

## 1. INTRODUCTION

A growing number of non-certified engines, based on the Lycoming engine series, are being installed in LAA aircraft. Having the ability to produce a full set of PMA (Parts Manufacturer Approved) parts for specific Lycoming engines, engine component manufacturers such as Superior and Engine Components, Inc. (ECI) also produce their own 'clones' of those engines, which are sold in kit form. Some of these clone engines also nowadays include components that are not PMA approved, and are only available for non-certified applications.

LAA Engineering has accepted certain versions of these 'clone' engines, subject to them being assembled by an organisation accepted for the purpose by the LAA, these currently being:

- Aero Sport Power Inc. of Canada
- CFS Aeroproducts Ltd
- Deltair Airmotive Ltd
- Nicholson McLaren Aviation
- Norvic Aero Engines Ltd, formerly Jade Air plc
- Swiftair Maintenance Ltd

## 2. LYCOMING OEM EXPERIMENTAL ENGINES

Lycoming produces a series of non-certified engines that are built in the same way as their certified engines, except those that are fuel injected use the non-certified Airflow Performance or Precision Airmotive fuel systems. These engines, known as OEM Experimental Engines, are available only through kit aircraft manufacturers and engine assembly companies that are approved by Lycoming. Although Lycoming prefix the part numbers of these engines with the letter 'Y', Vans Aircraft has used the letter 'X' to the designation prefix of the non-certified Lycoming engines that they supply. LAA Engineering has accepted the Lycoming non-certified YO-320, YIO-320, YO-360, YIO-360, YO-540 and YIO-540 engines on the basis that they are made using components identical to their certified counterparts and, in the case of the fuel injected engines, an LAA approved fuel injection system. The Lycoming Thunderbolt series of engines is not included in this general acceptance, being of a configuration that does not have a certified equivalent.

## 3. SUPERIOR 'XP' ENGINES

The Superior engines are identified with an 'XP' prefix. Superior has its own system of engine designation that requires a de-code sheet to interpret it.

LAA accepted Superior 'XP' engines are listed below:

XP-O-320-A1AC2	XP-O-360-A1AC2	XP-IO-360-B1HC2
XP-O-320-A1AHD2	XP-O-360-B1A2	XP-IO-360-B1HD2
XP-O-320-A1C2		XP-IO-360-B1LD2
XP-O-320-B1A2	XP-IO-360-A1A	XP-IO-360-B2CA2
XP-O-320-B3AC2	XP-IO-360-A1A2	
	XP-IO-360-A1AC2	
XP-IO-320-A1AC3	XP-IO-360-A1HC3	
XP-IO-320-A3A2	XP-IO-360-B1A2	
XP-IO-320-A3AD2	XP-IO-360-B1AA2	
XP-IO-320-A3AD3	XP-IO-360-B1AA3	
XP-IO-320-B1AC2	XP-IO-360-B1AC2	
XP-IO-320-B1AD2	XP-IO-360-B1AD2	
XP-IO-320-B1HC3	XP-IO-360-B1AD3	
XP-IO-320-B1XC2	XP-IO-360-B1B2	

XP-IO-320-B2HC2	XP-IO-360-B1BA3	
	XP-IO-360-B1C2	
	XP-IO-360-B1CA2	

#### **4. ENGINE COMPONENTS INC 'EXP' ENGINES**

The ECI Titan engines, as they are described, have the prefix 'EXP'. ECI also has its own system of engine designation that requires a de-code sheet to interpret it.

The LAA accepted ECI 'EXP' engines are shown below.

- Titan EXP-O-320-A1B1N
- Titan EXP-O-360-D1A1N
- Titan EXP-IOX-340S-A1H2N
- Titan EXP-DIOX-370-A4L2T

Note: Various other models of Superior and ECI engines may have features that are not acceptable to LAA Engineering, such as dual non-certified electronic ignition systems.

#### **5. METAL-BLADED PROPELLERS**

Note that for aircraft with an LAA Permit, metal-bladed propellers, whether fixed pitch or constant-speed, are only accepted subject to the combination of the propeller and the engine being approved as regards propeller vibration. Propeller manufacturers carry out test cell investigations using propellers fitted with strain gauges, slip-rings and monitoring equipment, using sample engines of each type running at different RPM and manifold pressures, to make sure that blade vibrations don't reach a dangerous amplitude anywhere within the working range. For type-certified propellers, the combination of propeller type, blade type, diameter, and engine model that are approved 'vibration-wise' are listed in the propeller type certificate data sheet (TCDS). For non-certified propellers, such as those produced for amateur-built aircraft by Sensenich and Hartzell, the manufacturer provides information about vibration approval by correspondence.

It is essential to understand that the vibration approval of engine/propeller combinations is specific to engines of the exact specification quoted, and does not automatically extend to 'clone' engines of a similar type. For example, when tested on a popular propeller type an increase in compression ratio from 8:1 to 9:1 caused an increase in vibration level that prevented the propeller type being cleared with the higher compression pistons fitted to one 'clone' engine. Since some propeller resonance modes also involve the torsional characteristics of the crankshaft, differences in the crankshaft and bearings, crankcase, etc, of a 'clone' engine also prevent 'read-across' of the propeller vibration approval.

Due to the above, extreme care is needed in selecting a metal-bladed propeller for use with any modified, clone or non-certified engine, as propellers acceptable on the engine type as originally vibration tested may well not be able to be approved by LAA because of the lack of vibration approval. Using a simple wooden propeller avoids this problem as wood propellers are not prone to resonance problems. See also 'Electronic ignition systems', below.

#### **6. ELECTRONIC IGNITION SYSTEMS**

In normal circumstances, unless the electronic ignition system installed on the engine is Type Certified, only one magneto may be substituted with an electronic ignition system, although a small number of LAA aircraft have been permitted to be so modified and are being monitored by LAA Engineering. Where a non-certified electronic ignition system is installed, each installation will require individual LAA acceptance. Makes and models of electronic ignition systems currently installed on LAA aircraft engines are the:

- Unison 'Limited Authority Spark Advance Regulator' (LASAR)
- ElectroAir 'Direct Ignition System' (DIS)
- Light Speed Engineering 'Plasma II' and 'Plasma III' 'Capacitor Discharge Ignition' (CDI)
- E-Mag Ignitions 'E-Mag' and 'P-Mag'.

The vibration characteristics of metal propellers can be affected by ignition timing; Sensenich, for example, specifically states that the vibration approval of their metal propellers does not extend to the use of non-standard ignition timing while Hartzell has carried out a very limited amount of testing on some of their later blade designs. Using a simple wooden propeller avoids this problem as wood propellers are not prone to resonance problems.

### **7 SERVICE BULLETINS AND AIRWORTHINESS DIRECTIVES**

Manufacturers of cloned Lycoming engines may produce their own Service Bulletins when necessary, however owners must also be aware that Lycoming Service Bulletins and AD's may also affect their engine or components within it and act accordingly. Normally an AD or SB identifies the engine or range of engines to which they apply by reference to the model designation. In the case of cloned Lycoming engines, its Lycoming engine equivalent will need to be identified to verify applicability. Lycoming Service Bulletins, etc. can be viewed on their web site at [www.lycoming.textron.com](http://www.lycoming.textron.com).

Please report any errors or omissions to LAA Engineering: [engineering@laa.uk.com](mailto:engineering@laa.uk.com)