1. The concept of allowing engines to run beyond the constructer's recommended overhaul period depends upon the presumption that it is possible to check the condition of the engine by prescribed inspections carried out at defined intervals. It is not intended to provide a freedom to run until the engine fails. The validity of the concept depends on the ability of the inspections to give warning of impending failure and in many areas of the engine this ability exists. There are, however, some types of failure (e.g. crank shaft cracking, counterweight wear) for which predictive checks are not possible other than by strip inspection.

2. Information has been supplied by the CAA to assist in the identification of those engine components which service experience has shown to have running time limits beyond which it would not be reasonable to operate, i.e. components the failure of which are not susceptible to prior detection but which would result in either an unacceptably high failure rate or a hazardous failure. These components and the associated life limits are detailed in paragraph 5 of this Appendix and further information will be added as it becomes available.

3. In assessing the suitability of any engine to continue in operation beyond the constructor's recommended overhaul period, the engineer concerned must not go beyond any life limits and conditions specified in this Appendix.

4. The DCA is taking the unusual step, in allowing this system to be applied to piston engines in ‘private’ light aircraft, of proceeding without the agreement of all the constructors concerned. This does not imply that the DCA considers it is better informed than the constructers. The DCA has made its decision on the grounds of the effect on airworthiness only, whilst the constructors have probably taken into account economics and serviceability. The DCA feels that the operator must make his own decisions on these other aspects.

5. Limitations

5.1 Rolls-Royce Gipsy Major Engines.

Prior to running beyond 120% of the constructor's recommended overhaul period, engines other than Major 10 and earlier marks incorporating modification 2385 (splined propeller attachment) must have the taper portion of the crankshaft sulfinuz treated by Modification 2690. In accordance with Rolls-Royce Technical News Sheet G 15, engines must not exceed an overhaul period of 1000 hours unless Modification 2495 is embodied.

5.2 Avco Lycoming Engines.

Nil.

5.3 Rolls-Royce Majors 0-240 Engines.

Nil.

5.4 Teledyne Continental Motors.

Nil.

6. Examination and checking of Engine

A number of items included in the normal scheduled maintenance of an engine may be repeated to determine the condition of an engine at the end of its normal overhaul period, and additional inspections may also be specified.

6.1 External Condition.

The engine should be examined externally for obvious faults such as a cracked crankcase, excessive play in the propeller shaft, overheating and corrosion, which would make it unacceptable for further use.

6.2 Internal Conditions.

Significant information concerning the internal condition of an engine may be obtained from an examination of the oil filters and magnetic plugs, for metal particle contamination. These checks may be sufficient to show that serious wear or breakdown has taken place and !hat !he engine is unacceptable for further service.

6.3 Oil Consumption.

Since the oil consumption of an engine may have increased towards the end of its normal overhaul period, an accurate check of the consumption over the last 10 flying hours would show whether it is likely to exceed the maximum recommended by the constructor, should the overhaul period be extended.

6.4 Compression Check.

Piston ring and cylinder wear, and poor valve sealing could, in addition to increasing oil consumption, result in a significant loss of power. A cylinder compression check is a method of determining, without major disassembly, the standard of sealing provided by the valves and piston rings.

6.4.1 On engines with a small number of cylinders a simple compression check may be carried out by rotating the engine by hand and noting the resistance to rotation as each cylinder passes through its compression stroke. The check should normally be made shortly after running the engine while a film of oil remains on the rubbing surfaces, to assist sealing and prevent scoring the working parts. If this is not possible, the constructor may recommend that oil is introduced into each cylinder and the engine turned through a number of revolutions before making the test.

(a) This method may be used to determine serious loss of compression on a single cylinder or the difference between the compressions of individual cylinders, but may not accurately show a similar partial loss of compression on all the cylinders of an engine.

(b) An alternative method which will give a more accurate result is to fit a pressure gauge (reading up to 1400 kPa (200 Ib./sq. in)) in place of one sparking plug in each cylinder in turn and note the reading as the piston passes through top dead centre (TDC) on the compression stroke.

6.4.2 Another method of carrying out a direct compression test is by use of a proprietary type compression tester equipped with a means of recording cylinder pressures on a graph card. One set of plugs should be removed immediately after an engine run, and the compression tester fitted to each cylinder in turn while rotating the engine by means of the starter motor. The effectiveness of combustion chamber sealing can be judged by assessment of the graph records obtained.

6.4.3 A further method of checking engine compression is the differential pressure test. In this test a regulated air supply (normally 560 kPa (80 Ib./sq. in)) is applied to each cylinder in turn and a pressure gauge used to record the actual air pressure in the cylinder. Since some leakage will normally occur, cylinder pressure will usually be less than supply pressure and the difference will be an indication of the conditions of the piston rings and valves. By listening for escaping air at the carburettor intake, exhaust and crankcase breather, a defective component may be located. As while the previous tests, it is usually recommended that the differential pressure test is carried out as soon as possible after running the engine.

NOTE: The crankshaft should be restrained during this test as, if the piston is not exactly at the end of its stroke, the test air pressure may be sufficient to cause rotation.

7. Power Output of Aeroplane Engines

The power developed by an aeroplane engine after initial installation is established in the form of a reference engine speed, which is recorded in the appropriate log book so that comparisons can be made during subsequent power checks. The reference engine speed is the observed engine speed obtained using specified power settings and operating conditions, corrected by means of graphs supplied by the engine constructer to the figure which would be obtained at standard sea-level atmospheric temperature and pressure; changes in humidity do not produce large changes in power and are ignored for the purpose of establishing a reference engine speed or subsequently checking engine power. Power checks should be carried out using the same power settings and operating conditions as when the reference engine speed was es1abJished, and should be corrected in the same way.

7.1 Power Checks.

The majority of light aeroplane piston engines are air-cooled and rely on an adequate flow of air for proper cooling of the cylinders. This condition can only be obtained during flight, and ground runs should, therefore, be as brief as possible. Cooling can be assisted by facing the aircraft into wind, but high wind conditions must be avoided when making power checks, as they will seriously affect the results obtained. Before running the engine at high power the normal operating temperatures should be obtained (not the minimum temperatures specified for operation) and during the test careful watch should be kept on oil and cylinder temperatures to prevent the appropriate limitations being exceeded.

7.1.1 Normally-aspirated engines are tested at full throttle and, where a controllable-pitch propeller is fitted, with maximum fine pitch selected. The changes in barometric pressure affecting engine power are considered to be balanced by changes in propeller load, so that only a temperature correction is necessary. This correction factor may be obtained from a graph supplied by the engine constructor. The observed full throttle speed multiplied by the correction factor will give the corrected speed.

7.1.2 Although normally-aspirated engines are often fitted with variable-pitch propellers, the engine speed obtained at full throttle is usually less than the governed speed and the propeller remains in fully fine pitch. With supercharged engines, however, the propeller is usually constant speeding at high power settings and small changes in power will not affect engine speed. The power of a supercharged engine is therefore, checked by establishing a reference speed at prescribed power settings.

(a) Since a supercharged engine is run at a specified manifold pressure regardless of the atmospheric pressure, corrections must be made for both temperature and pressure variations from the standard atmosphere.

(b) The procedure is to run the engine until normal operating temperatures are obtained, open up to maximum take-off manifold pressure, decrease power until a fall in engine speed occurs (denoting that the propeller blades are on their fine pitch stops), then throttle back to the manifold pressure prescribed by the constructor and observe the engine speed obtained.

(c) The correction factor to be applied to the observed engine speed of a supercharged engine may be obtained from graphs supplied by the engine constructor.

7.1.3 Although the engine speed obtained during a check of engine power is corrected as necessary for atmospheric temperature and pressure, no correction is made for humidity, ambient wind conditions or instrument errors and, consequently, the corrected engine speed is seldom exactly equal to the reference speed even if engine condition is unchanged. However, engine power may usually be considered satisfactory if the corrected speed obtained during a power check is within 3% of the reference speed.

7.1.4 If it is not possible to assess power deterioration by means of power check (e.g. due to fitting a different propeller), a rate-of-climb flight test should be carried out.

8. Power output of Helicopter Engines.

The power developed by the engine of a single-engined helicopter is considered to be adequately checked during normal operations; any loss of power should be readily apparent. It is thus not considered necessary separately to check the power output of a helicopter engine specifically for the purpose of complying with Airworthiness Notice No. 35.

9. Power loss.

If the power check (paragraph 7 of this Appendix) or normal engine operation reveal an unacceptable loss of power or rough running, it may be possible to rectify this by carrying out certain of the normal servicing operations or by replacement of components or equipment. The replacement of sparking plugs, resetting of tappets or magneto contact breaker points, or other adjustments to the ignition or carburetion systems, are all operations which may result in smoother running and improve engine power.

10. Servicing.

If the engine proves to be suitable for further service, then a number of servicing operations will normally be due, in accordance with the approved Maintenance Schedule. Unless carried out previously (paragraph 9 of this Appendix) these operations should be completed before the engine is returned to service.

11. Log Book Entries.

A record of the checks made, and any rectification or servicing work, must be entered and certified in the engine log book before the engine is cleared to service for its recommended or extended life under the provisions of Airworthiness Notice No. 35.