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**Service Bulletin:  
GEN-III Propeller Gearbox Upgrade**

***THIS UPGRADE IS MANDATORY***



GEN-1

GEN-II

GEN-III

May 2007 – Initial Draft  
Jan 2008 – General Review Input  
Jan 25th 2008 – Merged procedures into a single document  
Jan 26<sup>th</sup> 2008 – Added prop bolt spec and fixed flywheel torque value

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## Upgrade Policy

1. This document is the only official source of gearbox upgrade information. Any prior revision of this document or other source of information pertaining to gearbox upgrades is considered obsolete.
2. It is the official policy of Eggenfellner Aircraft Inc. to upgrade, rather than to service, older revisions of gearboxes. This assures that our customers are flying with the latest and most reliable gearbox available at the time.
3. We make no claims as to the expected lifecycle of any gearbox and we reserve the right to continually improve our products, therefore we cannot guarantee that there will be no further revisions of this critical component.
4. The cost of the upgrade parts, labor and shipping will be paid by the customer. The exact price of the upgrade is subject to change without notice and is dependent on the extent of upgrade required by the individual gearbox. Not all upgrades require gearbox replacement.
5. At any time, we reserve the right to declare an upgrade mandatory if, at our sole discretion, we determine that the latest available gearbox is significantly improved and would result in a safer product. Maximizing customer safety is our top priority. Customers choosing to ignore a mandatory upgrade do so at their own risk and in doing so, waiver all rights to claim damages resulting from their own failure to comply.
6. The factory provides a service to perform upgrades at our facility if desired. When taking advantage of this service, we charge a fair shop labor rate in addition to the parts required by the upgrade. Ask ahead of time for an estimate of the labor cost. Factory service must be scheduled well in advance.
7. YOUR EXISTING GEARBOX AND SPLINE DRIVE MUST BE RETURNED TO THE FACTORY PRIOR TO RECEIVING UPGRADE PARTS OR SERVICE. WE CANNOT ALLOW EXCEPTIONS TO THIS POLICY. WE DO NOT ALLOW CUSTOMERS TO RETAIN OLDER REVISIONS OF GEARBOXES OR TO PURCHASE MULTIPLE GEARBOXES. UPGRADE PRICES ALREADY REFLECT THIS POLICY.

## Document Overview

Please consider the fact that, over the last 16+ years, Eggenfellner Aircraft Inc. has built hundreds of different powerplants using a large number of engine models. There have been a number of specialized adaptations for fixed wing and rotor aircraft. There have been a variety of engine mounting plates. There have been four different flywheels. There have been three generations of gearboxes and a few oddballs. There have been six different propellers.

*ALL* of these variations are compatible with the GEN-III gearbox, however, when you consider the sheer number of variations, you would be correct to conclude that it is very difficult to document every conceivable combination and very difficult for us to “know in advance” every detail of each bolt, bracket and bushing that is needed to fit “your” installation! You’ll have to take an active role to let us know exactly what is needed. The more we know up-front, the more accurate your upgrade kit will be when shipped and the fewer items you’ll have to get back to us for.

While the basic gearbox is compatible with our powerplants, you may require various adapters to fit the gearbox to your flywheel and you may require special bushings and brackets to adapt the gearbox to your propeller. Keep in mind that we do not manufacture propellers! There is simply no way for us to guarantee backwards compatibility with several other vendors’ product lines!

Our original attempt to document the gearbox upgrade procedure was to create a separate document for each prior generation of gearbox and adapter. Unfortunately, this resulted in some redundancy and confusion as to which documents were needed. We have concluded that a single document, covering all variations would be the lesser of evils. Thus, this document is much larger, but as you navigate through the procedure, you need only pay attention to the sections that apply to the powerplant in front of you. There are plenty of photos to help you along the way.

While the process may seem overwhelming at first glance, we at the factory, routinely perform upgrades on customers’ aircraft in approximately two hours time. *It is far less difficult to perform than it is to describe.*

If you prefer to leave this type of work to the experts, please consider scheduling time at the factory for us to perform your upgrade. You can fly in, haul your engine in, or ship it to us. We charge only a modest and reasonable shop labor rate for our work.

## Upgrade Overview

***THIS IS A MANDATORY UPGRADE AS OF JANUARY 2008.***

All powerplant models built prior to 2007 require this upgrade.

The upgrade involves:

1. Removal and return of your existing gearbox.
2. Modifying the engine-mounting plate (cutting two bolts and in some cases, grinding away some aluminum plate).
3. Installation of a gearbox adapter, depending on your flywheel.
4. Installation of the new gearbox.
5. Adding or adjusting some cooling air ducts in your cowl inlet.
6. Reattaching your propeller brush block, if so equipped.
7. Balancing the propeller.

We estimate that the complete upgrade procedure will require approximately 4 hours of your time, 1 hour for removal, 1 hour for modifying the mounting plate and 2 hours for replacement. The procedure can be done by one person; however it would be wise to have a second person available for some of the heavy lifting.

### Rationale

In the pioneering field of “experimental” aviation and particularly in today’s legal climate, the few small companies still willing to conduct business to supply major components are faced with many tough decisions. But when a product design evolves to a point where it yields a significant improvement in reliability and safety, the decision to phase the product in slowly, versus declaring it a mandatory upgrade is simple. We must always favor safety, for the sake of our customers and for the security of our own business.

There are hundreds of our prior generation gearboxes in the field today. The majority of these units are exhibiting no problems at all, but a small number of them have developed indications of bearing wear and a much smaller number have suffered actual bearing related failures. This is not unexpected for such a highly stressed component as a gearbox. Consider how many transmission shops exist in every city. No gearbox failures have resulted in injury.

Ongoing analysis of product performance and a desire to support ever increasing power levels led to the development of the latest generation of gearbox. It was our initial intention to phase in the new gearbox through attrition. As older models were in need of service, we would replace them with the new generation rather than repair the old one.

After careful study of the policy, we determined that it best serves the interest of our customers and our business to bring all powerplants up to date proactively rather than reactively. The cost of the upgrade is minor when considering the high quality of the new gearbox and the increase in safety. You would spend more on a 'routine' cylinder job with any 'conventional' engine! Along with greater reliability, you'll be enjoying a nice performance boost.

## Identifying Your Gearbox

On the cover page of this document, you will find a photograph of our three generations of gearboxes. Use this photo to identify which gearbox you own.

**GEN-I** gearboxes have a SILVER natural aluminum gearbox front cover. Some of these gearbox cast housings were painted gold. All powerplants with these gearboxes also have a solid flywheel unless a specific flywheel upgrade was performed. Solid flywheels require a special adapter disk to upgrade to the GEN-III gearbox.

**GEN-II** gearboxes can be identified by their BLUE anodized front covers. Most powerplants with these gearboxes also have a solid flywheel unless a specific flywheel upgrade was performed. A small number of these powerplants were shipped with the "dual-mass/vibration-dampening" flywheel. Solid flywheels require a special adapter disk to upgrade to the GEN-III gearbox. Dual-mass flywheels do not require this adapter disk.

**GEN-III** gearboxes are fully RED anodized. All powerplants starting with 2007 are shipped with these gearboxes. A minor revision level is stamped into the base plate between the starter motor and gear housing. As of this writing, minor revision 4 is the latest. Contact the factory to determine whether it is important to upgrade a minor revision level. All 2007 and later powerplants were shipped with the dual-mass/vibration-dampening flywheel.

Once you remove your existing gearbox, you will need to identify which type of flywheel you have, in order to determine if an adapter disk or shim will be required. You will also need to determine what needs to be modified on your particular engine mounting plate. Finally, you will need to determine which type of propeller you have in order to obtain the necessary bolts, bushings and brackets required to reinstall your propeller.

## Gearbox Alignment Decision

It is imperative that the input drive shaft from your engine be perfectly aligned with the gearbox input shaft socket. Even a tiny misalignment will result in undesirable side-loads on the input shaft bearings and ultimately premature seal and bearing wear.

If your powerplant has never been altered after leaving our factory, then it is very unlikely that any misalignment will exist. If you have our latest gold colored engine mounting plate, then a misalignment is no longer possible.

If you have earlier engine mounting plates (bare aluminum or black) and have performed any maintenance or upgrades that have involved loosening of the bolts connecting the engine bell-housing to the engine mounting plate, then you **MUST** perform an alignment procedure prior to installing your gearbox. Earlier GEN-1 to GEN-II upgrades were often performed by the customer. In these cases, we have discovered evidence of misalignment resulting in seal failures.

A factory alignment tool and alignment kit will be loaned to you free of charge should your installation require it. The alignment procedure is simple. If the tool slips into place with no problem, no alignment is required. If the tool does not slip into place, the bell-housing bolts must be loosened to allow the engine to shift into position before tightening the bolts again. Some dowel pins are provided in the alignment kit to lock the engine into alignment.

*There is no acceptable excuse for skipping the alignment procedure* if your gearbox does not slip fully and easily into position! If you find a hammer in your hand, STOP, and perform the alignment. No hammers are required.

You can read more about the alignment procedure in the Service Bulletin titled: **“Propeller Gearbox Alignment Procedure”** posted on our website.

## Required Tools & Consumables

- ▶ Wheel chocks.
- ▶ Saw horse or similar object to support aircraft tail.
- ▶ SAE socket set, ratchet, swivels and extensions (3/8” and 9/16” sockets).
- ▶ SAE open-end or combination wrench set (3/8” and 9/16” wrenches).
- ▶ 17mm metric socket and impact gun or breaker bar.
- ▶ Torque wrench (capable of reading 600 inch-pounds (50 ft-lbs).
- ▶ Two long flat-blade screwdrivers or pry bars.
- ▶ (May be required) Electric Drill and drum sanding bit.
- ▶ Die Grinder and cutoff wheel
- ▶ Suitable place to rest propeller. We use a plastic trash barrel.

## CONSUMABLES

- ▶ We recommend a fresh set of propeller lock-nuts.
- ▶ Tube of Blue LocTite.
- ▶ Small amount (a dab) of high temp anti-seize compound.
- ▶ 16oz Mobil-1 Synthetic Gear Oil, 75w90 (Light Truck & SUV type)
- ▶ Large Ziploc bag or small box to hold parts.
- ▶ Rags or paper towels.
- ▶ Spray cleaning solution or equivalent.
- ▶ Snacks and beverage of choice.

## GEARBOX REMOVAL

1 – Position the aircraft on a flat, solid surface with plenty of room around the engine.

2 – Set your parking brake if so equipped and chock both main wheels

3 – Support the tail of the aircraft with a sawhorse or similar arrangement. The aircraft will become tail-heavy once the gearbox, and propeller are removed and the engine is separated from the forward mount. We do not want the tail to suddenly drop.

4 – Remove your upper and lower engine cowling.

5 – **Disconnect your battery cable/s to remove all power from the aircraft.** If your cables remain near the battery posts, wrap the lugs with electrical tape to avoid accidental contact.

6 – Remove your electric propeller brush assembly components (if any) that are attached to the gearbox and set them aside.

**NOTE:** If you are only having minor service (such as a seal replacement) to your existing gearbox and will be reinstalling the same gearbox, draw a mark across both prop flange and gearbox flange to assure proper indexing when reinstalling the prop. This way you may avoid having to rebalance the prop. If you are swapping gearboxes, you have no choice but to rebalance the prop when done.

7 – Remove your propeller and store in a safe manner. We set them nose-down over a plastic trash barrel. It may not be necessary to remove your spinner as long as you have access to the prop flange bolts.



8 – Drain the gearbox oil and dispose of it properly (never reuse gear oil). If you prefer, you can drain the gearbox after removal. After draining, plug all open holes.

9 – Disconnect your gearbox temperature probe wire and vent tubes. The temperature probe will be reinstalled; the external vent tubes can be discarded.

**NOTE:** Remove and retain any special probes, brackets, or fittings you may have on your existing gearbox.

10 – If your engine is equipped with a forward-mounted ignition coil, unbolt the coil and pull it aside if necessary to gain access to the gearbox housing bolts.

11 – Inspect the area between your starter motor and gearbox housing to see if the starter will prevent you from removing the gearbox. If so, use a 9/16” wrench to loosen the starter nuts. Some installations have starter bolts with 7/16” nuts on the backside of the engine mounting plate. You may not need to fully remove them. If you decide to remove them, just before the nut comes off the bolt, grip the nut with a pair of pliers to prevent it from falling into the bell-housing.

12 - Note the location of any aluminum starter motor spacers and washers. If you are upgrading an engine prior to model year 2007, retain these spacers as they are critical for proper starter engagement. After model year 2007, a spacer-ring is built into the gearbox, so no extra hardware is required.

13 – Remove all of the nuts that secure the gearbox housing to the engine-mounting plate. Note that these are 3/8” SAE nuts, not metric. All but two of the nuts can be accessed by a socket and long extension. The remaining two will require use of a 3/8” wrench. Save these nuts.

**NOTE:** Never remove the large nut in the center of the gearbox prop flange.

**14 – For some reason, people miss this step, so I have highlighted it.**

**The long bolt on the passenger side that extends from the engine mounting plate through the gearbox front cover must be loosened. To loosen this bolt, grip it with vise-grips as shown below and remove the nut on the face of the gearbox front cover. This is the only long bolt that also secures the gearbox to the mounting plate. It passes through the engine mounting plate, so just remove the nut for now. We will cut this bolt off shortly.**



Don't overlook this bolt!

15 - Support the gearbox with at least one hand during removal so you do not damage it or the engine-mounting plate (or your foot!). There are four pry-tabs on the casting. Use a pair of large flat-blade screwdrivers or pry bars under the tabs to work the gearbox loose. You may need to tap the gearbox with a soft mallet or block of wood to jar it loose (there are two press-pins that fight tightly into the engine-mounting plate). Do not be surprised if a small amount of gearbox oil is present behind the unit. Continue to gently work around the casting while tugging forward until it slides away from the bolts and off the spline shaft. Set the gearbox aside.

16 – Wipe the area clean with rags or paper towel. Acetone helps to clean the surface.

17 – Attached to the engine flywheel is a splined female drive plate or male drive shaft. Remove this part and return it to the factory along with your old gearbox.

***NOTE THE FOLLOWING VARIATIONS:***

It is important to identify which of the three major types of flywheels you have.

All powerplants equipped with a GEN-1 and a small number of powerplants equipped with a GEN-II gearbox were shipped with a **solid flywheel** and a **male spline shaft** protruding from the flywheel.

There were also two variations of these solid flywheels, a 1-piece flywheel and a 2-piece flywheel.

Some powerplants equipped with GEN-II gearboxes were shipped with a **dual-mass/vibration-dampening flywheel** with a **female spline drive plate**.

If your gearbox uses a **male spline shaft**, wedge a scrap of wood into the gap between the top bell-housing and the flywheel to help hold the flywheel in place. Now remove the six 17mm bolts attaching the drive shaft to the flywheel. Save these bolts. The drive shaft may require a sharp downward rap with a mallet to break it loose from the flywheel. Return this part with your old gearbox.

Upgrading with a solid flywheel will require purchase of a special **solid flywheel adapter disk** and possibly a **shim** to adapt the solid flywheel to the GEN-III gearbox. This is described in later pages.



One-piece solid flywheel.

The previous photo shows the one-piece solid flywheel and male spline shaft.

The rather small hole in the engine mounting plate would make it very difficult to install the GEN-III gearbox without completely removing and machining a larger opening in the engine mounting plate, but we sell a **solid flywheel adapter disk** to replace the male spline shaft with a female spline socket as required by the new gearbox. This eliminates the need to remove the engine mounting plate.

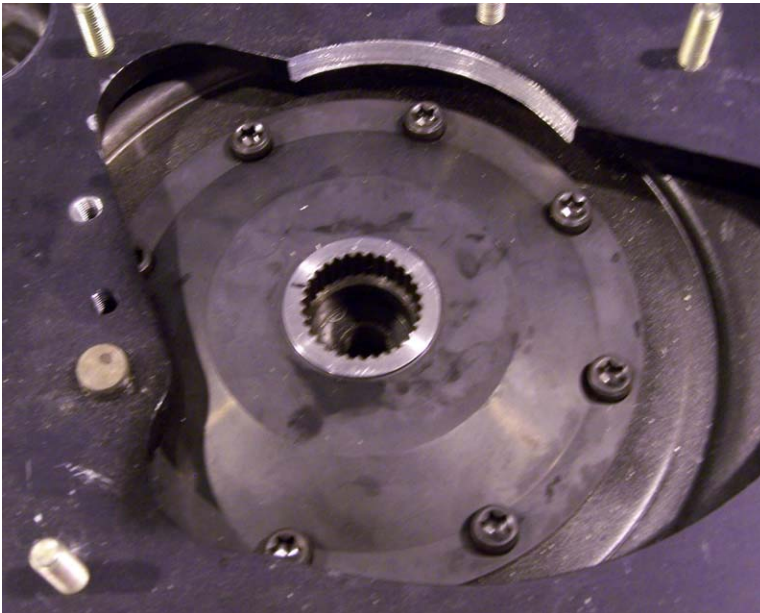


Two-piece solid flywheel.

The previous photo shows the two-piece solid flywheel after removal of the male spline shaft. Note the three cast tabs with numbers around the perimeter. Although this example of engine mounting plate has a nice large opening, it is still not possible to upgrade to the dual-mass/vibration-dampening flywheel without completely removing the engine mounting plate. Therefore, our **solid flywheel adapter disk** is used to replace the male spline shaft with a female spline socket as required by the new gearbox. The two piece solid flywheel will also require a **shim**. This will be described shortly.

If your gearbox uses a **female spline plate/disk**, remove the ring of bolts that secure the plate to the engine flywheel. These may be Allen head or Torx type bolts. Use the appropriate tool. Rotate the engine as needed to remove all of these bolts. You can rotate the engine with a screwdriver against the flywheel teeth.

The spline drive plate may appear to be 'stuck' into the flywheel. If gentle prying with a pair of flat screwdrivers around the outer perimeter does not pop the plate loose, you may try a pair of sharp pry bars for more leverage. When prying on the spline disk, wedge small blocks of wood against the opposite side of the disk to prevent it from distorting the moveable center of the flywheel. Return this part with your old gearbox. Your upgrade will require a new spline drive plate that will come with your new gearbox.



The previous photo shows a female spline drive plate (note Torx type bolts on some). These female plates are found only on the dual-mass/vibration-dampening flywheels.

It may be necessary to grind away a small arc at the top of the spline plate to facilitate easy removal and reinstallation. If this appears to be necessary, do so now. You can quickly make this small arc with a sanding drum in an electric drill, or with a die-grinder. Be sure to protect the area and clear away any metal particles when grinding. The pictures, above and below, show the location and extent of this arc.



Arc ground in plate.

The previous photo shows the dual-mass/vibration-dampening flywheel after the spline drive plate is removed. You can tell if you have one of these flywheels by rotating the prop. The dual-mass flywheels have springs inside them that take up some rotational forces.

18 – Package the gearbox and spline plate or shaft appropriately for return to the factory. Beware, shippers get very upset when packages drip oil, so make sure yours is drained, plugged, and wrapped in a plastic bag. If returning the gearbox in a cardboard box, pack it and tape it very tightly to prevent it from breaking out of the box or double-box it. A 5-gallon pail with a tight fitting lid also works well. These are available from any home builders supply store or paint store.

**Your upgraded gearbox will not be shipped until both the old gearbox and the splined drive plate/shaft are returned. We cannot allow old units to make their way into unsupported applications. We can make no exceptions!**

**Ship the Gearbox to:**

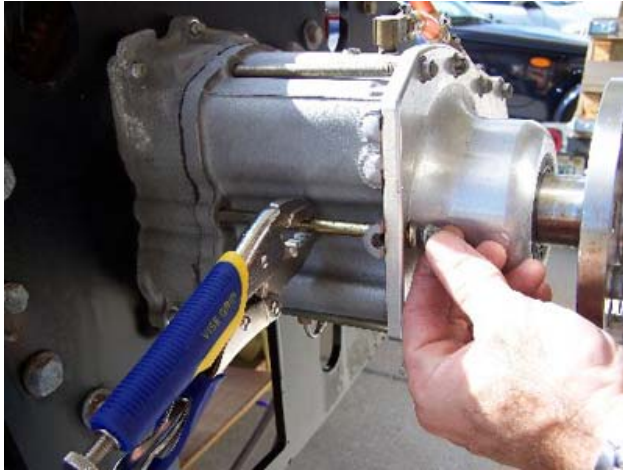
**Eggenfellner Aircraft Inc., 735 South Airpark Road, Hangar A5  
Edgewater, Florida USA 32132**

If you use a shipping service, make sure that YOUR name appears on the “from” field of the shipping label, or enclose a letter to tell us whose gearbox we just received!

## MODIFYING THE ENGINE MOUNTING PLATE

Your earlier generation gearbox may have used two bolts that are no longer required by the GEN-III Gearbox. These must be identified and removed.

1 – Look for the one long gearbox mounting bolt protruding approximately 6” from the engine mounting plate. The following photo shows where this bolt is found.



This bolt is not used by the GEN-III gearbox and must be removed.

2 - Inspect your flywheel to determine if there is enough room to remove the head of this bolt if you cut the bolt flush with the engine mounting plate.

Depending on which type of solid flywheel you have, you may be able to cut through the bolt, flush with the engine mounting plate and pop the head of the bolt out towards the flywheel. Look behind the bolt head and see if there is room to remove the bolt head and the short piece of the bolt shank that will remain after cutting the bolt.

If you have ample room, proceed with cutting the bolt flush with the engine mounting plate. We recommend using a die-grinder with a cutting wheel. This will slice through the bolt in seconds. Always wear eye protection and cover the exposed flywheel to block any metal filings. Be sure to recover and discard the bolt head!!!

If your flywheel does not provide enough room to remove the bolt head, you will need to cut a small slot in the engine mounting plate to slide the bolt out. The easiest way to cut this slot is to drill a series of small holes in the short span of engine mounting plate material between the bolt and the large opening. After weakening a path, cut, grind, or chisel away enough material to allow the bolt to

be removed. You can easily clean up any rough edges after removing the bolt. This will not weaken your new installation at all.

Below is a photo of a close-fitting bolt head and the slot required to remove the bolt.



A slot to remove long bolt.

3 – One additional mounting stud will need to be cut off prior to installing your new gearbox. Identify the stud in the following photograph and saw or grind off this stud perfectly flush with the surface of the engine mounting plate. A die grinder and cutting wheel works best. This stud is the one farthest to the right when viewed from the front. Don't worry about punching the remaining part of the stud out as it is actually a bolt that is threaded through the engine mounting plate and held forever in place with Loctite.

4 – Check to make sure the various other bolts and washers do not interfere with the gearbox base plate.



Arrow shows stud to cut off.

5 – Clean up the area with a rag and acetone or other solvent and a good blast of compressed air.

## Preparing the Pilot Bearing

The new gearbox will come with a short spline shaft connecting the gearbox to the spline drive plate (dual-mass flywheel) or solid flywheel adapter disk. Before installing the new drive mechanism, you must check to be sure that a pilot bearing is present in the flywheel and if not, install one.

### **NOTE THE FOLLOWING VARIATIONS**

If you have a dual-mass flywheel, you only need to verify that the pilot bearing is present in the center of this flywheel and not damaged. You can skip to the section of this document titled “**Spline Plate Installation**”.

If you have one of the two variations of solid flywheels, you may need to install a bearing if not already present and you will need to install the solid flywheel adapter disk and possibly a shim. Continue with this procedure.

## Solid Flywheel Adapter Disk Installation

1 - Inspect the pilot bearing in the center of the flywheel. Because the solid flywheels were used in standard-transmission automobiles, there should be a small (approx 1.25” diameter) ball-bearing pressed into the center of the flywheel for the automotive transmission. If this bearing is not present, or if it is damaged, you may purchase one from a local Subaru dealership or through our factory.

### **SUBARU PILOT BEARING PART NUMBER: 806212020**

**Last reported price: \$12.23 US**

The same bearing is used in all models and years having a standard transmission. You can also order a generic 32mm x 12mm x 10mm sealed bearing standard number #6201 from any good bearing supplier.

If you need to replace a bearing, you will need to locate a suitable “inside bearing puller”. These are available through most tool suppliers and good auto parts stores.

If you only need to install a new bearing, it can be pressed into the flywheel bore using a soft mallet against a socket that fits the outer bearing race.





Inserting the bearing



Use a socket to seat it

It is normal for the pilot bearing to remain slightly higher than the surface of the flywheel by  $1/32''$  to  $1/16''$ . If your bearing protrudes any further than this, you will need to install a shim as described below.

One-piece solid flywheels should not require a shim, while two-piece solid flywheels are likely to need a shim.

The following photograph shows a pilot bearing that protrudes too much and will require a shim. The solid flywheel adapter disk would never seat properly against this bearing.



Requires a shim!

This next photograph shows the shim. Contact us if you need one of these!

**Do not attempt to get by without it or you WILL damage your new gearbox.**



Shim

After inserting the shim (if needed) the pilot bearing now protrudes between 1/32" and 1/16" above the surface as expected. The solid flywheel adapter disk should now sit flush against the surface.



Proper bearing height

2 - Wipe a small amount of anti-seize compound on the new spline drive shaft.  
Note: the factory may already have done this if you find a copper-colored coating already on the shaft.

3 - Insert the new spline drive shaft into the solid flywheel adapter disk and then into the flywheel pilot bearing as shown below. It is critical that you allow the pilot bearing to provide alignment of the adapter disk.

**DO NOT BOLT THE ADAPTER DISK ON FIRST AND THEN TRY TO INSERT THE SPLINE SHAFT AS THIS WILL ALLOW DESTRUCTIVE MISALIGNMENT TO OCCUR.**



Shaft in adapter disk first.

Check that the snap-ring sits against the adapter disk and make sure that the adapter disk will sit fully seated against the flywheel face. If either of these parts do not seat well, investigate and resolve the problem. Never force the parts together! Once installed, it is normal to have a small gap between the snap ring and the adapter disk between zero and 1/16”.

4 – Gently tap the spline pilot shaft into the pilot bearing with a soft mallet. Insert one bolt to temporarily hold the adapter disk and flywheel.



Final check of fit.

5 - Add a drop of Blue Loctite to each crankshaft bolt and thread them all through the adapter disk into the crankshaft. Using a thin walled socket, progressively tighten and torque each bolt to 50 foot-pounds.

NOTE: Some early adapter disks made it difficult to get a standard socket over the heads of the bolts. You may be able to use a crows-foot wrench on these or grind a socket thin to solve this problem. NEVER hammer a socket down over the bolt heads as this will knock the adapter disk out of alignment for sure. Use common sense. The photograph below shows a crows-foot wrench if you have never seen one. You can also have a local machine shop turn these adapter disks down to 1.650” diameter and repaint it if that is easy for you.



Proceed to the next major section of this document titled “**Gearbox Installation**”.

## Spline Plate Installation

If you have the dual-mass/vibration-dampening flywheel, you will be replacing your old spline plate with a new one having a larger shaft socket. This new plate will come with your gearbox upgrade kit.

1 - In your installation kit, locate the new spline plate and allen head bolts. Fit this plate against the flywheel. Place a drop of BLUE LocTite on each of the allen head bolts and secure the plate. Torque these bolts to 250 inch-pounds (INCH, not foot).



Use Blue Loctite on plate bolts.

2 - In your installation kit, locate the short spline shaft. Wipe a very small amount of grease on the splined portion of the shaft and insert the small diameter pilot shaft into the pilot bearing in the center of your engine flywheel. The splines are a relatively close tolerance fit in the spline drive disk, so you may need to wiggle and tap the shaft gently with a soft mallet to get it to properly engage the disk. When fully inserted, the gap between the snap ring on the spline shaft and the spline disk should be between zero and 1/16”. If the gap is greater, investigate the reason and if stumped, contact the factory before proceeding.



Inserting the spline shaft.

## GEARBOX INSTALLATION

1 - Locate two short stainless-steel alignment dowel pins in your installation kit.

2- Smear a drop of Blue Loctite around the outside of one end of each pin and insert the pins into the back side of the new gearbox base plate as shown below. You will notice pockets on the back of the gearbox for these two dowel pins.



Inserting the alignment pins

3 – Identify where these new alignment dowel pins will land on the engine mounting plate to see if there are old pins remaining in the engine mounting plate. If you find old pins, remove them with a pair of vise-grips. Some force and wiggling may be required to work them loose. **NEVER DRIVE THEM THROUGH THE PLATE.** Some older installations used hollow split-pins instead of solid dowel pins. Remove and discard them.

4 – Hold the new gearbox in position and determine if there is adequate clearance from the oil-cooler and pilots side radiator. If necessary, the oil cooler may be lowered or tilted slightly to clear the gearbox and the radiator can be repositioned slightly by making slots in the mounting bracket or moving the mounting holes.

5 - Slide the gearbox into place over the spline shaft aligning the various mounting studs as needed.

WHEN PROPERLY ALIGNED, THE GEARBOX WILL SLIDE ALL THE WAY INTO PLACE WITH ONLY A MILD AMOUNT OF WIGGLING AND PUSHING.

AS THE DOWEL PINS ENGAGE, APPROXIMATELY THE LAST 1/8", THERE MAY BE A SMALL AMOUNT OF RESISTANCE WHICH IS EASILY OVERCOME BY WIGGLING AND PUSHING BY HAND OR A GENTLE TAP WITH A SOFT MALLET.

UNDER NO CIRCUMSTANCES SHOULD YOU EVER HAVE TO USE FORCE OR TIGHTEN DOWN THE PERIMETER NUTS TO GET THE GEARBOX TO SEAT ALL THE WAY AGAINST THE ENGINE MOUNTING PLATE.

IF YOUR GEARBOX DOES NOT SLIDE INTO PLACE, NEVER, EVER, FORCE IT! INVESTIGATE WHAT IS PREVENTING IT FROM ENGAGING AND DOUBLE CHECK YOUR ALIGNMENT.

THIS IS THE NUMBER ONE CAUSE OF GEARBOX PROBLEMS, DON'T TAKE SHORTCUTS!

6 – The GEN-III gearbox has an internal vent chamber. No external tubing should be required. The small brass vent tube on top of the gearbox must remain clear. If you remove this fitting when installing the housing nut, be sure to replace it again and do not replace it with a solid plug! If this vent hole is restricted, your gearbox will develop seal leakage.



Vent Fitting (MUST REMAIN CLEAR)

7 – Install the ten nuts around the perimeter of the gearbox housing and torque to 250 inch-pounds (INCH not foot).

8 – Reinstall your temperature probe in either the top-forward or front-forward NPT plug positions. Reattach the temperature probe wire. If your temperature indication is wrong or erratic, you may need to add a ground wire around the outside of the temperature probe running to the engine block. The anodized finish of the gearbox does not always provide sufficient electrical ground.

9 - Reinstall the starter motor, if removed, and any related wiring. Observe the proper position of the spacers, if applicable, between the starter flanges and engine mounting plate. The starter may require alignment if it makes a loud grinding noise the first time you try it. This is accomplished by loosening these bolts and pressing the starter closer to the flywheel. If the starter does not fully engage, move it away from the flywheel. It only takes a tiny amount of movement, barely visible. If your starter hits one of the gearbox housing bolts, you will need to grind a small bit of material away from the rim of the starter motor as shown below. If your starter has a large ground strap, be sure to reattach it.



Interference between nut and starter.

10 – Reinstall the ignition coil/s and wires (if previously removed).

11 – Remove the upper gearbox fill plug (large allen-head bolt) and fill the gearbox with **16 OUNCES OF 75w90 SYNTHETIC GEAR OIL**. We recommend Mobil 1, 75w90 Light Truck and SUV type gear oil available at most auto parts stores. The fill level should appear **very near the top of the glass sight gauge** on front of the gearbox. Take note of the correct level. Note also, that the position on the sight gauge will vary for taildragger aircraft.





Proper fill level indication when level.

12 – Reinstall your propeller. Use new locknuts on your prop bolts. Note that the GEN-III hub may require new bushings. If properly communicated when your gearbox was ordered, any new bushings should be included in your installation kit. In some cases, machining may be required to fit spacers to your prop. Take your time and make sure your prop fits correctly!

**Refer to the section of this document titled “Propeller Installation” for details of bushing and brush block installation.**

13 – Reinstall the electric prop servo brush assembly and related wiring (if applicable). You can fabricate your own brush bracket or purchase one from us. The GEN-III gearbox has a dedicated mounting boss with two threaded holes to attach brush block brackets to. Refer to your propeller documentation for correct alignment and gap procedures. Refer to separate Service Bulletins regarding our various brush brackets.

14 – Visually inspect the entire powerplant for any overlooked items, missing or loose bolts, wires, clamps, etc. Take care of anything you find now, before reconnecting the batteries.

15 - Remove any tail supports and return the aircraft to its resting position.

16 – Turn the propeller by hand through several engine rotations to distribute the gearbox oil. Listen for any sound of scraping or other contact or tightness in the new gearbox. If you detect any problems, express the appropriate sentiment loudly, then investigate and resolve them now. GEN-III has very large bearings, gears, and seals, so it is normal for it to be a little stiffer than your prior gearbox until it is properly ‘broken in’.

17 – Reconnect the battery cables. Note: a tiny spark is possible as you connect the cables. This is from the ECM Memory circuit and any other equipment that is always on, such as clocks, radio memories, etc.

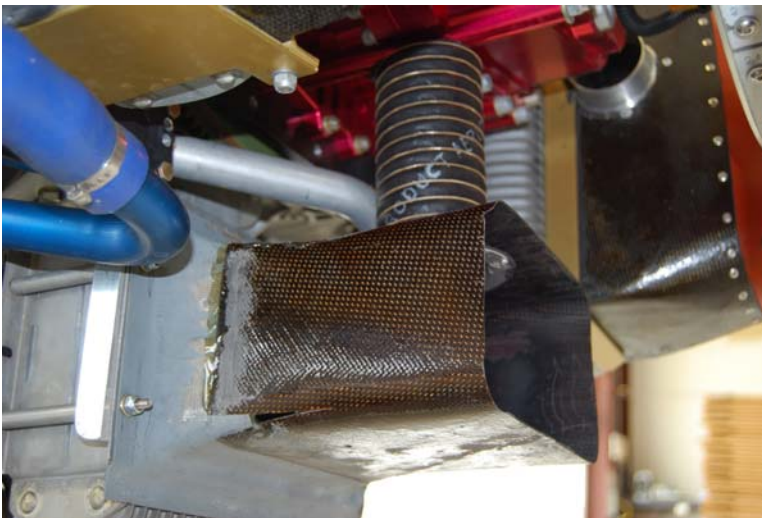
18 – Reinstall the lower cowling and perform one more thorough inspection to be sure the oil cooler is not hitting the cowl.

19 – Your gearbox will benefit from some cool airflow. This can be as simple as cutting some holes in strategic locations inside your cowl or adding small ducts. The following photo shows one builders solution of adding a short blast tube from each radiator duct pointing at the nose of the gearbox.



Radiator shroud blast tube.

Below is a similar blast tube extending upward from the oil cooler intake shroud. You don't need to get too carried away until you see how your gearbox performs. It doesn't take a lot of air to keep it cool and happy. **When properly cooled, your gearbox temperature should always run 10-15F cooler than your engine coolant.**



Oil shroud blast tube.

## PROPELLER INSTALLATION

Your new gearbox has a dual-pattern propeller flange supporting both SAE 1 and SAE 2 bolt patterns matching all factory-approved propellers. The variety of props we support will require an appropriate set of precision bushings and possibly new bolts. This section will detail the most common propeller options.

- ▶ Sensenich: 3 or 4 blade, electric constant-speed, with Quinti Avio hub.
- ▶ Sensenich: 3 or 4 blade, ground adjustable hub.
- ▶ MT: 3 blade, electric constant speed (MTV-7)
- ▶ Quinti Avio: 3 blade, electric constant speed, with Warp-Drive blades.
- ▶ IVO Magnum: 3 blade, electric in-flight adjustable hub.

### Sensenich Propellers with Sensenich or Quinti Electric Hub

The new line of Sensenich propellers with either Quinti-Avio electric constant speed hub or Sensenich ground-adjustable hub, will ship with the correct hardware for your GEN-III gearbox. If you use the Quinti hub, you will want to purchase a Sensenich/Quinti Brush Block Mounting Bracket.



Sensenich & Quinti Hub



Sensenich Adjustable

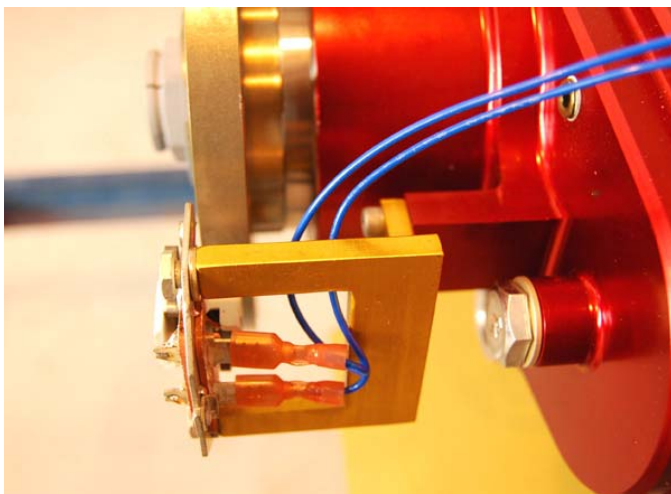
## Sensenich & Quinti Bushings

Sensenich propellers will ship with the correct bushings for your GEN-III gearbox. All six of these bushings are identical and use the SAE-2 bolt pattern.

Refer to the section titled “**Bushing Installation**” for details on installing the new set of bushings in the gearbox flange.

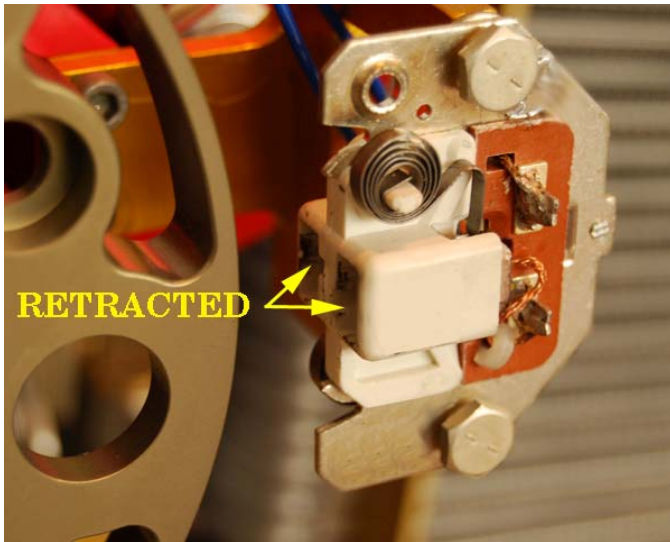
## Sensenich & Quinti Brush Block & Bracket

The Sensenich prop with Quinti-Avio hub will require purchase of a brush block mounting bracket. We make a nice anodized one.



Sensenich/Quinti Bracket

Quinti now uses a nice brush arrangement. Whether by design or not, a neat feature is the ability to retract the brushes during assembly to avoid breakage. Just push the brushes in until they are captured by their springs. To release them, just push the brushes towards the slip ring again. Very nice!



Retractable brush feature

Follow the mounting instructions that came with your propeller.

### MT Electric Constant Speed Propellers



MT Electric CS Prop

MT Propellers make a nice wooden-core constant speed prop. They are pricey, but have always worked well with our powerplants. If you use a MT prop, you will need to purchase a set of Bushings and a Brush Block Mounting Bracket.

### MT Bushings

MT props require a set of precision stainless steel bushings and a new set of 7/16" bolts. The bushings use five long bushings and one short bushing as a means of indexing the prop to the hub.



This is a view of the back side of a MT prop flange.

Notice how one bolt hole (bottom of photo) does not have a recessed pocket surrounding it as all of the others do.

This is where the SHORT bushing goes.

This is how MT chooses to index their prop to the hub.

If you are upgrading from a previous version of gearbox, your old set of bushings can be discarded. If they are stuck in the prop flange, you will need to remove them with a pair of vise-grips.



Remove old bushings

Shorter bolts are required when installing a MT prop on the GEN-III gearbox. Use the original thick washers supplied by MT when installing your new bolts. It is always wise to use fresh locknuts when installing a prop. You can order bolts from us or purchase them yourself. Use either AN spec bolts or grade 8 industrial bolts.

- 6) 7/16-20 x 1.75" long Grade 8 bolts zinc plated
- 6) 7/16-20 Grade 8 nylon insert lock nuts zinc plated
- 6) 7/16 Grade 8 flat hardened washers

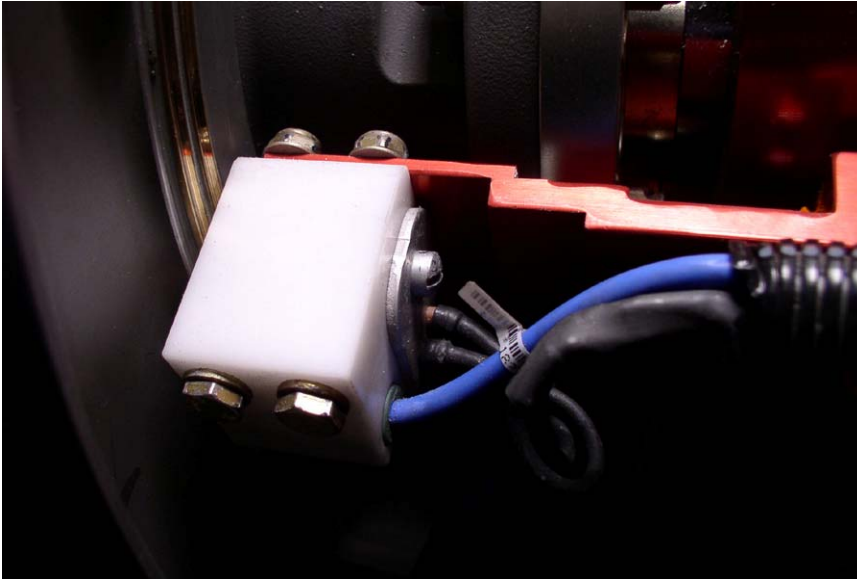


Shorter bolts & original washers

Refer to the section titled “**Bushing Installation**” for details on installing the new set of bushings in the gearbox flange.

### MT Brush Block & Bracket

The MT prop will require purchase of a brush block mounting bracket. We make a nice anodized one that assure proper brush alignment.



MT Brush Mount

MT Brushes are notoriously easy to chip when installing your prop. You can remove the brushes and reinstall them once the prop is in place, but it is often difficult to access this area. A technique we use is to tape a piece of a business card over the brushes before installing the prop. Once the prop is in place, simply peel the tape off the brush block and slide the business card out. These are expensive brushes, so you need a strategy!

### Quinti Hub with Warp-Drive Blades

If you have one of these propellers, you can use your existing bushings in the SAE-1 holes of the GEN-III gearbox flange. Before installing the prop, make sure the bushings do not bottom-out in the flange before the prop flange is fully seated against the gearbox flange. If the bushings are too long, they will need to be machined slightly shorter to assure the prop is fully seated. Use a washer on the back side of the gearbox flange under each nut.

The original “scissors type” brush assembly can be adapted to the GEN-III by fabricating a small mounting bracket. Refer to the separate Service Bulletin titled “**Quinti Brush Block for G3 Gearbox**” for fabrication details.

### IVO Magnum Propeller

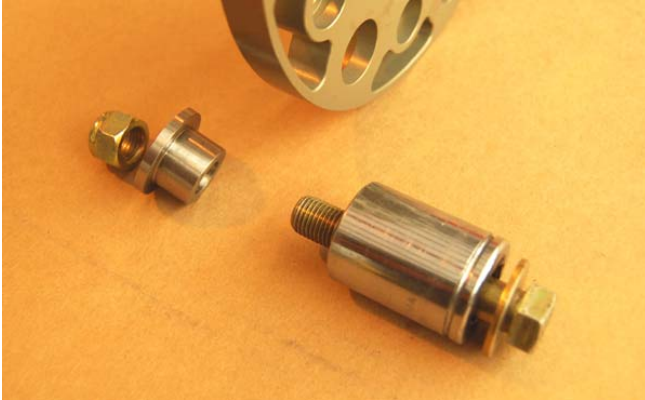
Though not real popular, some of our customers have reported good luck with the IVO Magnum propeller. You will require special bushings to install this prop. Contact our factory to purchase a set. We do not provide a brush block mounting bracket for this prop so you will need to fabricate your own or adapt one of our other models.



## Bushing Installation

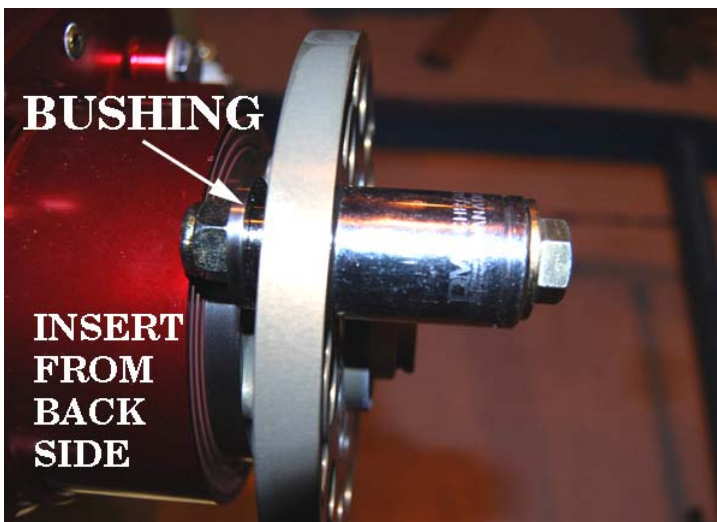
**“Hat”-shaped bushings are inserted through the gearbox flange from the back side of the flange.**

The various bushings we supply are precision parts. When first installing the bushings in a new gearbox flange, you may need to use a tool to pull the bushings into place. You can create a simple puller with a bolt and socket. The following photo shows the general idea.



Socket & Bolt Bushing Puller

Seat the bushings into the back side of the gearbox flange as squarely as possible. Locate a bolt long enough to extend through a socket, the flange, and the bushing. Insert the bolt through a washer, the socket and the bushing. Thread a nut on the back side of the bushing. Tighten the nut until the bushing is pulled all the way into the flange.



Using the puller

When fully seated, the typical bushing (MT shown) will protrude beyond the face of the flange. Other bushings may vary; use common sense here!



Fully seated long MT bushing

It is always tricky to bolt the propeller to a flange. Have a helper hold the prop while you get the bolts started and the bushings lined up. Torque the bolts per your propeller manufacturer's specifications.

Rotate the prop through a full revolution by hand to make sure nothing is binding.

### Balancing the Propeller

#### **HAVE YOUR PROPELLER DYNAMICALLY BALANCED BY A COMPETENT SHOP. THIS IS MANDATORY!**

Whenever the gearbox has been changed, it is necessary to re-balance your propeller. You wouldn't think of buying a new set of tires for your car without having them balanced, so please don't subject your passengers and expensive aircraft to needless vibration.

Even if your propeller is "statically" well balanced, there is a substantial number of rotating steel parts inside the gearbox that are now bolted to your propeller. It must be "dynamically" balanced.

The GEN-III gearbox is slightly more difficult to achieve fine balance than its predecessors simply because there are much larger gears and bearings. It is also unlikely to achieve 'perfect' balance across the entire operating RPM range.

We recommend balancing the props at your most common cruise RPM and full fine pitch. For the E6-Series powerplants, this is typically around 1800-1900 prop RPM.

If you have ever studied a spectrograph plot from a balancer, you will be able to identify all sorts of rotating and vibrating components on the powerplant, from alternator bearings to fan belt slap to impulses of air each time a prop blade

passes by the cowl or nose gear wheel pant. Screening out the uninteresting noise and focusing on the movement of the prop hub requires experience, patience and a good deal of trial and error.

Your balancing equipment will have a better chance of screening out gearbox sounds if you attach its transducer to the engine mounting plate just above the gearbox rather than the gearbox itself. Most mechanics are not familiar with balancing a gear-driven powerplant and can easily misinterpret what they are seeing. There's a lot of moving parts in the gearbox, but the final output shaft motion is what you are interested in. A final value of 0.06 or less is fine. With some care, a value of 0.02 can even be achieved. This is an order of magnitude smoother than most 'certified' aircraft powerplants.

One simple method:

1. Remove any weights (usually washers) from your prior balance job.
2. Set the prop pitch to FULL FINE and turn OFF your controller (assuming you have a constant-speed prop).
3. Take a base-line reading at the desired RPM.
4. Place a couple of fender washers under a spinner screw just to the right of prop blade number one and take another reading.
5. Progressively move the weights to each remaining blade and take readings.
6. Determine which segment (third) of the prop has benefited from the weights.
7. Narrow down which specific spinner screw within that segment yields the best balance.
8. Once you find the best screw position, now try a few runs with a different number of washers. If adding a washer makes it worse, remove one. Don't be surprised to exaggerate the number of washers if you are not seeing a significant change. Sometimes it takes quite a few!
9. When you are satisfied, attach the washers to the inside of the spinner or backing plate using a longer screw and discard one of the washers to make up for the extra weight of the screw (or just use a longer screw to begin with when you are moving the washers around).

It is quite normal to experience specific RPM values that are smoother than others. Often you will notice a faint shudder at a very low speed as RPM is increasing. If you are unhappy with the balance in cruise flight, you can rebalance at a different RPM. Keep in mind too that not all "harmonic" vibrations ("thrumming sounds") are a result of the prop balance. These can result from loose cowling or something rattling against the cowl or firewall, exhaust rattles or leaks, weather-strip leakage, etc. If the sound does not immediately vanish by increasing and decreasing RPM or prop pitch, then it is not a result of imbalance.

## **GEARBOX MAINTENANCE**

Change your gearbox oil after the first 25 hours of operation and thereafter every 100 hours of operation.

Use only 16 to 18 ounces of 75w90 Synthetic Gear Oil. We recommend using Mobil-1 brand "Light Truck and SUV" gear oil. Overfilling can lead to seal and vent leakage and high operating temperatures. Under-filling can lead to noisy operation and high operating temperatures.

Each time you change your oil, dip a magnet into the old oil to check for the presence of metal particles. As with all gearboxes, a fine metallic "slush" or paste is not necessarily a problem. If you find distinct metal filings, it is worth investigating.

Keep the vent opening (brass fitting on top of the gearbox) free of obstructions.

Check the torque of your prop bolts every maintenance period.

## **RUNUP AND TEST**

1 - The starter motor must be properly aligned to engage with the flywheel. The holes have enough play to allow the starter to move for adjustment. This is a trial-and-error process. Tap the starter switch briefly. If the starter just spins freely or makes a grinding sound, move the motor slightly and try again. When starter operation is smooth, tighten these bolts securely to prevent the starter motor from loosening up over time.

**SAFETY WARNING: Always use caution and/or disconnect the battery before physically working on a starter motor. Never try to pry the starter drive gear out with a screwdriver or fingers as this can engage the motor!**

2 - Crank the engine over for a few cycles WITHOUT turning on the ignition or fuel pumps. Listen carefully for any sounds of binding. Resolve any problems now.

3 - Start the engine. Have a trusted friend man the cockpit while you check for unusual sounds, leaks, prop tracking, etc. **STAY CLEAR OF THE PROP!!!**

4 – **Run the engine at idle for five minutes to break-in the new seals.**

5 – Run the engine through its full RPM range.

6 – Inspect the gearbox for any signs of leakage. Note that a small amount of grease that you applied to the spline shaft during assembly may be slung from the flywheel area during the first minutes of operation. This is to be expected. Also, we dip all the bolts in a light oil during gearbox assembly, so traces of this oil may be visible for a while when the unit is first installed.

7 - Reinstall your upper cowling and wash that dirty plane!!!

8 – Make the appropriate Engine and Propeller Logbook entries stating that the propeller gearbox was upgraded. Although you didn't do anything to the prop, it is customary to make a Propeller Logbook entry whenever the prop is removed for any reason. We appreciate a call or email to let us know that you have completed the upgrade.

9 - Perform a test flight remaining in the local traffic pattern until you are confident in the airworthiness of your aircraft.

*Thank you for doing business with Eggenfellner Aircraft Inc.  
Fly often and fly safe!*