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DRAFT SERVICE BULLETIN: JSB 012-1

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2 Applicability

All Jabiru 2200 engines

All Jabiru 3300 engines

Note that for 2200 engines S/No. 2058 and above, and 3300 engines S/No. 837 and above, the following bulletin is limited to a revised maintenance schedule. As such, for these engines using the latest approved issue of the Engine Instruction & Maintenance Manuals is equivalent to complying with this Bulletin.

Note:

- All 2200B engines are fitted with dowels and are to be treated as detailed in Section 4.7.
- All Hydraulic lifter engines are fitted with dowels and are to be treated as detailed in Section 4.7.
- 2200A engines other than those equipped with hydraulic lifters must have the alternator removed & the flywheel attachment inspected to determine if the engine lies in the serial number ranges detailed in Section 4.5, Section 4.6, or Section 4.7. (Whether an engine has hydraulic lifters can easily be seen with an external inspection, & all hydraulic lifter engines are treated as detailed in Section 4.7.

3 Background

The flywheels of Jabiru Engines are retained to the crankshaft by six cap screws (in early 2200 engines these screws were 1/4", while later engines and all 3300 engines use 5/16" screws).

Operational experience has shown that these screws can be affected by the condition and installation of the propeller. The propeller fitted to all Jabiru Engines is vital in helping to absorb engine vibrations and if the connection between the engine and propeller deteriorates or the propeller runs less smoothly for any reason, the resulting increase in vibration can cause damage to the flywheel screws. The main causes of this effect are listed below:

- **Prop strike.** Clearly, any time when the tip of the propeller touches another object it will send a spike of torque along the crank which can overload the flywheel screws.
- **Abrupt Engine Stoppage** An engine which has experienced an abrupt stoppage – such as is caused by valve or piston failure – will have experienced an overload on the flywheel screws.
- **Propeller Bolt Tension.** If the propeller bolts loose tension the propeller may move and fret on the mounting flange of the engine. This results in an increase in the vibration being reflected back down the crankshaft and can damage the flywheel mounting screws.
- **Propeller Balance.** An out-of-balance propeller creates extra vibration.
- **Propeller Condition.** A propeller with uneven pitch or one damaged blade creates extra vibration.
- **Propeller Drive Bushes.** If the drive spigots (also known as drive bushes) which go through the engine flange into the propeller are a loose fit in the propeller then the propeller will not be properly restrained – which has the same effect as running with insufficient propeller bolt tension (Note that this generally only occurs on propellers which have been previously damaged by running with badly tensioned propeller bolts).
- **Propellers.** While very rare, some cases of damage to the flywheel screws due to the installation of a prototype composite propeller have been recorded.
- **Propeller Flange.** Jabiru Aircraft propeller flanges are made to exacting tolerances. Use of a different, non-approved propeller flange is strongly discouraged. Inspection of non-OEM flanges fitted to some engines has shown poor machining – leading to the propeller running off-axis or out of true, creating extra vibration.

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- Damaged Flywheel. Once a flywheel has run with loose or damaged screws it is likely that the flywheel itself will have been damaged – the loose screws move in the flywheel, elongating the holes. In extreme cases this can lead to repeated screw breakages and the need to replace the flywheel.

The end result of this sort of damage is the loss of some or all of the flywheel retaining screws which allows the flywheel to partially or fully separate from the crankshaft. This results in loss of ignition timing, damage to the alternator and ignition coils and a stoppage of the engine.

In addition to the information contained within this bulletin, Jabiru Service Bulletin JSB 014 has been raised to increase owner awareness of the design and maintenance requirements of propellers. A loose or rough-running propeller will cause engine damage no matter how robust the engine design. Because of this, the following bulletin acts in concert with JSB 014 – failure to follow the recommendations of **either** bulletin will result in an incomplete approach which does not deliver the improvements to operating safety intended.



4 Recommendations:

4.1 General

Note that the changes to maintenance procedures detailed below are being incorporated into all Jabiru Engine Instruction & Maintenance Manuals. Copies of the latest versions of these manuals are available from Jabiru Aircraft for the cost of the CD and postage. As all the engine manuals are living documents which are regularly updated to include information developed during recent operational experience it is strongly recommended that all owners update their manuals to the latest revision. Note that manuals for older solid-lifter engines are also being maintained with the latest updates and are available to owners.

4.2 Propeller Installation

Jabiru Service Bulletin JSB 014 provides information and recommendations for installing and maintaining all propeller types.

Jabiru Aircraft consider compliance with JSB 014 mandatory for all aircraft being used for air work (such as training, hire & glider towing).

4.3 Propeller Strike

Jabiru Aircraft require all the flywheel screws be replaced whenever the aircraft has experienced a propeller strike. The propeller flange must also be checked for run-out, and in some cases the crankshaft must be replaced. Refer to the current engine Instruction & Maintenance Manual for details. Where in doubt, contact Jabiru Aircraft or our local authorised representative for advice.

4.4 Upgrade at Engine Overhaul

Jabiru Aircraft recommend that all engines be updated to current specifications – 5/16” flywheel screws with dowel pins – at the major overhaul (2000-hr TTIS overhaul). Drilling fixtures and instructions will be available from Jabiru Aircraft to allow modification of older crankshafts and mating parts. Note that these will only be available to authorised Jabiru Engine maintainers.

4.5 2200 Engines up to S/No. 436 (1/4” Flywheel Screws)

- a) If the engine has been overhauled, check to determine if the flywheel attachment has been upgraded. Note that new crankshafts are fitted to these engines at the major overhaul – this has been the practice since the crank using 5/16” screws was introduced.
 - i) If 5/16” screws have been substituted but there are no dowels between flywheel and crank, treat the engine as detailed in Section 5.2 below.
 - ii) If the engine has been upgraded and has both 5/16” screws and dowels, treat the engine as detailed in Section 5.3 below.
- b) Engines which have 1/4” screws may remain in service in their current configuration until major overhaul (2000-hr TTIS). During the major overhaul the engine is to be modified to current specifications (5/16” screws & dowels) by an Authorised Jabiru Engine maintainer. Refer to Section 4.4 above
- c) If the original 1/4” bolts are still in place, check the flywheel screw tensions (to 15lb.ft). If any loose or broken screws are found, replace all the screws in accordance with the

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procedure given in Section 7. This is a one-off requirement. Refer to Maintenance Schedule A in Section 6 below for ongoing maintenance.

- d) Maintain the engine in accordance with the Modified Maintenance Schedule A in Section 6 below.

4.6 2200 Engine S/No. 437 to 2057. 3300 Engine S/No. 0 to 836 (5/16" screws, no dowels)

- a) If the engine has been overhauled, check to determine if the flywheel attachment has been upgraded. If the engine has been upgraded and has both 5/16" screws and dowels, treat the engine as detailed in Section 5.3 below.
- b) Engines which have 5/16" screws but no dowels may remain in service in their current configuration until major overhaul (2000-hr TTIS). During the major overhaul the engine is to be modified to include the dowels by an Authorised Jabiru Engine maintainer. Refer to Section 4.4 above.
- c) Check the flywheel screw tensions (to 24lb.ft for 5/16" screws). If any loose or broken screws are found, replace all the screws in accordance with the procedure given in Section 7. This is a one-off requirement. Refer to Maintenance Schedule A in Section 6 below for ongoing maintenance.
- d) Maintain the engine as detailed in Modified Maintenance Schedule A in Section 6 below.

4.7 2200 Engines S/No. 2058 and Above. 3300 Engines S/No. 837 and Above.

- a) Maintain the engine as detailed in Modified Maintenance Schedule B in Section 6.2 below.

5 Compliance:

Where calendar time spans are given below, the start date is taken to be the date of first issue of this Service Bulletin - 23rd October 2006.

Note that Jabiru Aircraft consider the recommendations below mandatory for all aircraft being used for air work (such as training, hire & glider towing).

5.1 Engines in The Range Given in Section 4.4 (1/4" Flywheel Screws).

- a) Refer to Jabiru Service Bulletin JSB 014 and treat the propeller installation as detailed.
- b) Check flywheel screw tensions within the next 6 months or 50 operational hours whichever is the sooner.
- c) Maintain the engine in accordance with the Modified Maintenance Schedule A in Section 6 below from receipt of this Bulletin.
- d) At major overhaul (2000-hr TTIS) upgrade the engine to current specification flywheel attachment. Note that this may only be carried out by Authorised Jabiru Engine maintainers.

5.2 Engines in The Range Given in Section 4.6 (5/16" Flywheel Screws, no Dowels).

- a) Refer to Jabiru Service Bulletin JSB 014 and treat the propeller installation as detailed.
- b) Check flywheel screw tensions within the next 6 months or 50 operational hours whichever is the sooner
- c) Maintain the engine in accordance with the Modified Maintenance Schedule A in Section 6 below from receipt of this Bulletin.
- d) At major overhaul (2000-hr TTIS) upgrade the engine to current specification flywheel attachment. Note that this may only be carried out by Authorised Jabiru Engine maintainers.

5.3 Engines in The Range Given in Section 4.7 (5/16" Flywheel Screws Plus Dowels).

- a) Refer to Jabiru Service Bulletin JSB 014 and treat the propeller installation as detailed.
- b) Maintain the engine in accordance with the Modified Maintenance Schedule B in Section 6.2 below from receipt of this Bulletin.

6 Modified Maintenance Schedules

6.1 Modified Maintenance Schedule A

The following is an extract taken from Section 6.12 of the 2200 Engine Instruction & Maintenance Manual. Note that the additional flywheel attachment maintenance applies equally to the 3300 engine.

Due to the importance of propeller maintenance to the flywheel attachment, the propeller maintenance schedule is reproduced here also. Note that this propeller maintenance schedule assumes the following:

- A Jabiru wooden propeller is used
- The propeller is fitted using the Belleville (spring) washer system detailed in Jabiru Service Bulletin JSB 009.
- The installation uses a propeller extension manufactured by Jabiru Aircraft

Any deviations from this configuration will require revisions to the maintenance schedule – refer to Jabiru Service Bulletin JSB 014 for details.

Table 1. Modified Maintenance Schedule A

		Annual Inspection		
		Each 200 Hours		
		Each 100 Hours		
1	Check flywheel screw tensions (to 15lb.ft for 1/4" screws, 24lb.ft for 5/16" screws.)		*	*
PROPELLER				
1	Spinner		*	*
2	Spinner Flange (removal not required)		*	*
3	Spinner screws		*	*
4	Propeller condition (removal not required)		*	*
5	Propeller screws/nuts – Tension		*	*
6	Spinner / Prop Tracking		*	*

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6.2 Modified Maintenance Schedule B

The following is an extract taken from Section 6.12 of the 2200 Engine Instruction & Maintenance Manual.

Due to the importance of propeller maintenance to the flywheel attachment, the propeller maintenance schedule is reproduced here also. Note that this propeller maintenance schedule assumes the following:

- A Jabiru wooden propeller is used
- The propeller is fitted using the Belleville (spring) washer system detailed in Jabiru Service Bulletin JSB 009.
- The installation uses a propeller extension manufactured by Jabiru Aircraft

Any deviations from this configuration will require revisions to the maintenance schedule – refer to Jabiru Service Bulletin JSB 014 for details.

Table 2. Modified Maintenance Schedule B

		Annual Inspection		
		Each 200 Hours		
		Each 100 Hours		
1	Check flywheel screw tensions (24lb.ft for 5/16" screws.)			*
PROPELLER				
1	Spinner	*		*
2	Spinner Flange (removal not required)	*		*
3	Spinner screws	*		*
4	Propeller condition (removal not required)	*		*
5	Propeller screws/nuts – Tension	*		*
6	Spinner / Prop Tracking	*		*

6.3 Ongoing Maintenance – Under-Tensioned Flywheel Screws.

After the initial inspection has been completed, if any screws are found to be under-tensioned during subsequent inspections (if they rotate at all when being checked) they must be dealt with as follows:

- i) Remove the screw. Clean the Loctite residue out of the thread on the screw using a wire brush. Clean the thread inside the crankshaft using a Tap (1/4" UNF or 5/16" UNF, depending on screw size).
- ii) Re-install the screw. As detailed in the current Instruction & Maintenance Manual, apply a small amount of Loctite 620 (approximately the size of a match head) to the tip of the screw. Torque the screw to 15 lb.ft for 1/4" screws or 24lb.ft for 5/16" screws

NOTE: Jabiru Aircraft have increased the torque settings of the 5/16" flywheel screws during the last year. Engines built using lower flywheel screw tensions will require all the screws to be removed, cleaned and re-installed in accordance with the details above. Unless the engine has been overhauled this applies to engines in the following ranges: 2200 engines S/No. 437 – 2102, 3300 engines S/No. 01 – 856. This should be done according to the details given in Section 7 – replacing one screw at a time.

6.4 General Engine Maintenance Notes

- Always take care while working around the propeller – ensure the ignitions are turned OFF and that no-one is in the cockpit while working on the engine.
- Always use a good quality tension wrench.
- It is strongly recommended to check the accuracy of adjustable-type tension wrenches at least every year.
- The flywheel screws also retain the valve timing gear, so turning the crank with the flywheel removed will result in lost timing. Once lost, re-setting the timing requires significant disassembly of the engine and is a much larger job.
- Loctite 620 is an extreme strength, high temperature grade designed to retain bearings. Care must be taken when using to only use as much as required. Removing bolts which have been retained with Loctite 620 can normally be achieved by heating the bolt to over 150°C using a pencil-point gas burner.

7 Procedure – Replace Flywheel Screws In-Situ

- i) With reference to the engine's Instruction & Maintenance Manual, remove the alternator stator to allow access to the flywheel mounting screws.
- ii) If a broken screw is found it must be removed using a "Screw Extractor - "Rigid" or similar tool (Available in Australia from "Blackwoods" stores). Note that this process is not straightforward and Jabiru Aircraft recommend only experienced mechanics attempt it. Once the broken screw is removed the thread and hole must be cleaned as detailed below.
- iii) Remove one screw. Note that as Loctite is used on the screws they may be difficult to remove and care must be taken not to break the screw off. A pencil-type gas burner with a small flame may be used to heat the heat of the screws and soften the Loctite. If in doubt, contact Jabiru Aircraft or our local representative for advice.
- iv) Clean out the thread in the crankshaft using a thread tap (either ¼" UNF or 5/16 UNF, depending on bolt size). Use only hand tools – do not fit the tap in an electric drill or similar as this reduces control and makes damage to the thread much more likely. Blow out the hole using compressed air.
- v) Using a new flywheel screw, hand insert it into the crankshaft thread for three turns, then wriggle it. The screw should be a firm fit with minimal movement. If the tip of the screw moves by more than 1.5mm then the hole in the flywheel has been elongated and must be repaired. If the screw has less movement than this, skip the following steps up to number xi).
- vi) Remove all the remaining screws and remove the flywheel from the engine.

CAUTION

DO NOT TURN ENGINE CRANK WITH FLYWHEEL BOLTS REMOVED.

The flywheel bolts also retain the valve timing gear which is located inside the gear case and is not visible without disassembling the engine. Turning the crank with the flywheel removed will result in lost timing. Once lost, re-setting the timing requires significant disassembly of the engine and is a large job suitable for experienced mechanics only.

- vii) Measure the size of the mounting holes in the flywheel at the front face (which faces the flywheel). If the maximum measured diameter of three or more holes exceeds 8.5mm then the flywheel must be replaced. Lesser damage can be repaired as detailed in the following steps.
- viii) Clean the flywheel-crankshaft mating face & the flywheel screw holes using Loctite primer. Re-fit the flywheel to the engine, taking care to line up the timing mark on the flywheel (a small hole drilled through near the attachment screws.) to the timing marks on the vacuum pump drive and the crankshaft. Locate the flywheel to the engine using one temporary bolt.

CAUTION

Loctite 620 is an extreme strength, high temperature grade designed to retain bearings. Care must be taken when using to only use as much as required.

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- ix) Apply Loctite 620 to the replacement screws as detailed below. Place the replacement screws in the flywheel and screw into the crankshaft by 3 turns each (remove the temporary bolt once at least 2 of the replacement screws are in place).
- x) Apply a small amount of Loctite 620 (approximately 2 match-heads worth) to the shanks of the new screws near the heads. This Loctite will bond the shank of the bolt to the flywheel and prevent movement. Tighten the screws in a diagonal pattern as noted below in point xii).
- xi) Fit the replacement screw. Note that only new “Unbrako” or “Brighton Best 1960-Series” screws are to be used. As detailed in the current Instruction & Maintenance Manual, apply a small amount of Loctite 620 (approximately the size of a match head) to the tip of the bolt. Torque the screw to 15 lb.ft for ¼” bolts or 24lb.ft for 5/16” bolts.
- xii) One at a time, remove the remaining screws and replace them with new parts using the process detailed above. Note that a normal “star” or “diagonal” pattern must be used to avoid distorting the flywheel.
- xiii) Re-install the alternator stator in accordance with the details given in the current engine Instruction and Maintenance Manual. Check the gaps between the ignition coils and the flywheel magnet plates in accordance with the details given in the appropriate Engine Instruction & Maintenance Manual.

8 Airworthiness Note:

Where required, work called for by this Bulletin must be carried out by authorised personnel only. In Australia this generally means the original builder of an Experimental-category aircraft (either RAAus or VH registered), an RAAus Level 2 holder for other RAAus aircraft or a Licensed Aircraft Maintenance Engineer (LAME).

On completion of the work, the authorised person must note the completion of the actions required by this bulletin in the aircraft’s maintenance logbook. This note should refer to the completion of maintenance requirements of this Service Bulletin, indicate if any loose or broken screws were found, indicate the date of the work and the identity (including licence number where appropriate) of the person carrying out the work.

9 Reporting

To help monitor engines in service Jabiru Aircraft Australia requests that any engines found with broken flywheel screws be reported to us. Owners should contact Jabiru Aircraft (or our local representative) via email or fax:

Email: info@jabiru.net.au
Fax: +61 7 4155 2669

Please include the following details:

- Engine Serial Number
- Engine Time Since Overhaul

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- Aircraft use & Maintenance (i.e. private use, maintained by owner **or** flying school use, maintained by RA-Aus Level 2).
- Propeller type
- Propeller extension type
- Any other relevant information.

