect condition of the magneto drive gears on the engine for looseness which would indicate the supporting idler shafts are loose due to failure of safety attachments. If applicable, inspect condition of magneto bearing recess in crankcase for excessive wear. Repair as necessary in accordance with Service Instruction No. 1140 or No. 1197.

4. Remove the supercharger drain cover and look for presence of engine lubricating oil which, if found is indicative of a damaged supercharger seal. To determine the extent of damage, permit the oil to drain from the supercharger for a period of 8 hours; if the quantity of oil accumulated is more than a teaspoonful the amount is excessive and the supercharger seal should be replaced.

5. Disconnect both the inlet and outlet attaching hardware from the turbocharger and examine the compressor and turbine wheels for possible damage. Check the shaft-wheel assembly for free turning and for vertical and lateral motion indicative of damaged center housing bearings. Damage in these areas must be corrected before the engine is returned to service.

6. Either repeated moments or short periods of operation in the overspeed region accelerates the rate of wear in the parts that comprise the valve train and consequently reduce the reliability of the engine. In addition to the checks normally performed on the engine during a 100 hour periodic maintenance inspection, also accomplish the following before the aircraft is returned to service:-

   a. Inspect all screens and filters in the lubrication system for metal contamination; if any unexplainable accumulation is discovered the cause must be determined and corrected before the engine is returned to service.

   b. By means of a Boroscope or equivalent illuminated magnifying optical device determine the condition of the intake and exhaust valve faces and seat faces. Evidence of excessive wear or grooving is reason for valve and seat replacement.

   c. Inspect external condition of valve keys, rockers, and exhaust valve guides for damage; particularly check valve springs for coil strikes or severe bottoming of the coils. If damage to springs is evident, remove them and check compression load as specified in Table of Limits; replace any that are not within limits.

   d. Rotate the crankshaft by hand to determine if valve lift is uniform or equal for all cylinders; also note if valve rockers are free when the valves are closed. Unequal valve lift is an indication of bent push rods, and tight rockers when the valves are closed indicates a tuliped valve or a damaged valve lifter. Repair any suspected damage before the engine is returned to service.

   e. Comply with Service Bulletin No. 388 to determine exhaust valve stem to valve guide clearance condition.

7. Remove the engine from the aircraft; disassemble it and inspect the parts in accordance with the applicable overhaul manual. Replace any parts that are damaged or not within the service limits as shown in the Table of Limits, SSP2070-3. In engines that employ dynamic counterweights, the bushings must be replaced in both counterweight and crankshaft.

PART II - OVERBOOST

Overboost of Avco Lycoming supercharged or turbocharged engines is not permitted beyond the limiting manifold pressures which appear on the Sea Level and Altitude Curves of the applicable Avco Lycoming Operators Manual. Any operation of an engine beyond this limit raises the possibility of serious engine damage. Because of this, any overboost, whether momentary or inadvertent, which exceeds the allowable manifold pressure specified for the corresponding ambient pressure and temperature should be considered as shown in the following chart.

CHART III - OVERBOOST RECOMMENDATIONS

Overboost Conditions	Recommendations
Momentary overboost not exceeding 2" Hg.	Check flight instruments before next flight. Enter in log book. Include maximum manifold pressure reached, duration of overboost, cylinder head temperature, ambient air temperature, pressure altitude.
Not exceeding 5" Hg. or 10 seconds	Normal 50 hour inspection plus particular attention to items 1, 2 and 3 in the following list.
Not exceeding 10" Hg.	Remove engine from aircraft; completely disassemble and inspect. Replace all parts that do not come within maximum service limits as shown in Avco Lycoming Service Table of Limits, SSP2070-3.
Over 10" Hg.	Complete engine overhaul required, plus replacement of crankshaft.

1. Inspect cylinder assemblies for signs of cracked heads, particularly around the lower spark plug holes; and for cracks around the hold down flange of cylinder barrels. Also, check barrels for burned paint and for oil leaks around cylinder base flanges.

2. Remove oil screens and inspect for metal particles using care to insure that particles are metal and not hard carbon.

3. Remove all spark plugs and inspect them closely for physical and structural defects. Spark plugs removed may be used providing that each plug on inspection checks out satisfactorily in spark plug test unit and exhibits none of the following defects:

a. Fine wire plugs with loose center or ground electrodes.

b. Electrodes show signs of metal or impact damage.

c. Massive electrode plugs with copper run-out of center electrodes.

d. Ceramic core nose with a cracked or crazed surface.

CAUTION

It is the responsibility of the operator to monitor manifold pressure during take-off to assure limits are not exceeded. The continued use of an engine after momentary overboost has occurred is at the discretion and the responsibility of the operator.

MANIFOLD PRESSURE LIMITING VALVE

If a manifold pressure limiting valve is installed in either a TIO or TIGO-541-E series engine it will monitor induction air pressure to prevent a severe overboost condition, thereby preventing damage to the engine by excessive power output. A typical description of this valve will be found in Service Instruction No. 1293. The valve is set to start opening when maximum manifold pressure at rated power is exceeded and thereafter maintains a maximum pressure approximately 5 inches Hg. above maximum specified for normal rated power and speed.

However, at anytime manifold pressure is observed to be above specified maximum for the engine, a malfunction has occurred to both the turbocharger control system and the manifold pressure limiting valve; in this event engine operation must be discontinued and inspection carried out as recommended in Chart III. In addition to correcting the overboost condition in the engine, the malfunctioning valve must be replaced; return the replaced valve through your distributor to Avco Lycoming, Williamsport, Pa.

NOTE: Revision "C" revises text and Charts I and II to provide clarification.

AVCO LYCOMING DIVISION
WILLIAMSPORT, PENNSYLVANIA 17701

Service Bulletin

L

DATE: October 3, 1975

Service Bulletin No. 385C
(Supersedes Service Bulletin No. 385B)
Engineering Aspects are
FAA (DEER) Approved

SUBJECT: Oil Pump Impeller and Drive Replacement

MODELS AFFECTED AND TIME OF COMPLIANCE: See chart on page 3.

REFERENCE: During April, 1970 newly designed oil pump impellers, made of sintered iron and featuring a Woodruff key in the drive shaft were introduced in production of some four and six cylinder Avco Lycoming engines: this change was offered to owners of earlier built engines by Service Instruction No. 1230. However, it became evident that although not subject to failure, the wear characteristics of the new drive were not comparable to the earlier design and a further change was introduced in December, 1972 to provide a hardened drive impeller; this is described in Service Instruction No. 1272. In addition to the hardened sintered iron drive impeller, a steel impeller was also used in some engines. It is now evident that the area of the Woodruff keyway in the hardened drive impeller and the steel impeller is subject to severe wear and eventual failure and consequently the drive components are now further modified as herein described.

This modification consists of replacing the oil pump drive shaft and drive impeller to eliminate the Woodruff key drive which has proven to be the cause of excessive wear in the keyway of the hardened drive impeller. Therefore, it is recommended that all of the applicable engines listed in the chart, as well as any others that may have been modified in accordance with Service Instruction No. 1272, use the following procedure for parts replacement.

NOTE

The modifications shown in Service Instruction No. 1272 are no longer recommended and the instruction may be considered as inactive and non-applicable. Actually, engines that were never modified to incorporate the hardened sintered iron impellers as described in Service Instruction No. 1272, are not subject to the modification required by this bulletin.

INSPECTION: Applicable remanufactured engines shipped after December 21, 1972 should be inspected to determine if this modification is required: first of all, if the engine log book indicates the engine has not been modified in accordance with Service Instruction No. 1230 or No. 1272, proceed to remove the accessory drive cover from the mounting pad at the lower right side of the accessory housing to obtain access to the area between the crankcase and the accessory housing. On some engines this accessory drive pad is not machined, in this event it will be necessary to remove either the left magneto or the *fuel pump to obtain access to the area between the crankcase and the accessory housing. Regardless of which accessory pad is used, determine if the oil pump idler gear is secured with a cotter pin at the location shown in figure 1. This can be accomplished using an inspection mirror, preferably an illuminated one. If the cotter pin is visible, it is unnecessary to perform the modification required by this bulletin.

PROCEDURE:

Essentially this modification consists of replacing the oil pump drive shaft and drive impeller; since this necessitates removal of the accessory housing the procedure varies by engine model and airframe installation. Usually, this can be accomplished by removing only the accessory housing; however, on engines where the accessory housing is attached to the sump with studs and nuts instead of capscrews it will be necessary also to remove the sump.

*1. Unless the entire sump is to be removed it is very important during removal of the accessory housing to not damage the gasket between the sump and the accessory housing; if it is damaged, the partial gasket supplied with the kit may be installed as described in step 4.

2. After the accessory housing has been removed, disassemble the oil pump and carefully inspect both the housing and oil pump cover for damage.

3. Reassemble the oil pump using the new drive shaft and drive impeller supplied with the kits shown in the following "Parts Data" section. See figure 2. Be sure all of the parts are lubricated thoroughly during assembly.

* - Before removing the fuel pump, be sure the cam on the hub of the idler gear is not in position to exert force on the arm of the fuel pump; if it is, damage to the mounting threads will occur when the fuel pump is removed.

CAUTION

After assembly turn the drive shaft several revolutions to determine if it moves freely; if not, open the pump and correct the cause before the unit is reassembled on the engine.

4. Before returning the accessory housing to the engine it is necessary to replace the gasket on the mating flange between the sump and the accessory housing if it has been damaged. (If the sump has been removed the entire sump gasket is replaced.) To replace the rear portion of the sump gasket, lay the gasket on the sump flange and cut it diagonally with a sharp knife to obtain a line to line match between the ends of the old and new gaskets. Use POB gasket compound for sealant.

5. When reassembling the accessory housing align the idler gears in their exact position for engagement with the timing gear on the camshaft. See no. 60294-7 overhaul manual for assembly procedure.

6. After reassembly, time the magnetos to the engine and run the engine to check oil pressure and magneto drop-off; check for any noticeable variance from normal oil pressure and significant change from normal magneto drop-off.

7. Compliance with this modification should be noted in the aircraft records.

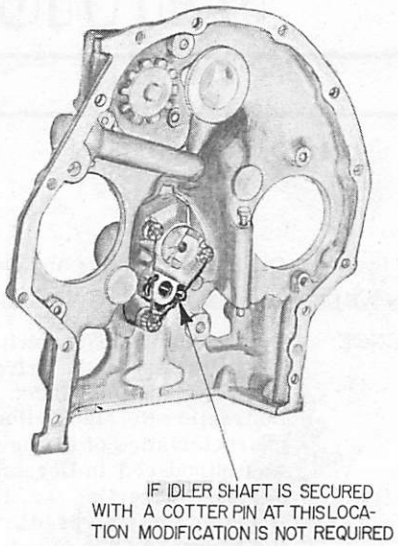


Figure 1. Interior View of Accessory Housing Showing Location of Cotter Pin in Oil Pump Idler Shaft

Full credit allowance for parts and labor will be made in accordance with the following schedule for compliance with this bulletin. Claims must be filed with nearest Avco Lycoming Distributor and be accompanied with engine serial numbers.

Engines with	0 to 400 hours service time	$50.00
Engines with	400 to 800 hours service time	$35.00
Engines with	800 to 1200 hours service time	$20.00
Engines with	1200 or more hours service time	materials only

PARTS DATA:

LW-14129	Gasket Kit, Oil Pump Shaft Replacement (4 cylinder engines) consists of: (1) 60096 fuel pump gasket, (3) 62224 magneto gasket, (1) 73818 accessory housing gasket, (2) LW-12681, -1200 series magneto gasket, (1) LW-13353 oil sump gasket
LW-14130	Gasket Kit, Oil Pump Shaft Replacement (6 cylinder engines) consists of: (1) 60096 fuel pump gasket, (3) 62224 magneto gasket, (1) 73818 accessory housing gasket, (2) LW-12681, -1200 series magneto gasket, (1) LW-14128 oil sump repair gasket
LW-14131	Oil Pump Shaft Replacement Kit (4 cylinder engines) consists of: (1) 61174 oil pump drive shaft, (1) LW-14038 or 60746 drive impeller
LW-14132	Oil Pump Shaft Replacement Kit (4 cylinder, dual drive magneto engines) consists of: (1) LW-14040 oil pump drive gear, (1) LW-14038 or 60746 drive impeller
LW-14133	Oil Pump Shaft Replacement Kit (6 cylinder engines) consists of: (1) 74641 oil pump drive shaft, (1) LW-14038 or 60746 drive impeller

MODELS AFFECTED AND TIME OF COMPLIANCE

*Engine Model	**Serial Numbers of Applicable Engines	Serial Numbers of Engines Not Applicable to this Bulletin	Time of Compliance
O-235 Series	11268-15 thru 12098-15 and 12100-15	12099-15, 12101-15 and up	Engines that have accumulated 400 or more hours of service since new, remanufactured or overhauled, must be modified in accordance with this bulletin within next 50 hours of operation.
O-320 Series	33329-27 thru 41054-27	41055-27 and up O-320-E2D: 41029-27 and up O-320-E3D: 41017-27, 41021-27 and up	
O-320-B and -D	6809-39 thru 6971-39	6972-39 and up	
IO-320-B1A	4953-55 thru 5270-55	5271-55 and up	
LIO-320 Series	292-66 thru 296-66	297-66 and up	
O-360 Series	17427-36 and 17440-36 thru 19846-36	19817-36, 19818-36, 19847-36 and up	
IO-360-B, -E, -F	10146-51 thru 13540-51	13541-51 and up	
AEIO-360-B	10179-51 thru 13616-51	13617-51 and up	
IO-360-A, -C, -D	10146-51 thru 13540-51	13541-51 and up	
IO-360-A1B6D	10115-51 thru 13529-51	13530-51 and up	
AEIO-360-A	10179-51 thru 13616-51	13617-51 and up	
AIO-360 Series	171-63 thru 208-63	209-63 and up	
LIO-360	634-67 thru 1059-67	1060-67 and up	
TIO-360	116-64 thru 145-64	146-64 and up	
+O-540 Series	15327-40 thru 17105-40	17106-40 and up; 17098-40, 17103-40 and engines modified in accordance with Service Bulletin No. 381.	
+IO-540 Series	10536-48 thru 12896-48	12897-48 and up; engines modified in accordance with Service Bulletin No. 381. All IO-540-P1A5 and -S1A5 models; also 10623-48, 10624-48, 10813-48, 10814-48, 11246-48, 11247-48, 11266-48, 11267-48, 12144-48, 12145-48, 12146-48, 12147-48, 12231-48, 12287-48 thru 12298-48, 12371-48 thru 12378-48, 12463-48, 12464-48, 12636-48, 12637-48, 12684-48, 12685-48, 12711-48, 12712-48, 12713-48, 12726-48 thru 12729-48, 12734-48 thru 12739-48, 12744-48 thru 12753-48, 12806-48, 12821-48 thru 12823-48, 12840-48 thru 12844-48, 12859-48 thru 12867-48, 12888-48.	

* - All of the engines listed in this column that were remanufactured at Avco Lycoming and shipped between December 21, 1972 and December 10, 1974 are subject to the modification described in this bulletin. However, during remanufacture many of these engines were built with oil pump drive components that are satisfactory for continued service and not subject to the modification herein required, see inspection paragraph to determine if compliance is required.

** - In addition to the engines listed by serial numbers in this column, all engines modified at overhaul to incorporate hardened impellers in accordance with Service Instruction No. 1272, including O-235, O-290, O-320, IO-320, LIO-320, O-340, O-360, HIO-360, VO-360, IO-360, TIO-360, LIO-360, O-540 and IO-540 are subject to compliance with this bulletin. Serial numbers of many engines shown in this list have the suffix "A"; this letter suffix has no significance insofar as this bulletin is concerned and therefore has been omitted.

\+ - O-540 and IO-540 engines built with large capacity oil pumps and dual magnetos are designated with the term "5D" in the model description and they are exempt from the requirements of this bulletin. They include O-540-H1A5D, -H1B5D, -H2A5D, and -H2B5D; IO-540-K1A5D, -K1B5D, -K1E5D, -K1F5D, -M2A5D, and -T4A5D.

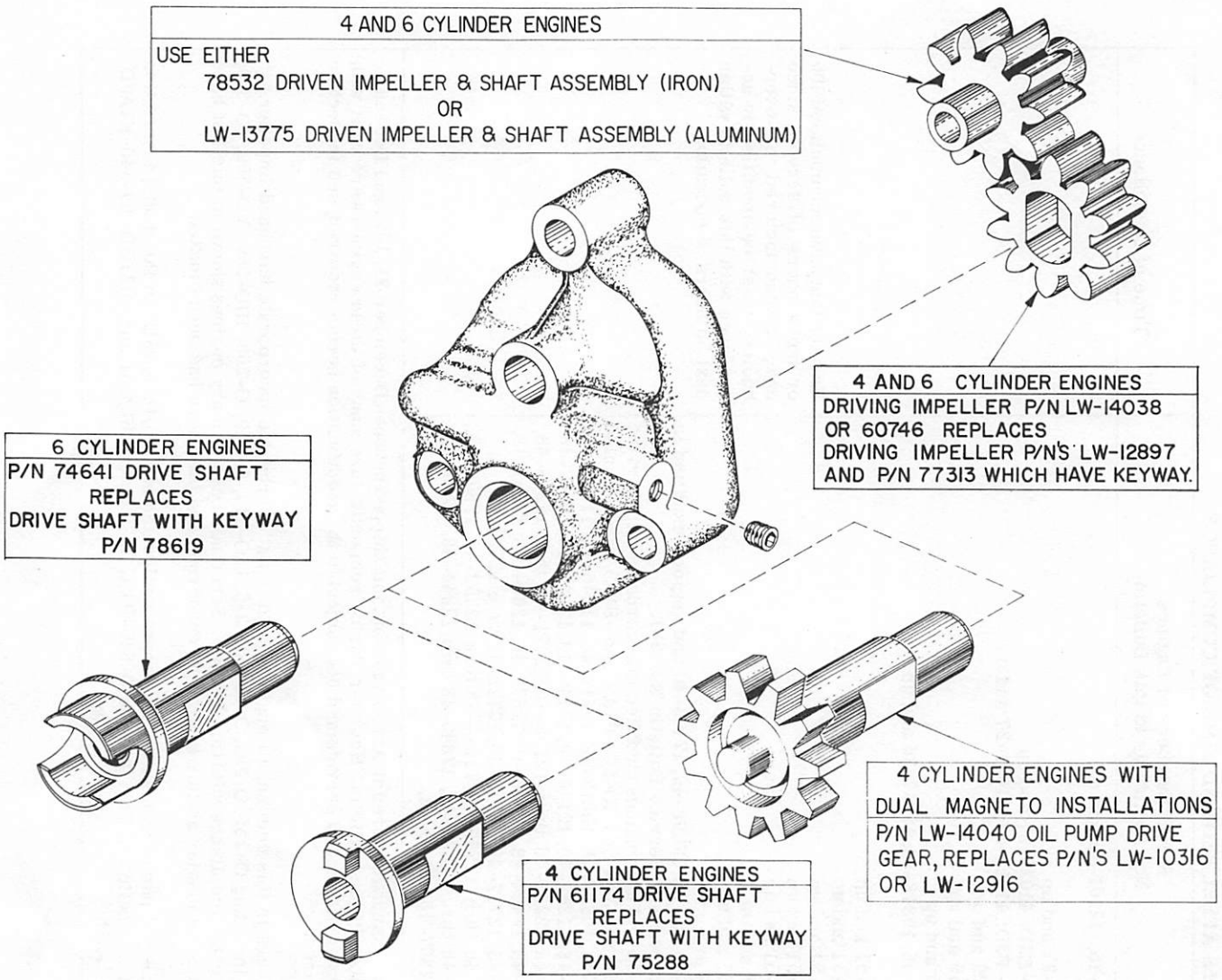


Figure 2. Oil Pump Drive Assembly

NOTE: Revision "C" adds part number 60746 drive impeller; removes Note from compliance column of chart which affects O-235, O-320, O-360 series engines.

19060 - This number for Avco Lycoming reference only.

AVCO LYCOMING DIVISION
WILLIAMSPORT, PENNSYLVANIA 17701

Service Letter

L

Service Letter No. L179A
(Supersedes Service Letter No. L179)
May 16, 1975

TO: All owners and operators of Avco Lycoming aircraft engines.

SUBJECT: Factory Policy for Prorated Engine Replacement

In addition to the published basic warranty, Avco Lycoming engines have extended pro rata coverage against defects in material and workmanship as follows:

> If an engine is found by Avco Lycoming factory inspection to be defective in material of workmanship so that replacement is required after the warranty period and before a total of 800 hours of operation (or equivalent number of hours computed at a minimum of 240 hours per year) it will be exchanged for a new or remanufactured engine. The cost of exchange will be on a pro rata basis for the unused portion of the initial 800 hour period. In computing the unused portion of the 800 hour period, engine hours will be based on the larger of actual log book hours or on the time accrued at a minimum of 240 hours per year from the date of delivery to the first user.

NOTE: Revision "A" removes second paragraph.

AVCO LYCOMING DIVISION
WILLIAMSPORT, PENNSYLVANIA 17701

Service Letter

L

Service Letter No. L185
December 19, 1975

TO: All Owners and Operators of Avco Lycoming Aircraft Engines

SUBJECT: The Use of Higher Octane Aviation Fuel, 100 LL Blue or 100 Green, for Engines Rated for 80/87 Octane Fuel

We have received many inquiries from the field expressing concern over the limited availability of 80/87 grade fuel and associated problems from use of higher leaded fuel in engines rated for grade 80/87 fuel. The leading fuel suppliers indicate that in some areas 80/87 grade aviation fuel is not available. It is further indicated that the trend is toward phase out of 80/87 aviation grade fuel. The low lead 100 LL Avgas, blue color, which is limited to 2cc tetraethyl lead per gallon and the higher 100 aviation fuel, color green, with a maximum of 4.6cc tetraethyl lead per gallon are available. Whenever 80/87 is not available you should use the lowest lead 100 grade fuel to keep engine deposits and spark plug fouling to a minimum. Automotive fuels should never be used as a substitute for aviation fuel in aircraft engines.

The continuous use, more than 25% of the operating time, with the higher leaded fuels will result in increased engine deposits both in the combustion chamber and in the engine oil. It will require increased spark plug maintenance and more frequent oil changes. The frequency of spark plug maintenance and oil drain periods will be governed by the amount of lead per gallon and the type of operation with the higher leaded fuel and longer operation requiring full rich mixture resulting in more frequent maintenance periods.

To reduce or keep engine deposits at a minimum when using the higher leaded fuels, 100 LL Avgas, blue or 100, green, it is essential that the following three conditions of operation and maintenance are adhered to:

A. Fuel management required in all modes of flight operation. (See A, GENERAL RULES.)

B. Replace lubricating oil and filters each 50 hours of operation, under normal environmental conditions. (See B, LUBRICATION RECOMMENDATIONS.)

C. Proper selection of spark plug types and maintenance are necessary. (See C, SPARK PLUGS.)

The use of economy cruise engine leaning whenever possible will keep deposits to a minimum. Pertinent portions of the manual leaning procedures as recommended in Avco Lycoming Service Instruction No. 1094 are reprinted here for reference.

A. GENERAL RULES.

1. Never lean the mixture from full rich during take-off, climb or high performance cruise operation unless the airplane owners manual advises otherwise. During take-off from high elevation airports or during climb at higher altitudes, roughness or reduction of power may occur at full rich mixture. In such a case the mixture may be adjusted only enough to obtain smooth engine operation. Careful observation of temperature instruments should be practiced.

2. Operate the engine at maximum power mixture for performance cruise powers and at best economy mixture for economy cruise power; unless otherwise specified in the airplane owners manual.

3. Without exception, observe the red line cylinder head temperature limit during take-off, climb and high performance cruise power operation.

4. For maximum service life, maintain the cylinder head temperature below 435°F. during high performance cruise operation and below 400°F. for economy cruise powers.

5. Always return the mixture to full rich before increasing power settings.

6. During let-down and reduced power flight operations it may be necessary to manually lean or leave mixture setting at cruise position prior to landing. During the landing sequence the mixture control should then be placed in the full rich position, unless landing at high elevation fields where leaning may be necessary.

7. Methods for manually setting maximum power or best economy mixture.

a. Engine Tachometer - Airspeed Indicator Method: The tachometer and/or the airspeed indicator may be used to locate, approximately, maximum power and best economy mixture ranges. When a fixed pitch propeller is used, either or both instruments are useful indicators. When the airplane uses a constant speed propeller, the airspeed indicator is useful. Regardless of the propeller type, set the controls for the desired cruise power as shown in the owners manual. Gradually lean the mixture from full rich until either the tachometer or the airspeed indicator are reading peaks. At peak indication the engine is operating in the maximum power range.

b. For Cruise Powers: Where best economy operation is allowed, the mixture is first leaned from full rich to maximum power, then leaning is slowly continued until engine operation becomes rough or until engine power is rapidly diminishing as noted by an undesirable decrease in airspeed. When either condition occurs, enrich the mixture sufficiently to obtain an evenly firing engine or to regain most of the lost airspeed or engine RPM. Some slight engine power and airspeed must be sacrificed to gain a best economy mixture setting.

c. Exhaust Gas Temperature Method - (EGT): Refer to Service Instruction No. 1094 for procedure.

Recommended fuel management, manual leaning, will not only result in less engine deposits and reduced maintenance cost but will provide more economic operation and fuel saving.

B. LUBRICATION RECOMMENDATIONS.

Many of the engine deposits formed by use of the higher leaded fuel are in suspension within the engine oil and are not removed by a full flow filter. When sufficient amounts of these contaminents, in the oil, reach high temperature areas of the engine they can be baked out resulting in possible malfunctions such as in exhaust valve guides causing sticking valves. When using the higher leaded fuels the recommended oil drain period of 50 hours should not be extended and if the occurrences of valve sticking is noted all guides should be reamed using the procedures as stated in Service Instruction No. 1116 and a reduction in oil drain periods and oil filter replacement used.

C. SPARK PLUGS.

Spark plugs should be rotated from top to bottom on a 50 hour basis and serviced on a 100 hour basis. If excessive spark plug lead fouling occurs the selection of a hotter plug, from the approved list on Service Instruction No. 1042, may be necessary, however, depending on the type of lead deposit formed a colder plug, from the approved list, may better resolve the problem. Depending on the lead content of the fuel and the type of operation more frequent cleaning of the spark plugs are required.

AVCO LYCOMING DIVISION
WILLIAMSPORT, PENNSYLVANIA 17701

Service Instruction

L

DATE: April 25, 1975

Service Instruction No. 1009V
(Supersedes Service Instruction No. 1009U)
Engineering Aspects are
FAA (DEER) Approved

SUBJECT: Recommended Overhaul Periods

MODELS AFFECTED: All Avco Lycoming engines in current production.

The following chart shows the factory recommended overhaul time periods for all Avco Lycoming aircraft engines. The established hours of service are based on average experience in operation, continuous service and economic factors at time of engine overhaul. The term, continuous service is intended to mean that the engine will have been in operation a minimum of 15 hours each month, and that the forecasted hours of service will have been attained within a proportionate period of time. These hours can be normally expected provided recommended operation, periodic inspections and engine maintenance have been exercised in accordance with respective engine operators manuals. Although the time between overhaul periods shown in the following table represents Avco Lycoming's recommendations, operators of Avco Lycoming engines may continue operation beyond the hours stated unless otherwise limited by FAA regulations. It is the responsibility of the agency maintaining the aircraft to decide if the engine shall be operated beyond the recommended number of hours; this decision should be based on knowledge of the engine and the conditions under which it has been operated. Engine accessories, including propellers, may require overhaul prior to engine overhaul; this decision too, is the prerogative of the operating agency of the accessory manufacturer.

Engine reliability and service life cannot be predicted when any normally aspirated engine has been altered by the addition of a supercharger device, or change in propeller, that is not approved by Avco Lycoming, which imparts operational characteristics to the engine that are different from those of an unaltered engine. The hours of service life shown in the chart are recommendations for engines as manufactured and delivered from the Avco Lycoming factory, without consideration for any modification that may have been made that improves the life of the engine. The recommended overhaul periods in no way affect change or alter Avco Lycoming standard warranty policy or prorated engine replacement policy; see Service Letter L179.

RECOMMENDED OVERHAUL PERIODS

FIXED WING AIRCRAFT

Engine Models	See Note	Hours
O-235 Series; O-290-D	3	2000
O-290-D2 Series	3	1500
O-320; IO-320-A, -E	1, 3	2000
IO-320-B, -D, -F	3, 5, 7	2000
IO-320-C	2, 5	1800
AIO-320 (160 hp)	7	1600
AEIO-320 Series	1, 7	1600
O-340 Series	1, 3	2000
O-360; IO-360-B, -E, -F (180 hp)	1, 3, 5	2000
IO-360-A, -C, -D Series (200 hp)	6	1600
AIO-360 (200 hp)	7	1200
TIO-360	4	1200
AEIO-360 Series (180 hp)	1, 7	1400
AEIO-360 Series (200 hp)	7	1200
O-435; GO-435	-----	1200
GO; GSO-480; IGSO-480 Series	-----	1400
O-540 Series; IO-540-C, -D, -N (235 hp), (250 hp), (260 hp)	1, 3	2000
IO-540-A, -B (290 hp)	3	1200
IO-540-E, -G, -P (290 hp)	3	1400
IO-540-S	2	1800
IO-540-J, -R	2	1800
IO-540-K, -L, -M	-----	2000
AEIO-540 Series	1, 7	1400
IGO and IGSO-540 Series	-----	1200
TIO-540-A, -C	4, 5, 8	1800
TIO-540-F	4, 5	1500
TIO-540-J, -N	4, 5	1200
TIO-541-A (310 hp)	4	1300
TIO-541-E (380 hp); TIGO-541-E (425 hp)	4	1200
IO-720 Series	3	1800

ROTARY WING AIRCRAFT

Engine Models	See Note	Hours
O-360-C2B, -C2D; HO-360; HIO-360-B	1	1200
HIO-360-A, -C, -D Series	-----	1000
VO-360-A Series	-----	600
VO-360-B; IVO-360	-----	1000
VO-435-A Series	-----	1200
VO-435-B Series	-----	1200
TVO-435 Series	4	1000
VO-540 Series	9	1200
IVO-540 Series	-----	600
TVO, TIVO-540 Series	4, 9	1200

NOTES

1. Only engines built with 1/2 inch dia. exhaust valves. Engines of this series with 7/16 inch dia. exhaust valves should not exceed 1200 hours between normal overhauls.

New engines built with 1/2 inch dia. exhaust valves:

O-320-A, -C, -E	15541-27 and up	O-360 Series	9048-36A and up
O-320-B, -D	6140-39 and up	IO and HIO-360-B	1940-51 and up
O-320-A, -C, -E	15431-27A and up	IO and HIO-360-B	1903-51A and up
O-320-B, -E	6136-39A and up	O-540 Series	9100-40 and up
O-340 Series	433-30 and up	IO-540-C, -D Series	2713-48 and up
O-360, HO-360 Series	9088-36 and up		

All remanufactured engines shipped after January 31, 1966.

2. These engines are designed to incorporate exhaust turbocharging.

3. Except engines engaged in crop dusting and other chemical application flying; for such engines 1200 hour overhaul intervals are recommended regardless of exhaust valves used or other modification incorporated in the engine.

4. Turbochargers may require removal, prior to engine overhaul, for carbon removal and repair.

5. Engines with reverse rotation have same overhaul times as corresponding normal rotation models.

6. 1200 HOURS: Engines that do not have large main bearing dowels must not be operated more than 1200 hours before overhaul.

   1400 HOURS: Engines that have large main bearing dowels may be operated to 1400 hours before overhaul: These include new engines with serial numbers 7100-51A and up; engines which are in compliance with Service Bulletin 326; and remanufactured engines shipped after January 26, 1970.

   1600 HOURS: Engines that have large main bearing dowels and redesigned camshaft may be operated to 1600 hours before overhaul. These include engines with serial numbers 9762-51A and up; IO-360-C1E6 engines with serial numbers 9723-51A and up; LIO-360-C1E6 engines with serial numbers 524-67A and up; engines that are in compliance with Service Bulletin 326 and Service Instruction 1263. Remanufactured engines shipped after October 1, 1972 may be operated to 1600 hours before overhaul except those with serial numbers 2349-51A and 7852-51A which do not have the redesigned camshaft and must not exceed 1400 hours operating time before overhaul.

7. The reliability and service life of engines can be detrimentally affected if they are repeatedly operated at alternating high and low power applications which cause extreme changes in cylinder temperature. Flight maneuvers which cause engine overspeed also contribute to abnormal wear characteristics that tend to shorten engine life. These factors must be considered to establish TBO of aerobatic engines; therefore it is the responsibility of the operator to determine the percentage of time the engine is used for aerobatics and establish his own TBO. The maximum TBO recommended is the time specified in this instruction.

8. TIO-540-A series engines with serial numbers 1880-61 and up, and TIO-540-C series engines with serial numbers 1754-61 and up, and remanufactured engines built after March 1, 1971 were built with large main bearing dowels and may be continued in service to 1800 hours. Also, TIO-540-A and -C engines that have been modified to incorporate large main bearing dowels in accordance with Service Instruction 1225B may be operated to 1800 hours. Engines that do not have this modification incorporated may not exceed 1500 hours before overhaul.

9. VO, TVO and TIVO-540 engines built with 77450 connecting rods as described in Service Bulletin No. 303D may be continued in service to 1200 hours. Engines that do not incorporate this new connecting rod are restricted to 1000 hours for VO-540 models and 900 hours for TVO and TIVO-540. See Service Bulletin No. 371A for improved connecting rod assembly.

NOTE: Revision "V" adds models IO-320-F; AEIO Series; IO-540-L, -S; TIO-540-N. Changes TBO for AIO-320 and AIO-360. Revises note 1; removes note 3; revises note 7.

AVCO LYCOMING DIVISION

WILLIAMSPORT, PENNSYLVANIA 17701

Service Instruction

L

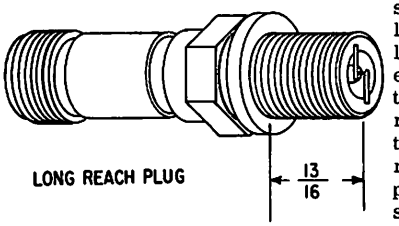
DATE: May 23, 1975

Service Instruction No. 1042J
(Supersedes Service Instruction No. 1042H)
Engineering Aspects are
FAA (DEER) Approved

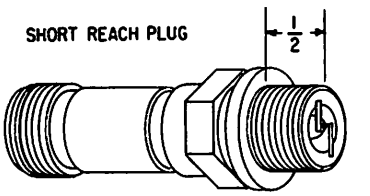
SUBJECT: Factory Approved Spark Plugs

Listed below are the approved spark plugs for Avco Lycoming opposed series aircraft engines. It is recommended that only the spark plugs listed be used in Avco Lycoming aircraft engines. Substitution of equivalent plugs is permissible only as an emergency measure. Always use new gaskets (STD-295) when reinstalling spark plugs.

CAUTION



Do not depend on engine model designation for spark plug application; same engine model may use short or long reach plugs. The following charts lists long reach spark plugs and the engines in which they may be used; the chart on page two lists the short reach plugs and the engines to which they are applicable. Engines with long reach plugs are identified by yellow paint on the cylinder fins between the spark plug hole and the rocker cover; engines with short reach plugs have no identifying color. See Service Instruction No. 1181.



AVCO LYCOMING AIRCRAFT ENGINE LONG REACH SPARK PLUG TABLE
Correct Torque for all Spark Plugs is 360 to 420 in. lbs.

ENGINE MODEL	CHAMPION		BG	AC		LODGE		AUTO LITE
	REB37N+ø RHB37Nø REB37E+ø RHB37Eø+ REB36W***+ RHB36P* RHB36W**	RHB32P* RHB32W** RHB32Eø	RB39R*	171+ø 271ø 181*+ 281* 291**	273ø 283* 293**	RS35-3R*	RS35-8R** RSE35-8R**+	PL350*
IO-320-C, LIO-320-C	A		A	A		A	A	A
TIO-360, IO-360-C1F	A		A	A		A	A	A
VO-435-A, -B Series	A		A	A		A	A	A
TVO-435-A, -B, -C, -D, -E, -F, -G Series	A	A	A	A	A	A	A	A
GO-480-G Series	A		A	A		A	A	A
GSO-480-A Series	A		A	A		A	A	A
GSO-480-B	A	A	A	A	A	A	A	A
IGSO-480-A Series	A	A	A	A	A	A	A	A
VO-540 and IVO-540 Series	A		A	A		A	A	A
TIO-540-A, -C, -E, -F, -G, -H, -J, -N; LTIO-540-F, -J, -N Series	A	A	A	A	A	A	A	A
TIVO-540-A Series	A	A	A	A	A	A	A	A
TIO-541-A, -E Series	A	A	A	A	A	A	A	A
TIGO-541 Series	A	A	A	A	A	A	A	A
IGO-540-A, -B Series	A		A	A			A	A
IGSO-540-A, -B Series	A	A	A	A	A		A	A
IO-540-G, -J, -K, -M, -P, -R, -S	A	A	A	A	A	A	A	A
IO-720-B1B	A		A	A			A	A

* - Indicates spark plugs having fine wire platinum electrodes.
** - Indicates spark plugs having fine wire iridium electrodes.
ø - Indicates spark plugs having massive electrodes.
A - Indicates spark plug gap is set at .017 to .021.
\+ - Indicates spark plug with 5/8 terminal thread (all weather plugs have 3/4-20 terminal thread).

NOTE: Revision "J" adds new engine models and spark plug application for O-235-K, -L, -H.

17535 - This number for Avco Lycoming reference only.

AVCO LYCOMING AIRCRAFT ENGINE SHORT REACH SPARK PLUG TABLE

Correct Torque for all Spark Plugs is 360 to 420 in. lbs.

	CHAMPION					AUTO LITE				BG		AC						LODGE
	M41Eø M41Nø EM41E+ø EM41N+ø	REM40E+ø RHM40Eø	REM38E+ø	RHM38Eø	REM38P*+ RHM38P* REM38W**+ RHM38W**	SH15+ø SH15Rø+	SH20A+ø SH200Aø	SH26+ø SH260ø	PH26*+ PH260*	RB485S*+ RB955S*	RB963S* HRB963S*	A-88+ø	S-88+ø	SR88+ø HSR88ø	SR87+ø HSR87ø	SR86+ø HSR86ø	SR83P*+ HSR83P* SR83IR**+ HSR83IR** SR93**+ HSR93**	RSE23-3R**+ RSH23-3R**
O-235-C, -E, -H, O-290-D	A	A			A	A	A		A	A		A	A	A	A		A	
O-235-F, -G, -J Series																A		A
O-235-K, -L			A	A	A			A	A	A						A	A	A
O-290-D2 Series	A	A			A	A	A		A	A		A	A	A	A		A	A
O-320-A, -C, -E Series IO-320-A, -D, -E Series	A	A			A	A	A		A	A		A	A	A	A		A	A
O-320-B, -D, IO-320-B, AIO-320, LIO-320-B		A	A	A	A		A	A	A	A		A	A	A	A		A	A
O-340-A Series		A	A	A	A		A	A	A	A		A	A	A	A		A	A
O-340-B Series	A	A			A	A	A		A	A		A	A	A	A		A	A
HIO-360-B, HO-360, O-360-A, -C, IO-360-B, -E, -F		A	A	A	A		A	A	A	A		A	A	A	A		A	A
O-360-B, -D Series	A	A			A	A	A		A	A		A	A	A	A		A	A
IVO-360, VO-360		A	A	A	A		A	A	A	A				A	A		A	A
IO-360-A, -C, -D, LIO-360- C1E6, HIO-360-A, -C, -D, AIO-360			A	A	A			A	A	A						A	A	A
O-435-C, -C1, -C2	A	A			A	A	A		A	A		A	A	A	A		A	A
VO-435-A Series		A	A	A	A		A		A	A	A				A	A	A	A
TVO-435 Series			A	A	A			A	A	A					A	A	A	A
GO-435-C2 Series		A	A	A	A		A	A	A	A					A		A	A
GO-480-B, -D, -F Series		A	A	A	A			A	A	A					A		A	A
GO-480-C, -G, GSO-480, IGSO-480			A	A	A			A	A	A	A				A		A	A
O-540-A, -D, -E, -F, -G, -H, IO-540-C, -D, -N Series		A	A	A	A		A	A	A	A	A	A	A	A	A		A	A
O-540-B Series	A	A			A	A	A		A	A		A	A	A			A	A
IO-540-A, -B, -E, -G, -K, -L, -P			A	A	A			A	A	A						A	A	A
VO-540 Series			A	A	A			A	A	A					A	A	A	A
IGO-540, IGSO-540			A	A	A			A		A							A	A
IO-720-A, -B, -C Series			A	A	A			A	A	A						A	A	A

* - Indicates spark plugs having fine wire platinum electrodes.
** - Indicates spark plugs having fine wire iridium electrodes.
ø - Indicates spark plugs having massive electrodes.

\+ - Indicates spark plug with 5/8-24 terminal thread (all-weather plugs have 3/4-20 terminal threads).
A - Indicates spark plug gap is set at .017 to .021.

AVCO LYCOMING DIVISION
WILLIAMSPORT, PENNSYLVANIA 17701

Service Instruction

L

DATE: January 30, 1976

Service Instruction No. 1070H
(Supersedes Service Instruction No. 1070G)
Engineering Aspects are
FAA (DEER) Approved

SUBJECT: Specified Fuels

MODELS AFFECTED: Avco Lycoming opposed series aircraft engines.

TIME OF COMPLIANCE: When refueling the aircraft.

During the past few years several significant changes have occurred in the grade designations and tetraethyl lead content of some of the commercial aviation fuels available on the world markets. Among these events has been the discontinuance of commercial grades 91/98 and 115/145 fuels and the limited availability of 80/87 grade in U.S. as well as over seas countries. Also, a new low lead content fuel, currently designated "100LL" has been introduced. A summary of the current grades as well as the previous fuel designations are shown in the following chart.

FUEL GRADE COMPARISON CHART

Previous Commercial Fuel Grades (ASTM-D910)			Current Commercial Fuel Grades (ASTM-D910-75)			Current Military Fuel Grades (MIL-G-5572E) Amendment No. 3		
Grade	Color	Max. TEL ml/U.S. gal.	Grade	Color	Max. TEL ml/U.S. gal.	Grade	Color	Max. TEL ml/U.S. gal.
80/87	red	0.5	80	red	0.5	80/87	red	0.5
91/98	blue	2.0	*100LL	blue	2.0	none	none	none
100/130	green	3.0	100	green	3.0	100/130	green	3.0
115/145	purple	4.6	none	none	none	115/145	purple	4.6

* - Grade 100LL fuel in some over seas countries is currently colored green and designated as "100L".

The importance of using the fuel specified for a specific model Avco Lycoming engine has always been stressed in Avco Lycoming service publications. However if the specified fuel is not available a higher grade fuel may be used, subject in some instances to the restrictions described in the footnotes to the following Table of Specified Fuels. The chart showing specified and alternate fuels that can be safely used in no instance permits use of fuels of lower grade than that which is specified. Also, it is not permissible in any instance to use automotive fuel in aircraft engines, regardless of its octane or advertised features because of the corrosive effect of its chlorine content and because of vapor lock that could result from its high vapor pressure. Any fuel used in Avco Lycoming engines must conform with Specifications ASTM-D910 or MIL-G-5572E.

NOTE

Isopropyl alcohol in amounts not to exceed 1% by volume may be added to the fuel to prevent ice formation in fuel lines and tanks. Although approved for use in Avco Lycoming engines, isopropyl alcohol should not be used in the aircraft fuel systems unless recommended by the aircraft manufacturer.

TABLE OF SPECIFIED FUELS

Engine Models	SPECIFIED FUEL		Alternate Military and Commercial Grades
	Certificated for Use with Grade	Commercial Grade Designation	
O-235-C, -E, -H; O-290-D; O-435-A, -C	80	80	①⑤ 100LL or ②③ 100 or ④②③ 100/130
O-290-D2; O-320-A, -C, -E; IO-320-A, -E; AEIO-320-E; O-340-B; O-360-B, -D; GO-435-C2*; VO-435-A; GO-480-B, -D, -F; O-540-B; VO-540-A, -B	80/87		
O-320-B, -D; IO-320-B, -D; LIO-320-B1A; AIO-320-A, -B, -C; O-340-A; O-360-A, -C; IO-360-B, -E; AEIO-360-B, -D, -H; VO-360; IVO-360; HO-360-A, -B; HIO-360-B; O-435-A2; GO-435-C2*; O-540-A, -D, -E, -F, -G, -H; IO-540-C, -D, -N, -T; AEIO-540	91/98	①100LL or 100	④100/130 or ④115/145
O-235-F, -G, -J, -K, -L; IO-320-C, -F; LIO-320-C1A; IO-360-A, -C, -D, -F; AIO-360-A, -B; HIO-360-A, -C, -D; TO-360; LTO-360; TIO-360-A; VO-435-B; TVO-435; GO-480-C, -G; IGO-480; GSO-480; IGSO-480; IO-540-A, -B, -E, -G, -J, -K, -L, -M, -P, -R, -S; HIO-540-A; TIO-540; LTIO-540; TIO-541; VO-540-C; IVO-540; TIVO-540; IGO-540; IGSO-540; TIGO-541; IO-720	100/130		

* - GO-435-C2 engines with Marvel-Schebler carburetor No. 10-3391 are certificated to use 91/98 fuel.

①- Grade 100LL or 100L in which the lead content is limited to 2 ml. of TEL per U. S. gallon are approved for continuous use in all Avco Lycoming engines listed herein. Inspection procedures described in the following footnotes are not required for engines using this fuel.

②- O-235-C, O-290-D, -D2 and O-435-A2, -K1 (O-435-4) engines are built with solid stem exhaust valves. The use of fuels with higher lead content of more than 2 ml. of TEL per U. S. gal. must be limited to 25% of the operating time. If used for longer periods of time the same 150 hour inspection requirement, described in the following note is applicable. O-235-C and O-290-D models can be converted to use sodium cooled exhaust valves. See Service Instruction No. 1246 for procedure.

③- Early production O-320-A, -C, -E; GO-435; VO-435-A; and GO-480-B, -D, -F were built with solid stem exhaust valves and their use with fuels having lead content of more than 2 ml. of TEL per U. S. gal. is limited to 25% of operating time. If specified fuel is not available and usage with high leaded fuel exceeds 25% of the operating time, the valve stems should be inspected at 150 hour intervals for erosion, or "necking". This inspection is accomplished by removing the exhaust manifold and visually inspecting the valves through the exhaust ports. To determine if an engine has solid stem exhaust valves, remove the rocker cover and look for valve rotor caps which are used with sodium cooled valves but not with solid stem valves in these particular engines.

④- Continuous use of military grade 100/130 or 115/145 fuel with 4.6 mililiters of TEL per U. S. gal. can result in increased lead deposits both in combustion chambers and spark plugs causing engine roughness and scored cylinder walls. It is recommended that the use of this fuel be limited wherever possible; however when 115/145 fuel is used, periodic inspections of combustion chambers, valves and valve parts should be conducted more frequently and spark plugs rotated or cleaned whenever lead fouling is experienced.

⑤- See Service Letter No. L185 for operating recommendations.

NOTE: Revision "H" adds Note ⑤ for engines rated to use 80/87 octane fuel. Changes note on use of isopropyl alcohol. Revises "Table of Specified Fuels".