Lycoming **FLYER**

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THE UNFORTUNATE CHOICE

There are many who look for an aircraft engine on the open market. While there is nothing wrong with this approach to acquiring a needed powerplant, it sometimes results in a purchase which is an unfortunate choice. Perhaps a little information on the possible pitfalls may help to reduce the number of bad choices.

Individuals working on home built aircraft are particularly susceptible to this type of error. At Lycoming, there have been many calls from people who grabbed an engine which seemed to be an exceptionally good deal — only to find that this "engine of their dreams" would not fit into the aircraft they are building.

Consider the circumstances which lead to these problems. The person looking for an engine is usually building an aircraft from his own plans or from a kit supplied by a kit manufacturer.

In the latter case, a particular engine model is often recommended. Finding that model engine available, and for sale on the open market, may be virtuallly impossible. Lycoming requires an exchange engine core of the same model for any overhauled or remanufactured engine ordered. Since the home builder is starting from scratch, there is no core to exchange. This means a new engine is the only readily available option; for many, this option is prohibitively expensive.

As the airframe begins to take shape, obtaining a suitable engine may be reason for some concern and anxiety. When a Lycoming O-320, O-360, or other engine with appropriate horsepower rating is found, there is a temptation to buy now and ask questions later. This could be a serious mistake.

The article "Low Time Engine May Not Mean Quality and Value" which appeared in *Flyer* No. 48 explained that old engines with low time are frequently affected by internal rust and corrosion. Any engine which is not used frequently should be preserved. The condition of the engine is just one of the items to be considered when acquiring a power plant in the resale market.

Other mistakes often involve the engine model. Unfortunately there are those who believe that all Lycoming O-320 engine models are alike and that all Lycoming O-360 engine models are also very similar. The Lycoming certificated aircraft engine list shows 58 O-320 models and 51 O-360 models. While these engines may be similar in many respects, it is the differences which are likely to cause installation problems and which should be well understood before an engine is purchased.

What are these differences which may cause installation problems? The engine mounts should be considered. Older engine models were built with conical mounts which make installation somewhat easier, but which do not dampen engine vibration as well. With very few exceptions, engines certified during the 1970s and 1980s have dynafocal mounts.

Although the type of engine mount is not likely to be a serious problem, the shape of the sump, the location of the carburetor, or an engine mounted oil filter may result in airframe interference which makes installation of a particular engine model difficult or impossible. Some aircraft, for example, do not have enough space between the engine and the fire wall for an engine mounted oil filter. In the case of an engine with a single unit dual magneto, there is nothing which can be done since the filter is a required part of the engine design. All Lycoming engines with two individual magnetos can be configured to operate without an oil filter. Should an oil filter and the space needed to remove it be the only problem in adapting this type of engine to an airframe, the filter and adapter can be removed and an oil pressure screen housing can be installed instead. Should this step be necessary, the recommended oil change interval is reduced to 25 hours. A second option would involve removing the filter from its standard location and mounting it remotely.

Engine to firewall is not the only area where space may be limited. The sump is often tailored in size and shape to meet the requirements for a particular airframe. For that reason the homebuilder may find that some engine models will not fit the

(CONTINUED ON PAGE 6)

EDITOR'S COLUMN

By Ken W. Johnson

Dear Friends:

This is my "Goodbye" issue after exactly ten years as editor of the *Lycoming Flyer*. As I move into retirement at the end of 1989, it is evident that there have been many things that helped to make the *Flyer* and Key Reprints what they are.

First, the many years as a Naval aviator did much to prepare me for my role as editor. Second, my predecessor, Mr. Joe Diblin, had already established the *Flyer* and Key Reprints as publications with an excellent reputation. He also left volumes of written information from which I acquired much of my knowledge of the flat, opposed cylinder Lycoming engine. Third, the company — first Avco and now Textron — has paid the bills while giving me freedom to write what seemed to be most appropriate for Lycoming engine owners. But, it has been you, the readers, who have really helped the cause.

There have been numerous questions and comments from readers which pointed the direction for articles which later proved beneficial for all. The major thrust of the *Flyer* has been simple — provide information which will help readers to get the best possible service from their Lycoming engine, and to make flying safer.

It has been a pleasure to speak with many *Flyer* readers, both by telephone and in person. The invitations I have received to visit many of your organizations are greatly appreciated.

Finally, the many letters received from readers all over the world — from Australia to Zimbabwe and just about everywhere else — have provided much praise for the *Flyer*. Those complimentary letters from you, the *Flyer* readers, have provided satisfaction and incentive for the *Flyer* editor. I thank you for all the kind words.

Goodbye — may you have fair skies and many tailwinds.

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TEXTRON LYCOMING CYLINDER BARREL SURFACES

There are pilots and technicians who remember when the TBO's for general aviation piston engines were much shorter than they are today. In the 1950's and early 1960's, normal overhaul at 800 hours of operation was the recommendation for most Lycoming engines. An engine examined and found to be in good condition might be extended for 200 hours on two occasions. This made 1200 hours the maximum TBO for even for the simplest direct drive engine.

Today, 1800 or 2000 hour TBO's are recommended for many Lycoming engines. There are a variety of reasons for these significant increases in recommended TBO. This discussion will be directed at the methods used to reduce cylinder barrel wear and the reasons why Lycoming prefers the nitriding process.

The first Lycoming opposed cylinder engines with a design similar to today's models were certificated in the early 1940's. These early engines were designed with low compression, were relatively low in horsepower, and were built with plain steel cylinder barrels.

As higher horsepower engines were developed, compression ratios were increased. The higher compression ratios caused increased cylinder wear. To combat this increased wear, and to provide a desired improvement in recommended TBO, harder cylinder wall surfaces were needed.

The plating of cylinder walls with chromium to obtain a harder wearing surface was an invention of the 1930's. As larger and more powerful engines were developed, the use of chrome plating became standard in the manufacture of Lycoming cylinders. Cast iron rings were used in a variety of combinations to keep oil consumption within specifications. The increased cylinder life did contribute to longer TBO's than could be obtained with plain steel barrels.

In spite of the good results in terms of cylinder wear, the use of chrome plating created many manufacturing and quality problems. Any cylinder barrel surface must be capable of trapping and retaining enough oil to provide good lubrication between piston rings and cylinder wall. Chrome is not oil wettable, and therefore, each chrome plated cylinder barrel had to receive a secondary treatment which could create a channel chrome surface which was porous enough to hold the needed lubricating oil. For Lycoming this was not a cost effective program.

Obtaining a quality product consistently is also very unlikely when chrome plating cylinder walls. The plating process is very sensitive. Absolute cleanliness is necessary. Even a tiny speck of dirt may cause a spot where the chrome does not adhere to the cylinder wall. Inspection of the cylinder barrel may not reveal this flaw until after the engine has been run.

After the engine has been run, it may be too late. Should a tiny piece of chrome peel away from the cylinder wall and be dispensed through the engine, this very hard material will contaminate the engine causing bearing surfaces to wear quickly. The result could be a very short TBO.

Lycoming had years of experience with chrome, and as a result, the need for a better process was very evident. The development of the nitride hardened steel alloy surface was a great step forward. Manufacturing is simpler, and the completely homogenous surface results in consistent high quality in the final product. Nitrided cylinders also produce excellent oil consumption results when the engine is properly broken in.

What is nitriding? It is the addition of nitrogen to the surface of an alloy steel producing a hard, wear resistent surface. The introduction of nitrogen into the surface layers of alloy steel is brought about by subjecting the practically finished parts to an atmosphere of ammonia gas. The process requires special heat treating furnaces which are air tight and capable of holding the parts at high temperature. At a heat level of 975 degrees fahrenheit, the ammonia gas flowing into the furnace is broken down into its elements, hydrogen and nitrogen. This is the source of the nitrogen which penetrates the surface of the steel. To produce a satisfactory nitrided surface, the process must be continuously operated for up to 80 hours.

Production of nitrided cylinder barrels began at Lycoming in 1960. The service record of these nitrided cylinders has been excellent. Only a few small, low power engines are built with plain steel barrels today. The vast majority of Lycoming engines have nitrided barrels when they leave the factory. Some favorable characteristics of nitrided barrels are:

1. Reduced cylinder wall wear — the harder a surface the more difficult to wear down.

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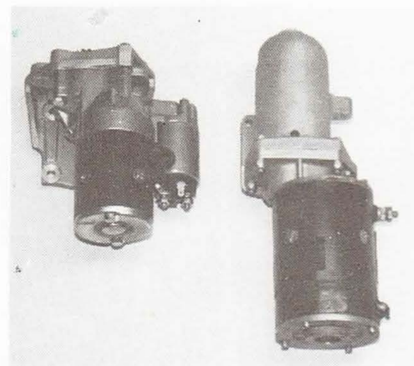
LIGHTWEIGHT STARTER AVAILABLE FROM LYCOMING

Aircraft weight and balance is a critical factor in aircraft design. The weight of the engine and accessories in the nose of the aircraft must be balanced by some equivalent amount in the back of the aircraft. Because of this, aircraft builders — both individual and companies — often find it desirable to reduce the weight of the engine and accessories. This is not an easy task since most items attached to the engine are considered to be necessary.

To assist aircraft builders with weight reduction, Lycoming has developed and certified the Lycoming light weight starter which weighs less than 11½ pounds. Use of these new starters will reduce weight approximately 5½ to 6½ pounds depending upon the model being replaced.



STARTERS

The new Lycoming lightweight starter is on the left and the Prestolite starter is on the right.

In most cases, the Lycoming light weight starter is a direct replacement for the standard Prestolite starter presently used on most Lycoming direct drive engines. Some engines with alternators mounted on the left side may not accommodate the lightweight starter. The pad used to attach the starter to the engine is the same, and the electrical wiring connections are also duplicated. In some cases the alternator attaching link may require modification by simply adding a spacer, but this is a very minor adjustment.

The pinion gears on starters for Lycoming engines come in 12/14 pitch and 10/12 pitch. To utilize the 12/14 pitch, the starter ring gear will have 149 teeth. A ring gear with 122 teeth will accept the 10/12 pitch pinion gear.

The light weight starters are currently available in both 12 and 24 volt models with 12/14 pitch pinion gears. It is expected that 10/12 pitch light weight

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TEXTRON LYCOMING RECIPROCATING ENGINE TROUBLESHOOTING SCHOOL

Textron Lycoming Williamsport offers a four-day, Monday through Thursday, troubleshooting course for aircraft mechanics. Emphasis is on the diagnosis and correction of problems in various piston engine parts or accessories such as turbocharger systems, magnetos and fuel injectors. A tour of the Williamsport Plant is included.

The course is offered at no charge, but each individual attending will be responsible for travel, meals and lodging. Transportation between local motels and the school will be provided if required.

Although the schedule for 1990 is not complete as this notice is written, classes are normally scheduled about twice each month. For further information on specific class dates and to reserve a space in a future class, contact:

Don Stahl
Instructor/Training Center
Textron Lycoming Williamsport
652 Oliver Street
Williamsport, PA 17701

Phone: (717) 327-7338/7308

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ENGINE OVERBOOST — *Continued*

Back to the density controller. What should the pilot expect and how should the controller be set? The A & P mechanic must have the tools specified in the latest revision of service instruction 1187, and must follow the procedures outlined. The engine must be at normal operating temperature. Induction air temperature is then checked against manifold pressure utilizing the curves in the service instruction. The controller should only be adjusted if this is necessary to bring the manifold pressure within the limits shown on the curve.

When the controller is set properly, the pilot should not expect the manifold pressure needle to settle on the manifold pressure limit marked on the gage. Air temperature is a major factor in the amount of power produced. Since the density controller is sensing temperature, as well as pressure, it will demand more manifold pressure in hot weather and less in cold weather. In either case, an equivalent amount of power will be produced.

For the pilot, expect lower than red line manifold pressure readings for all takeoffs. Once it is set correctly, the density controller will insure that you get rated engine power for take off.

Once the function of the density controller is understood, it truly is an aid to the pilot. In addition to supplying rated power, it goes one step further. It will also prevent engine overboost.

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The Flyer provides *product information. Informed* pilots and mechanics contribute to *safe flying.*

CYLINDER BARREL SURFACES — *Continued*

2. Natural choked barrels providing improved piston ring life due to a resulting straight cylinder wall when engine is hot or operating, and a better job of sealing.
3. Nitriding permits use of chrome plated piston rings which are more wear resistent and quite compatible with hardened steel.
4. Nitriding provides a hardened surface with an increased fatigue strength.
5. Nitrided barrels also have the ability to resist softening when heated during engine operation.

The main advantage of chrome over nitriding comes into play when used cylinders are to be overhauled. Worn cylinder barrels which are out of service limits can be coated with enough chrome to bring them back to their original specification. The problem with this is that the up-to-specification cylinder barrel will be matched with a used cylinder head. The steel barrel with its chrome coat may now be ready to perform through another full TBO, but it is very unlikely that the cylinder head will survive for that period of time.

Typically, cylinder barrels which are worn beyond service limits have worked through more than one TBO. The aluminum head which is the other major component of the cylinder will also have been in use for this period. Running at 2400 RPM, that head is exposed to 72,000 firing impulses every hour. Over a period of 2000 hours, this is over 140 million impulses or quick thermal changes. The aging process is also affected by the continuous heating and cooling each time the engine is started and shut down. Assuming average flight lengths of two hours, this is 1000 thermal cycles during the life of a 2000 hour TBO engine. The longer an engine runs, the more susceptible the cylinder head is to cracking. Cylinder heads which are cracked are often repaired by welding, a process which Lycoming has found to be of limited value. While the overhauled cylinder may look good, and the chrome barrel may provide an excellent wearing surface, the unknown quality of the overhauled cylinder head is typically the weakest structural part of the cylinder. This could be the place where cylinder problems occur before the engine has again reached TBO. In this case, the quality of the cylinder barrel coating is of little consequence.

Lycoming has adopted a policy of shipping all engines from the factory (new, remanufactured, and overhauled) with brand new cylinders. By doing this, the factory engine has the best cylinder quality it is possible to provide.

Lycoming cylinder kits are available through all distributors. Each kit contains a brand new cylinder assembly and all the parts needed to assemble the cylinder on the engine. Currently selling at reduced prices, these high quality genuine Lycoming cylinder kits are an exceptional value, and at the same time eliminate all the questions relative to the value of chrome plating and reworking of cylinders.

To summarize, the improved hardness of cylinder barrel surfaces is an important factor in the increase in recommended engine TBO. For Lycoming, the nitriding process has many advantages. These include manufacturing efficiency and consistent quality. Although this article has focused primarily on methods of obtaining cylinder barrel hardness for good wear characteristics, it is the entire cylinder which must be considered when making a decision about the cylinders to be used for engine overhaul or for replacement of a single cylinder for any reason.

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DID YOU KNOW?

The diaphragm style fuel pumps used on many Lycoming engines are generally known as AC fuel pumps. Since they have been used on Lycoming engines, they have both an AC part number and a Lycoming part number. Today, these pumps are a product of Textron Lycoming. They still carry an AC and a Lycoming part number. The AC number is retained for reference purposes, but the Lycoming number should be used when a pump is to be ordered from Lycoming.

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ENGINE OVERBOOST

Many Lycoming turbocharged engines are equipped with density controllers. These engines are used in aircraft such as the Piper Aztec, Piper Navajo series, the Lake Renegade, the Aerospatiale Trinidad TC, and the Mooney TLS.

The purpose of the density controller is to aid the pilot. When the throttle is fully advanced, the controller should assume responsibility for obtaining rated horsepower from the engine. Note two very important items: (1) Should assume responsibility is based on the controller being adjusted as described in the latest revision of Textron Lycoming Service Instruction 1187 and, (2) Rated horsepower does not mean a specific manifold pressure.

It is unfortunate that pilots who fly these aircraft do not always understand what the density controller is designed to do. This may also apply to some A & P technicians. Let's take an example. Cold weather has just arrived with fury and Mr. Pilot goes out to fly. On takeoff he notes that the manifold pressure is two or three inches below the red line manifold pressure on the gage. Back on the ground he tells his favorite A & P that he is not getting enough manifold pressure at takeoff. When the A & P finds nothing wrong with the engine, he adjusts the controller so that the needle on the manifold pressure gage goes to red line when the throttle is fully advanced. Both of these individuals are in error, and each time the throttle is fully advanced, the engine is being overboosted. the engine is being forced to produce more power than its type certificate allows.

Generally speaking, overboost is bad for the engine. It may cause exhaust system leaks. Internal engine damage from preignition or the excessive loads put on internal engine parts may also occur. But, you say, as a pilot I will take my chances with a controller which causes the engine to produce more power than it is rated for. It may come in handy if an engine should fail and I am faced with a single engine situation on the twin I fly. Keep in mind that aircraft performance is only assured when all parameters are the same as when the aircraft was test flown for certification. The available rudder may not be adequate to handle additional power on one engine. That extra power with too little rudder might be enough to cause the aircraft to roll inverted. Too much power may be just as bad as too little.

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SERVICE BULLETINS, LETTERS, INSTRUCTIONS PUBLISHED FROM JUNE 30, 1989 TO NOVEMBER 30, 1989

The service publications listed below are those which have been issued most recently. We strongly recommend that a complete set of these publications be maintained by all maintenance organizations which work on Lycoming reciprocating aircraft engines. A subscription may be obtained through any Textron Lycoming distributor or directly from the Textron Lycoming Williamsport Product Support Department. Call or write for a copy of Textron Lycoming Service Letter No. L114 which provides a listing of available publications, prices, and ordering instructions.

SERVICE BULLETINS

486	Inspection of SINGLE BELT Driven Ring Gear Support Assemblies — All new, remanufactured and overhauled engines shipped from Textron Lycoming from January 1, 1988 until June 12, 1989.
487	Fuel pump vent restriction — TI0-540-AE2A engines with serial numbers up to and including L9064-61A.
488	Propeller governor line support — All four cylinder engines with rear mounted governor.
490A	Installation of intake and exhaust valve guides — TI0/LTI0-540-V2AD, -W2A engine.

SERVICE INSTRUCTIONS

1187G	Turbocharger density controller adjustment — TI0-540-A1A, -A1B, -A2A, -A2B, -A2C, -C1A, -F2BD, -J2B, -J2BD, -N2BD, -AA1AD, -AB1AD, -AF1A; LTI0-540-F2BD, -J2B, -J2BD, -N2BD
1445	Precision Airmotive Service Bulletin No. PRS-91 — Textron Lycoming HI0-360-D1A engines.
1446	Possible ruptured pressure regulator diaphragm in AN fuel pump. — All Textron Lycoming engines equipped with AN type fuel pumps.

SERVICE LETTERS

114AC	Reciprocating engine and accessory maintenance publications.
214A	Discontinuance of reconditioned camshaft exchange program.
227	Listing of parts catalogs and applicable revisions or special service publications.

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THE UNFORTUNATE CHOICE — *Continued*

plane being built because of interference. As if this were not enough to be concerned about, the carburetor or fuel injector location must also be considered. These fuel metering devices are frequently mounted under the engine in an up-draft configuration, but there are also front and rear mounted configurations. Some engine models are equipped with horizontal carburetors. All of these variations in model may have an effect on engine/airframe fit.

Another error in choice which occurs all too frequently is the purchase of an engine originally designed for a high wing aircraft when the builder has a low wing design under construction. The low wing needs a fuel pump, but the high wing usually delivers fuel to the carburetor by gravity. In most cases a fuel pump cannot be added to the engine because the drive mechanism was not built in during engine manufacture and the accessory housing was not machined to allow mounting of a fuel pump.

As a result of contacts with individuals who have made engine purchases for their aircraft, we know that the variations in engine configuration outlined in this article have resulted in problems. The purpose of bringing these issues to the attention of *Flyer* readers is to help them avoid making the same mistakes others have made. If a particular engine model has been recommended by a kit manufacturer, it is best to search out that model. Although similar, other engine models may not meet your needs. When buying a used engine in the open market, do not make an unfortunate choice — get it right the first time.

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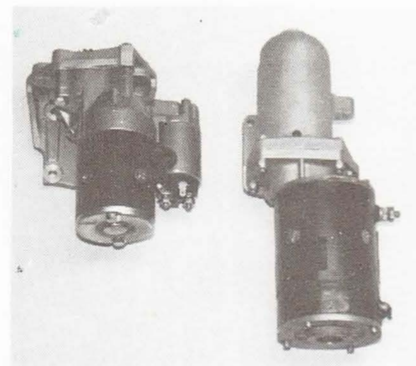

STARTERS

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ACCESSORY TBO — *Continued*

An "as needed" accessory overhaul may be the result of normal wear and tear. Exposure to unusual conditions could also bring about the need for accessory overhaul. Conditions such as lightning strike, engine overspeed, or sudden stoppage are examples of conditions which could have a very detrimental effect on engine accessories.

Should an accessory require overhaul before the engine reaches its recommended TBO, a very careful logbook record should be kept. This will provide information on which to base a decision at engine overhaul time. A new or overhauled accessory which has had only limited service on an engine which is due for overhaul would probably not be repaired at the same time as the engine.

An accessory which continues to provide satisfactory service for the life of the engine or for a long period before the engine reaches TBO should be overhauled or replaced at the same time the engine is overhauled. Not only will this be more convenient and less expensive over the long term, it will usually assure a relatively long period of maintenance-free operation with the newly overhauled engine.

From this discussion it becomes clear that TBO is not a well defined period for most engine accessories. Overhaul will usually be accomplished on an "as needed" basis and it is not unusual for this need to occur prior to the requirement for an engine overhaul. Unless an accessory has only a very brief period of operation before the engine is overhauled, overhauling the accessory at the time of engine overhaul is a reasonable course of action.

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MOBIL AV 1 OIL APPROVED FOR USE IN LYCOMING AIRCRAFT ENGINES

Textron Lycoming Service Instruction No. 1014 states that the company which produces a lubricating oil is responsible for insuring that the oil conforms to MIL-L-22851. The results of extensive testing done by MOBIL were presented to Lycoming engineers for evaluation. The tests indicated that Mobil AV 1, a fully synthetic oil, exceeded the requirements of MIL-L-22851. Based on the testing by MOBIL and evaluation of the results by Lycoming, Mobil AV 1 Oil is approved by Lycoming for use in Lycoming aircraft engines.

Although this fully synthetic oil received Lycoming approval in December, 1989, compliance with Lycoming service publications is required, and may qualify certain aspects of the approval. For example, service instructions 1014 and 1392 set specific temperatures below which the engine should be preheated, regardless of the type of oil used. Service bulletin 480 recommends oil and filter replacement at 50 hour intervals. Engines which do not have filters should have the pressure screen cleaned at 25 hour intervals and oil changed at the same time. In any case, a maximum of four months between oil changes should not be exceeded.

No matter what oil is used, Lycoming considers compliance with all service publications dealing with lubricating oils to be important in achieving long engine life. In particular, the oil change intervals specified in Lycoming Service Bulletin 480 are necessary to avoid a build up of contaminants which result from combustion.

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LIGHTWEIGHT STARTER — *Continued*

starters will be available early in 1990.

Individuals building an aircraft may find it convenient to plan for use of the light weight starter when calculating weight and balance. Although these new starters are capable of directly replacing the mounting and starting capability of the standard starter now in use on many certified aircraft which are Lycoming powered, this may not be done without careful consideration of the effect on aircraft weight and balance. Because of the weight difference, weight and balance must be recalculated and proper FAA approval obtained. After recalculating weight and balance, the filing of Form 337 with the FAA may be adequate for approval, but this change in certification data must not be overlooked.

For those who may need a light weight starter, they can be ordered through any Lycoming distributor. The 12V model with 12/14 pitch may be identified by use of this part number — 31A21198. The 24V model with the same pinion gear pitch has this part number — 31B21064. Part numbers for light weight starters with 10/12 pitch pinion gears will be assigned when these models are available.

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LYCOMING "FLYER"

December 1989

ISSUE NO. 49

Editor .... K. W. Johnson

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Have You Moved?

If so, please send your old and new address.

EXHAUST SYSTEM MAINTENANCE PAY NOW OR PAY LATER

It is unfortunate that the exhaust systems attached to aircraft engines are one of the most overlooked and ignored parts of the aircraft. Almost all aircraft with normally aspirated engines have an exhaust system supplied by the airframe manufacturer. Engines which are turbocharged by Lycoming will also have most of the exhaust system supplied by Lycoming.

Lycoming technical representatives get many calls about exhaust system problems. It makes no difference who supplied the system. There are several areas where discrepancies may occur — loose baffles in the muffler, exhaust leaks at the exhaust flange gasket, and slipjoints which do not slip. Exhaust gas leakage at the exhaust flange gasket will cause erosion of the aluminum cylinder head material, and a frozen slipjoint will cause cracks in the exhaust pipe system. Loose baffles in the muffler may result in a loss of power. These problems can be minimized by regular exhaust system maintenance at each periodic inspection.

The muffler should be checked carefully each time the exhaust system is inspected or anytime a loss of power is evident. Baffles which have come loose tend to lodge at various places inside the muffler. When the exhaust outlet is blocked, a power loss will occur due to the excessive back pressure created in the exhaust system. Attempting to look into the muffler may reveal baffling which is loose, but usually this is not something that can be determined visually. A sharp bump on the muffler with the palm of the hand while listening for any rattling sound may produce better results than looking. If loose baffling is found, the muffler should be replaced with a new or overhauled unit before the next flight.

Another important part of the exhaust system is the exhaust flange gasket. Three different types are available from Lycoming. The manufacturing standard is the copper/asbestos gasket or the beaded gasket. Where the beaded exhaust flange type gaskets are used, they must be assembled (two each per exhaust port flange) with their beads interlocking. The flat side of the gasket must face toward the cylinder head, and the raised or bead side, toward the exhaust stack. After initial installation, exhaust flange nuts should be carefully retorqued after the first 25 hours of engine operation. These standard gaskets should not be reused.

The third type of exhaust flange gasket available from Lycoming has V-shaped spiral wound layers of stainless steel and asbestos. These gaskets are available for all Lycoming engines using the 2 or 3-hole gasket design. This design provides a resilient action that automatically adjusts for mechanical compression, internal pressure variations, and temperature changes. The spiral wound exhaust flange gasket has superior sealing qualities and, unless an exhaust leak is evident, may be reused when the exhaust manifold is loosened or removed. New gaskets should always be used when the engine is overhauled.

All exhaust flange gaskets which were originally designed with asbestos as one of the basic materials are now manufactured to a new standard. Although the part number may be the same, asbestos has been replaced with an alternate material.

At each periodic inspection, the exhaust system should be checked to insure that exhaust gases are not leaking at the exhaust flange. A leak can be identified by the powdery residue which will be evident around the place where the leak is occurring. This residue may range from white to light brown in color.

A leak at the exhaust flange gasket is often caused by improper torquing. Too little torque and the connnection loosens. Too much torque and the gasket will bow slightly -- again allowing exhaust gases to leak. If left uncorrected, erosion of the aluminum cylinder head material will occur quite quickly. A loss of material amounting to only a few thousandths of an inch could be enough to make the cylinder unusable. Therefore, correcting the problem quickly is essential.

If the aluminum cylinder head material has already eroded as the result of an exhaust gas leak, repair is sometimes possible. This cannot be done by hand. Studs must be removed and the damaged surface refinished by use of a milling operation. No more than twenty thousandths of an inch may be removed. Should it be necessary to remove more than twenty thousandths of an inch to obtain a true surface, the cylinder should be replaced.

Where erosion of the cylinder head has not occurred, replacing the exhaust flange gasket with a new one will usually eliminate the leak. Insuring that the correct torque is applied during installation of the gasket is necessary to avoid future problems.

Fortunately, an exhaust leak at the exhaust flange is not a frequent occurrence. A close visual check at each periodic inspection and prompt attention to correct any defect which may be found will usually be enough to avoid the need for more expensive repairs.

Exhaust systems with slipjoints present another problem. The joints are necessary because the pipes must move. Vibration, along with heating and cooling of the system which causes expansion and contraction make it essential that the system be designed so that it has flexibility. Exhaust residue and heat may eventually cause slipjoints to seize. Because a slipjoint which has seized can be expected to cause breakage of the exhaust system pipes, regular maintenance to keep these joints free is a must. Mouse Milk or a similar lubricant should be applied to the slipjoint at regular intervals to prevent seizing of the pipes.

Maintenance of an exhaust system with slipjoints is a pay now or pay later situation. If the preventive maintenance is not accomplished, it will mean buying new parts for the exhaust system. Paying for a new exhaust system is not the worst part. A broken pipe could allow hot exhaust gases to escape into the engine compartment where there is the potential for fire which would further damage the aircraft and present a serious hazard for pilot and passengers.

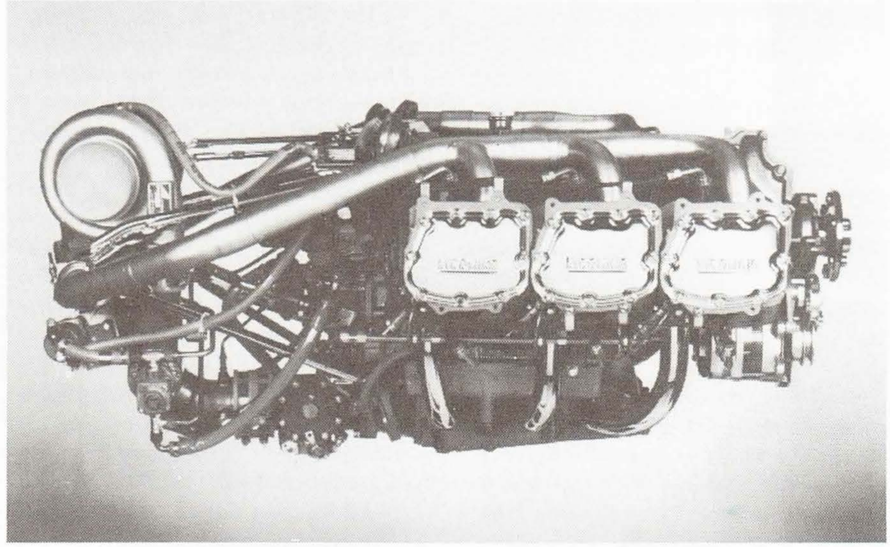
Maintenance on this type of exhaust system requires that it be taken apart if the slipjoint will not move. Should a slipjoint be frozen, Mouse Milk or a good penetrating oil should be used to free it up. Then each joint must be cleaned of all exhaust residue and thoroughly examined to insure that there are no cracks or damage that would prevent free movement. Before reassembling the exhaust system, the slipjoint surfaces should be coated with high temperature lubricant such as Fel-Pro C5A or equivalent.

Exhaust system maintenance probably should not be considered as complete unless it has included a review of airframe and engine manufacturer bulletins which may apply. From time to time product improvements are made available. A prior review of service bulletins would allow these to be incorporated when the regular periodic maintenance is being done.

The point of this entire discussion is to point out the need for regular inspections and preventive exhaust system maintenance. Prevention is always less expensive and less hazardous than waiting for serious problems to occur.

* * *

THE "SAME ENGINE" MYTH



TEXTRON LYCOMING TIO-540-J2BD

The Mooney TLS engine pictured on the next page is NOT a derated version of the the Navajo series engine pictured above. "The 'SAME ENGINE' Myth" article on these pages has more details. (The pictures are not the same scale)

Questions which frequently are asked of Lycoming sales personnel, engineers and technical representatives indicate that there is a myth regarding Lycoming piston engines. This myth seems to be prevalent among aircraft owners and aviation writers. In the minds of these individuals, each Lycoming engine series is essentially the same. For example, all 360 cubic inch displacement engines are inherently the same except for differences in fuel metering or turbocharging. The idea that these engines are the same is false. A few specific examples may help to put this myth to rest.

Lycoming builds O-320 engines which produce 150HP or 160HP. The 150 HP O-320-E series engines operate at a compression ratio of 7.0:1. The O-320-D series has high compression pistons which raise the compression ratio to 8.5:1 and increase rated output to 160HP. Those who believe that the pistons are the only difference in these engines will be disappointed when they plan to upgrade their O-320-E to the higher horsepower by simply changing pistons. Many models in the O-320-E series were designed for the purpose of keeping the cost down. Thousands of these low compression engines were built with plain steel cylinder barrels instead of the nitrided barrels used in the O-320-D series engines. They also had two narrow bearings instead of one long front main bearing. The engines were certified at 150HP and were not intended to withstand the additional stress of higher horsepower.

Because of the similarity in designation, it would be easy to believe that the O-360-A1A and the IO-360-A1A are the same engine except that the first engine has a carburetor and the second a fuel injection system. Here are some features of each engine for comparison. The O-360-A1A has a bottom mounted updraft carburetor, parallel valves, 8.5:1 compression ratio, and produces 180HP. The IO-360-A1A features a horizontal front mounted fuel injector, angle valves, 8.7:1 compression ratio, and is rated at 200HP. The IO-360-A1A also incorporates these design items which are not included in the O-360: piston cooling nozzles, stronger crankshaft, tongue and groove connecting rods with stretch bolts, tuned intake system, and rotator type intake valves. There are actually few similarities except for the 360 cubic inch displacement.

There are individuals who have suggested that by putting 10.0:1 compression ratio pistons in an IO-360 engine, it could be the same as the HIO-360-D1A. These are some characteristics of the HIO-360-D1A helicopter engine which can be compared with the data on the IO-360 listed in the previous paragraph. To start, the HIO has conical rather than dynafocal mounts. The main bearing is a thick wall bearing instead of the thin wall, high crush bearing used in the IO-360. Other differences include: crankshaft designed for small crankpins, high speed camshaft, rear mounted RSA7AA1 fuel injector, large intake valves, and torsional vibration damper magneto drives.

Finally, both the Navajo engines and the new turbocharged Lycoming used in the Mooney TLS are equipped with differential and density controllers which automatically set the maximum allowable horsepower when the throttle is advanced fully for takeoff. Some who have not taken the time to compare these engines have jumped to the conclusion that the TIO-540-AF1A which powers the Mooney TLS is simply a derated Navajo engine. This conclusion could hardly be more inaccurate. The most obvious difference, even to the complete novice, can be seen by looking at the rocker box covers. The TIO-540-AF1A is rated at 270HP and has parallel valve down exhaust cylinders. The Navajo series had three engines at 310HP, 325HP, and 350HP. All have cylinders designed with up exhaust and angle valves. Other differences respectively in the 270HP AF1A and the Navajo series engines are: small main bearing instead of large main bearing, 8.0:1 compression ratio rather than 7.3:1, intercooled and non-intercooled, pressurized Slick magnetos versus Bendix/TCM magnetos, and an RSA5AD1 fuel injector in place of the RSA10AD1 injector. There are some other differences, but those comparisons listed should convince even the most skeptical that these engines are vastly different.

By making comparisons of various parts and accessories used in engine models which some individuals have considered to be much the same, it is possible to illustrate the differences. Although some Lycoming models are closely related, this cannot be assumed. A review of the engineering parts list for each engine model by a knowledgeable individual is the only sure way of establishing similarities and differences. For those who may have been taken in by the myth that all Lycoming engines of a particular displacemeent are very much the same, you are now armed with a better knowledge of this subject.

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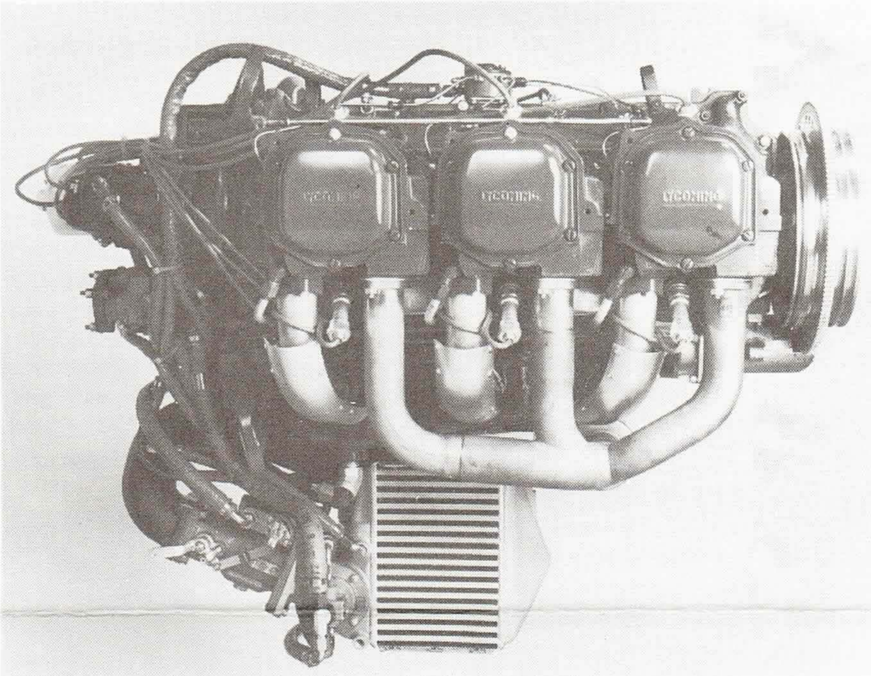

TEXTRON LYCOMING TIO-540-AF1A

MAGNETOS NEED TLC

It would seem to be self-evident that magnetos are a critical element in the reliable and efficient operation of the reciprocating aircraft engine. A review of the Textron Lycoming Index for service bulletins, instructions, and letters reveals that both the magneto and engine manufacturer have printed numerous recommendations for the maintenance and inspection of magnetos.

As an example, Textron Lycoming Service Bulletin 183A was written in 1957 — more than 30 years ago — and is still an active publication. This bulletin states that faulty engine performance, burnt pistons and engine failures were traced to improperly timed ignition and inadequate ignition inspection. Some maintenance personnel have inspected ignition timing without using a timing light to indicate breaker point opening. This is an error in technique since a timing light is necessary to achieve required accuracy.

Maintenance items for special attention is the subject of Textron Lycoming Service Instruction 1080A which is dated January, 1978. This instruction warns that inefficient engine operation, roughness, loss of power, and detonation developing into pre-ignition could all be the result of lack of magneto maintenance. These maintenance actions are recommended: (a) check condition of magneto breaker points, (b) check for excessive oil in breaker compartment and wipe dry with a clean cloth if necessary, (c) lubricate felt located at the breaker points and at the distributor gear bearing, an (d) time magnetos in accordance with instructions in the operator's manual.

The magneto manufacturers also make recommendations for inspection and maintenance of their products. The latest revision of Slick Service Bulletin 2-80 says that 4200 and 6200 series magnetos now being produced should be inspected externally every 100 hours and internally every 500 hours. The 500 hour inspection would include such items as contact points, carbon brush, impulse coupling and other components subject to wear. Based on the inspection, these components should be replaced as necessary. Magneto rotor shaft bearings must be replaced every 1000 hours.

These standard maintenance schedules are supplemented by a series of service bulletins from the magneto manufacturer. Bulletins usually require inspections or hardware changes in addition to the routine maintenance items mentioned earlier.

To summarize, magneto inspection and maintenance should be a part of every regularly scheduled inspection. To insure engine reliability, this maintenance must be conscientiously accomplished. Perhaps the best advice for the powerplant mechanic is to research and follow the manufacturers' instructions at every periodic inspection.

★ ★ ★

ENGINE ACCESSORY TBO

Do engine accessories have a specified TBO? This question has been asked by Flyer readers on several occasions. Except for early throw-away versions of Slick magnetos (4000 and 4100 series) which were produced during the 1970s, accessories are not assigned a specific number of hours which they are expected to operate.

May we assume then, that the TBO for accessories is the same as the engine on which they are used? For many accessories this is not a bad assumption. An Air Research Industrial Division Service Letter states that turbochargers, controllers, wastegate valves, and pressure relief valves manufactured by AirResearch should be overhauled when their service time reaches the TBO of the engine. A communication from the Romec Division of Lear Siegler also indicates that Romec fuel pump overhaul should coincide with overhaul of the engine on which it is used. According to manufacturer documents, fuel system products such as injectors and flow dividers from Bendix, and Marvel-Schebler or Facet carburetors are to be overhauled at the time of engine overhaul. In the case of the carburetors, Facet does state that service may be required prior to the engine TBO.

Magnetos are a particularly critical accessory. Bendix Engine Products bulletin SB586A recommends magneto overhaul at the time of engine overhaul. This statement is qualified by stating that magneto overhaul is recommended at four-year intervals regardless of the time accumulated on the engine.

Unison Industries, the manufacturer of Slick magnetos, requires that the current 4200/6200 series magnetos be inspected externally every 100 hours and internally every 500 hours. Should the inspections find discrepancies which require it, the magnetos are to be completely overhauled. In any case, total time in service may not exceed the manufacturer's TBO for the engine on which the magneto is installed.

The manufacturers of other accessories such as propellers, governors, ignition harness, starters, and alternators may have specified TBOs for their products, but no written documentation regarding these items was available when this article was prepared. Unless there is notification from the manufacturer, it will be necessary to consider accessory overhaul as an "as needed" requirement.

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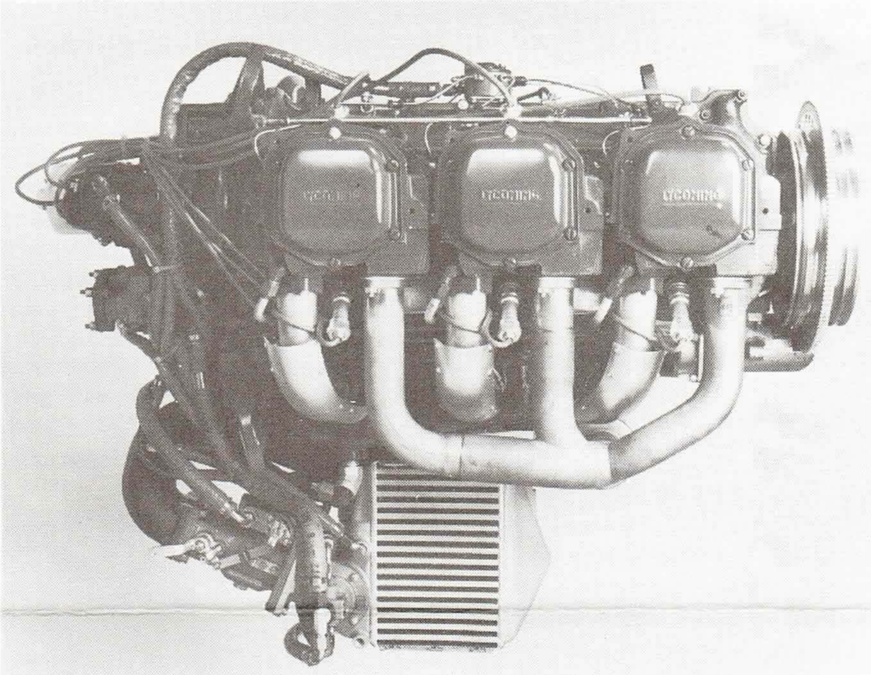

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(CONTINUED ON PAGE 8)

23MSS

ACCESSORY TBO — *Continued*

An "as needed" accessory overhaul may be the result of normal wear and tear. Exposure to unusual conditions could also bring about the need for accessory overhaul. Conditions such as lightning strike, engine overspeed, or sudden stoppage are examples of conditions which could have a very detrimental effect on engine accessories.

Should an accessory require overhaul before the engine reaches its recommended TBO, a very careful logbook record should be kept. This will provide information on which to base a decision at engine overhaul time. A new or overhauled accessory which has had only limited service on an engine which is due for overhaul would probably not be repaired at the same time as the engine.

An accessory which continues to provide satisfactory service for the life of the engine or for a long period before the engine reaches TBO should be overhauled or replaced at the same time the engine is overhauled. Not only will this be more convenient and less expensive over the long term, it will usually assure a relatively long period of maintenance-free operation with the newly overhauled engine.

From this discussion it becomes clear that TBO is not a well defined period for most engine accessories. Overhaul will usually be accomplished on an "as needed" basis and it is not unusual for this need to occur prior to the requirement for an engine overhaul. Unless an accessory has only a very brief period of operation before the engine is overhauled, overhauling the accessory at the time of engine overhaul is a reasonable course of action.

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MOBIL AV 1 OIL APPROVED FOR USE IN LYCOMING AIRCRAFT ENGINES

Textron Lycoming Service Instruction No. 1014 states that the company which produces a lubricating oil is responsible for insuring that the oil conforms to MIL-L-22851. The results of extensive testing done by MOBIL were presented to Lycoming engineers for evaluation. The tests indicated that Mobil AV 1, a fully synthetic oil, exceeded the requirements of MIL-L-22851. Based on the testing by MOBIL and evaluation of the results by Lycoming, Mobil AV 1 Oil is approved by Lycoming for use in Lycoming aircraft engines.

Although this fully synthetic oil received Lycoming approval in December, 1989, compliance with Lycoming service publications is required, and may qualify certain aspects of the approval. For example, service instructions 1014 and 1392 set specific temperatures below which the engine should be preheated, regardless of the type of oil used. Service bulletin 480 recommends oil and filter replacement at 50 hour intervals. Engines which do not have filters should have the pressure screen cleaned at 25 hour intervals and oil changed at the same time. In any case, a maximum of four months between oil changes should not be exceeded.

No matter what oil is used, Lycoming considers compliance with all service publications dealing with lubricating oils to be important in achieving long engine life. In particular, the oil change intervals specified in Lycoming Service Bulletin 480 are necessary to avoid a build up of contaminants which result from combustion.

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LIGHTWEIGHT STARTER — *Continued*

starters will be available early in 1990.

Individuals building an aircraft may find it convenient to plan for use of the light weight starter when calculating weight and balance. Although these new starters are capable of directly replacing the mounting and starting capability of the standard starter now in use on many certified aircraft which are Lycoming powered, this may not be done without careful consideration of the effect on aircraft weight and balance. Because of the weight difference, weight and balance must be recalculated and proper FAA approval obtained. After recalculating weight and balance, the filing of Form 337 with the FAA may be adequate for approval, but this change in certification data must not be overlooked.

For those who may need a light weight starter, they can be ordered through any Lycoming distributor. The 12V model with 12/14 pitch may be identified by use of this part number — 31A21198. The 24V model with the same pinion gear pitch has this part number — 31B21064. Part numbers for light weight starters with 10/12 pitch pinion gears will be assigned when these models are available.

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Editor .... K. W. Johnson

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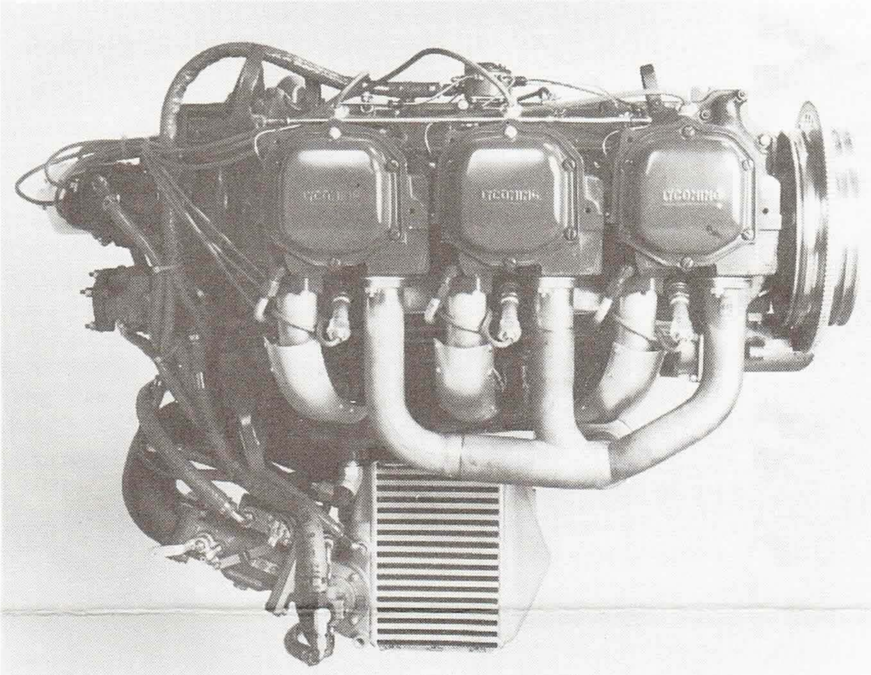

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(CONTINUED ON PAGE 8)

ENGINE OVERBOOST

Many Lycoming turbocharged engines are equipped with density controllers. These engines are used in aircraft such as the Piper Aztec, Piper Navajo series, the Lake Renegade, the Aerospatiale Trinidad TC, and the Mooney TLS.

The purpose of the density controller is to aid the pilot. When the throttle is fully advanced, the controller should assume responsibility for obtaining rated horsepower from the engine. Note two very important items: (1) Should assume responsibility is based on the controller being adjusted as described in the latest revision of Textron Lycoming Service Instruction 1187 and, (2) Rated horsepower does not mean a specific manifold pressure.

It is unfortunate that pilots who fly these aircraft do not always understand what the density controller is designed to do. This may also apply to some A & P technicians. Let's take an example. Cold weather has just arrived with fury and Mr. Pilot goes out to fly. On takeoff he notes that the manifold pressure is two or three inches below the red line manifold pressure on the gage. Back on the ground he tells his favorite A & P that he is not getting enough manifold pressure at takeoff. When the A & P finds nothing wrong with the engine, he adjusts the controller so that the needle on the manifold pressure gage goes to red line when the throttle is fully advanced. Both of these individuals are in error, and each time the throttle is fully advanced, the engine is being overboosted. the engine is being forced to produce more power than its type certificate allows.

Generally speaking, overboost is bad for the engine. It may cause exhaust system leaks. Internal engine damage from preignition or the excessive loads put on internal engine parts may also occur. But, you say, as a pilot I will take my chances with a controller which causes the engine to produce more power than it is rated for. It may come in handy if an engine should fail and I am faced with a single engine situation on the twin I fly. Keep in mind that aircraft performance is only assured when all parameters are the same as when the aircraft was test flown for certification. The available rudder may not be adequate to handle additional power on one engine. That extra power with too little rudder might be enough to cause the aircraft to roll inverted. Too much power may be just as bad as too little.

(CONTINUED ON PAGE 7)

SERVICE BULLETINS, LETTERS, INSTRUCTIONS PUBLISHED FROM JUNE 30, 1989 TO NOVEMBER 30, 1989

The service publications listed below are those which have been issued most recently. We strongly recommend that a complete set of these publications be maintained by all maintenance organizations which work on Lycoming reciprocating aircraft engines. A subscription may be obtained through any Textron Lycoming distributor or directly from the Textron Lycoming Williamsport Product Support Department. Call or write for a copy of Textron Lycoming Service Letter No. L114 which provides a listing of available publications, prices, and ordering instructions.

SERVICE BULLETINS

486	Inspection of SINGLE BELT Driven Ring Gear Support Assemblies — All new, remanufactured and overhauled engines shipped from Textron Lycoming from January 1, 1988 until June 12, 1989.
487	Fuel pump vent restriction — TI0-540-AE2A engines with serial numbers up to and including L9064-61A.
488	Propeller governor line support — All four cylinder engines with rear mounted governor.
490A	Installation of intake and exhaust valve guides — TI0/LTI0-540-V2AD, -W2A engine.

SERVICE INSTRUCTIONS

1187G	Turbocharger density controller adjustment — TI0-540-A1A, -A1B, -A2A, -A2B, -A2C, -C1A, -F2BD, -J2B, -J2BD, -N2BD, -AA1AD, -AB1AD, -AF1A; LTI0-540-F2BD, -J2B, -J2BD, -N2BD
1445	Precision Airmotive Service Bulletin No. PRS-91 — Textron Lycoming HI0-360-D1A engines.
1446	Possible ruptured pressure regulator diaphragm in AN fuel pump. — All Textron Lycoming engines equipped with AN type fuel pumps.

SERVICE LETTERS

114AC	Reciprocating engine and accessory maintenance publications.
214A	Discontinuance of reconditioned camshaft exchange program.
227	Listing of parts catalogs and applicable revisions or special service publications.

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THE UNFORTUNATE CHOICE — *Continued*

plane being built because of interference. As if this were not enough to be concerned about, the carburetor or fuel injector location must also be considered. These fuel metering devices are frequently mounted under the engine in an up-draft configuration, but there are also front and rear mounted configurations. Some engine models are equipped with horizontal carburetors. All of these variations in model may have an effect on engine/airframe fit.

Another error in choice which occurs all too frequently is the purchase of an engine originally designed for a high wing aircraft when the builder has a low wing design under construction. The low wing needs a fuel pump, but the high wing usually delivers fuel to the carburetor by gravity. In most cases a fuel pump cannot be added to the engine because the drive mechanism was not built in during engine manufacture and the accessory housing was not machined to allow mounting of a fuel pump.

As a result of contacts with individuals who have made engine purchases for their aircraft, we know that the variations in engine configuration outlined in this article have resulted in problems. The purpose of bringing these issues to the attention of *Flyer* readers is to help them avoid making the same mistakes others have made. If a particular engine model has been recommended by a kit manufacturer, it is best to search out that model. Although similar, other engine models may not meet your needs. When buying a used engine in the open market, do not make an unfortunate choice — get it right the first time.

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TEXTRON LYCOMING RECIPROCATING ENGINE TROUBLESHOOTING SCHOOL

Textron Lycoming Williamsport offers a four-day, Monday through Thursday, troubleshooting course for aircraft mechanics. Emphasis is on the diagnosis and correction of problems in various piston engine parts or accessories such as turbocharger systems, magnetos and fuel injectors. A tour of the Williamsport Plant is included.

The course is offered at no charge, but each individual attending will be responsible for travel, meals and lodging. Transportation between local motels and the school will be provided if required.

Although the schedule for 1990 is not complete as this notice is written, classes are normally scheduled about twice each month. For further information on specific class dates and to reserve a space in a future class, contact:

Don Stahl
Instructor/Training Center
Textron Lycoming Williamsport
652 Oliver Street
Williamsport, PA 17701

Phone: (717) 327-7338/7308

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ENGINE OVERBOOST — *Continued*

Back to the density controller. What should the pilot expect and how should the controller be set? The A & P mechanic must have the tools specified in the latest revision of service instruction 1187, and must follow the procedures outlined. The engine must be at normal operating temperature. Induction air temperature is then checked against manifold pressure utilizing the curves in the service instruction. The controller should only be adjusted if this is necessary to bring the manifold pressure within the limits shown on the curve.

When the controller is set properly, the pilot should not expect the manifold pressure needle to settle on the manifold pressure limit marked on the gage. Air temperature is a major factor in the amount of power produced. Since the density controller is sensing temperature, as well as pressure, it will demand more manifold pressure in hot weather and less in cold weather. In either case, an equivalent amount of power will be produced.

For the pilot, expect lower than red line manifold pressure readings for all takeoffs. Once it is set correctly, the density controller will insure that you get rated engine power for take off.

Once the function of the density controller is understood, it truly is an aid to the pilot. In addition to supplying rated power, it goes one step further. It will also prevent engine overboost.

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The Flyer provides *product information. Informed* pilots and mechanics contribute to *safe flying.*

CYLINDER BARREL SURFACES — *Continued*

2. Natural choked barrels providing improved piston ring life due to a resulting straight cylinder wall when engine is hot or operating, and a better job of sealing.
3. Nitriding permits use of chrome plated piston rings which are more wear resistent and quite compatible with hardened steel.
4. Nitriding provides a hardened surface with an increased fatigue strength.
5. Nitrided barrels also have the ability to resist softening when heated during engine operation.

The main advantage of chrome over nitriding comes into play when used cylinders are to be overhauled. Worn cylinder barrels which are out of service limits can be coated with enough chrome to bring them back to their original specification. The problem with this is that the up-to-specification cylinder barrel will be matched with a used cylinder head. The steel barrel with its chrome coat may now be ready to perform through another full TBO, but it is very unlikely that the cylinder head will survive for that period of time.

Typically, cylinder barrels which are worn beyond service limits have worked through more than one TBO. The aluminum head which is the other major component of the cylinder will also have been in use for this period. Running at 2400 RPM, that head is exposed to 72,000 firing impulses every hour. Over a period of 2000 hours, this is over 140 million impulses or quick thermal changes. The aging process is also affected by the continuous heating and cooling each time the engine is started and shut down. Assuming average flight lengths of two hours, this is 1000 thermal cycles during the life of a 2000 hour TBO engine. The longer an engine runs, the more susceptible the cylinder head is to cracking. Cylinder heads which are cracked are often repaired by welding, a process which Lycoming has found to be of limited value. While the overhauled cylinder may look good, and the chrome barrel may provide an excellent wearing surface, the unknown quality of the overhauled cylinder head is typically the weakest structural part of the cylinder. This could be the place where cylinder problems occur before the engine has again reached TBO. In this case, the quality of the cylinder barrel coating is of little consequence.

Lycoming has adopted a policy of shipping all engines from the factory (new, remanufactured, and overhauled) with brand new cylinders. By doing this, the factory engine has the best cylinder quality it is possible to provide.

Lycoming cylinder kits are available through all distributors. Each kit contains a brand new cylinder assembly and all the parts needed to assemble the cylinder on the engine. Currently selling at reduced prices, these high quality genuine Lycoming cylinder kits are an exceptional value, and at the same time eliminate all the questions relative to the value of chrome plating and reworking of cylinders.

To summarize, the improved hardness of cylinder barrel surfaces is an important factor in the increase in recommended engine TBO. For Lycoming, the nitriding process has many advantages. These include manufacturing efficiency and consistent quality. Although this article has focused primarily on methods of obtaining cylinder barrel hardness for good wear characteristics, it is the entire cylinder which must be considered when making a decision about the cylinders to be used for engine overhaul or for replacement of a single cylinder for any reason.

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DID YOU KNOW?

The diaphragm style fuel pumps used on many Lycoming engines are generally known as AC fuel pumps. Since they have been used on Lycoming engines, they have both an AC part number and a Lycoming part number. Today, these pumps are a product of Textron Lycoming. They still carry an AC and a Lycoming part number. The AC number is retained for reference purposes, but the Lycoming number should be used when a pump is to be ordered from Lycoming.

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