Democratic Socialist Republic of Sri Lanka

Civil Aviation Authority of Sri Lanka

Directive

(Issued under Sec. 121, Civil Aviation Act No. 14 of 2010)

Title: Light Aircraft Piston Engine Overhaul Periods

Reference No.: CA-Directive-2018-AW-003 S.N. : SLCAD-010 Date: 10th April 2018

Pursuant to Section 121 of the Civil Aviation Act No.14 of 2010, Director General of Civil Aviation shall have the power to issue, such directive for the purpose of giving effect to stated provisions of the Civil Aviation Act, any regulations or rules made thereunder including the Articles of the Convention on International Civil Aviation which are specified in the Schedule to the CA Act.

Accordingly, I, undersigned being the Director General of Civil Aviation do hereby issue the Directives as mentioned in the Attachment hereto (Ref: CA-Directive-2018-AW-003-Att-01) , for the purpose of giving effect to the provisions in the aforementioned Act and Standards & Procedures described under Article 37 and Article 41 of the Convention which are specified in the Attachment.

This Directive shall come into force with immediate effect and remain in force unless revoked.

Attention is also drawn to sec. 103 of the Act, which states inter alia that failure to comply with General Direction, issued by DGCA is an offence.

H.M.C. Nimalsiri
Director General of Civil Aviation and
Chief Executive Officer

Civil Aviation Authority of Sri Lanka
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Enclosure: Attachment No. : CA-Directive-2018-AW-003-Att-01

Directive

Title : Light Aircraft Piston Engine Overhaul Periods

1. Article 41 of the Air Navigation Regulations of 1955 (as amended) and IS Part M, Subpart C, M.A.302 require that aircraft registered in the Sri Lanka, for which a Certificate of Airworthiness (C of A) is in force, to be maintained in accordance with an approved Maintenance Programme. The instructions for continuing airworthiness requirements relating to overhaul of light aircraft piston engines are normally defined as the engine manufacturers' recommended overhaul periods, where these have been promulgated under a system approved by the airworthiness authority responsible for the engine. CAASL policy in respect of extensions to the recommended overhaul periods (operating time and calendar time) for piston engines used in light aircraft is set out in this Directive.

   The basis for this Directive is UK CAA CAP 747 GC 24 of 30 July 2016.

   NOTE:

   a) 'Light aircraft piston engine' in this context means either:

      i) a piston engine installed in an aircraft, the Maximum Take Off Weight of which does not exceed 2730 kg; or

      ii) a piston engine of 400 hp (298 kW) or less.

   b) For the purpose of this Directive 'engine' is as defined in the EASA's publication "CS-Definitions" and includes the components and equipment necessary for satisfactory functioning and control. The propeller and its associated equipment are excluded except for those components that are part of the engine type design.

   c) For the purpose of this Directive, the definitions of 'Public Transport', 'Aerial Work' and 'Private flight' shall be those of the Air Navigation Regulations (as amended).

2. It is emphasized that the CAASL has taken the decision to allow extension of recommended overhaul periods as defined in 3.1.1 and 3.1.2 on the basis of the effect on airworthiness only. The economics of operation is not the responsibility of the CAASL, although this may have been considered by the manufacturer in establishing the recommended overhaul periods. Aircraft Owners/Operators must make their own decisions on these other aspects. Unless satisfied that the engine remains in an airworthy condition, the Owner/ Operator should have the engine overhauled.

3. Continuation in service shall be subject to compliance with paragraph 3.1, as qualified by paragraphs 3.1.1 to 3.1.2, as appropriate.

   3.1 Unless otherwise stated, engines may be operated to the overhaul periods which have been recommended by the manufacturer and promulgated under a system approved by the airworthiness authority responsible for the engine. All such recommendations, whether stated in terms of operating time or calendar time, constitute a recommended overhaul period for the purposes of this Directive including recommendations by the

manufacturer for reduced overhaul periods with particular types of operation or particular service bulletin/modification configurations.

3.1.1 Under the provisions of this Directive, engines that have reached the operating time or calendar time limitation of a recommended overhaul period may continue in service for a further period of operation not exceeding 10% of the recommended operating time or calendar time, whichever occurs first, subject to compliance with a), b), c), d) e) and f).

a) Compliance being shown with the appropriate limitations specified in Appendix 1 paragraph 5, to this Directive.

b) Compliance being shown with any applicable Airworthiness Directive (AD) which requires compliance at engine overhaul, unless otherwise agreed by CAASL.

c) The engine must have been installed and operated in a SL-registered aircraft, and operated for a period of at least 200 hours immediately prior to completion of the engine manufacturer's recommended overhaul period expressed in hours, and 12 months prior to completion of the manufacturer's overhaul period expressed in terms of calendar time. For engines on aircraft transferring to the SL from operation on another State's register, where an engine manufacturer's recommended overhaul limit has already been exceeded, shall be subject to further assessment to determine DR 24 eligibility. Under such circumstances, engines will only qualify under this requirement where it can be demonstrated that the previous continued in service operation was in accordance with maintenance programme instructions issued by the Competent Authority of the exporting State.

d) The engine being inspected in accordance with paragraph 4 in order to assess its condition immediately prior to the increase, and subsequently at 100 hour or yearly intervals, whichever occurs first.

e) The data obtained during the inspections of paragraph 4 being entered in the engine log book.

3.1.2 Engines that have complied with paragraphs 3.1 and 3.1.1, and have completed 110% of the recommended operating time or calendar time, whichever occurs first, may continue in service indefinitely, subject to compliance with a), b), c) and d).

a) The engine being installed in an aircraft which is not used for the purposes of Public Transport or Aerial Work

b) Compliance being shown with the appropriate limitations specified in Appendix 1 paragraph 5, to this Directive.

c) The engine being inspected in accordance with paragraph 4 in order to assess its condition before exceeding 110% of the recommended operating time or calendar time, whichever occurs first, and subsequently being inspected and re-assessed at 100 hour or yearly intervals, whichever occurs first.

d) The data obtained during the inspections of paragraph 4 being entered in the engine log book. A log book entry should also be made to restrict engine usage during this extension period to flying for the purposes of Private Flight only.

3.2 In the event that the inspection referred to in paragraphs 3.1.1 and 3.1.2 results in rejection, a thorough engineering investigation must be carried out to establish the maintenance actions required to return the engine to an airworthy condition.

4. The inspections referred to in paragraphs 3.1.1 and 3.1.2 to assess the condition of engines shall be in accordance with Appendix 3 and shall be carried out by persons or Organizations as follows:

a) Engines installed in aircraft that are used for the purposes of Public Transport or Aerial Work by an SLCAIS -013 approved Operator under an Air Operators Certificate, shall, in order to comply with paragraph 3.1.1, be inspected by a IS -145 Maintenance Organization appropriately approved for the purpose.

b) All other engines, in order to comply with paragraph 3.1.1 and 3.1.2, shall be inspected by an appropriately licensed aircraft maintenance engineer or an Organization specifically approved for the purpose.

5. In no case shall any mandatory requirements be exceeded, and the compliance with mandatory bulletins/modifications/inspections shall be completed at the specified times.

If during the course of operating beyond the engine manufacturer's recommended overhaul limits in accordance with Directive No.SLCAD-010 the engine experiences a mechanical failure or inspection requirement necessitating full or significant partial engine disassembly, the organization performing the work should inspect the engine to determine if it is practicable to restore the engine to a serviceable condition without performing an overhaul. The results of the inspection should be recorded in the engine logbook.

Examples of activities requiring significant disassembly include propeller strike/shock load inspections and crankshaft/camshaft replacements for wear-related issues. Defects requiring replacement of individual cylinder and piston assemblies, and oil pump (where such work does not involve the removal/replacement of individual gears) are not included in the category of maintenance necessitating assessment.

6. In the case of engines not incorporating all the service bulletins/modifications or parts that would enable it to qualify for any manufacturer's recommended overhaul period as defined in paragraph 3.1 of this Directive or in the case of engine types not included in the manufacturers' bulletins, a specific statement of acceptability in writing must be sought from the engine manufacturer, and if this is not obtainable, an application must be made to the CAASL. The

CAASL need not be consulted in a case where the only question is that an engine manufacturer's documents restrict recommended overhaul periods to engines embodying only parts specified by the engine manufacturer. The CAASL will not require such restrictions to be applied provided that all parts are acceptable under Leaflet B110 of CAASLIP (CAP 562) for non-EASA aircraft or in accordance with Part M Subpart E for EASA aircraft, and there has been no adverse experience relating to the use of such parts.

7. For clarity, the requirements of paragraph 3 are presented in tabular form in Appendix 2.

Appendix 1 to Directive No. SLCAD - 010

1. The concept of allowing engines to run beyond the manufacturer's recommended overhaul period depends upon it being possible to assess 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.

2. Although it is possible to identify engine degradation in many areas of the engine, there are some potential failure modes (e.g. crankshaft cracking, counterweight wear) for which predictive checks would not be effective without engine disassembly.

3. For the above reasons, the overhaul period extensions defined in 3.1.1 and 3.1.2 of this Directive may not be applied unless adequate in service reliability has been demonstrated, particularly in relation to failures which cannot be prevented by on-wing inspection. Those engine types that are not eligible to make use of the provisions of this DR are detailed in paragraph 5.

4. The UK CAA has sought the advice of the manufacturers of the majority of the piston engines currently used in light aircraft to try to identify 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). Any limits identified are reflected in paragraph 5 below.

5. Limitations

5.1. The provisions of this DR are applicable to all light aircraft piston engines except where listed below: 5.1 Rolls-Royce (de Havilland) Gipsy Major Engines - Prior to running beyond 110% of the manufacturer'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 or appropriate alternative. In accordance with Rolls-Royce Technical News Sheet G15, engines must not exceed an overhaul period of 1000 hours unless Modification 2495 is embodied.

5.2. Rolls-Royce (de Havilland) Gipsy Engines - With effect from 1 January 2011, crankshafts fitted to engines on aircraft used for the purposes of Public Transport or Aerial Work must be fully inspected in accordance with the relevant overhaul manual workshop instructions at intervals not exceeding 20 years, if operating hours limits requiring overhaul are not achieved within this period.

5.3. The following engine types have yet to accumulate sufficient service experience to demonstrate acceptable reliability when operating at the manufacturer's recommended overhaul period. The provisions of this DR are not applicable to:

a) Societe de Motorisations Aeronautique - All types;

b) Rotax - All types, except when installed in self-launching or self-sustaining sailplanes;

c) Thielert Centurion Engines - All types;

d) Mid-West Engines - All types.

Appendix 2 to Directive No. SLCAD - 010

Light Aircraft Piston Engine Overhaul Periods

	Aircraft used for the purposes of Public Transport or Aerial Work	**Aircraft not used for the purposes of Public Transport or Aerial Work (i.e. used for Private flight only)**
Within Recommended Overhaul Period	Manufacturer's recommended overhaul period, defined in operating time and calendar time (if applicable), provided the engine conforms to appropriate service bulletin/modification configuration and types of operation. (Otherwise see paragraph 6 of this DR)	
Extensions not exceeding 10% of Recommended Overhaul Period (operating time and calendar time)	Acceptable subject to: Compliance with Appendix 1 paragraph 5 to this DR. Compliance with all applicable ADs required to be incorporated at engine overhaul. Inspections in accordance with paragraph 4 of this DR at completion of recommended overhaul period (operating time or calendar time) and then at 100 hour or yearly intervals, whichever occurs first. The engine must have been installed and operated in a SL registered aircraft for a period of 200 hours prior to completion of the engine manufacturer's recommended overhaul period.	
Extensions in excess of 10% of Recommended Overhaul Period	No further extension (In exceptional circumstances, CAASL may consider applications for extension for a limited period to address an urgent operational need).	Engines may continue in service indefinitely subject to: a) Compliance with Appendix 1 to this DR. b) Further inspection in accordance with paragraph 4 of this DR at 110% and then

		at 100 hour or yearly intervals, whichever occurs first.

NOTE:

This Table is intended for easy reference only; for detail the main text of this Directive applies.

Appendix 3 to Directive No. SLCAD - 010

Light Aircraft Piston Engine Maintenance Requirements for Operation beyond Manufacturers' Recommended Overhaul Periods

1. This Appendix gives guidance on the procedures which are necessary for a light aircraft piston engine to be accepted as being in a condition that will allow operation beyond the recommended overhaul period under the terms of this Directive.

2. A piston engine that has reached the end of its normal overhaul period may be expected to have suffered some wear to cylinders, pistons, valves, bearings and other moving parts, but an engine that has been carefully operated and maintained may still be in a condition suitable for a further period of service.

2.1 Many factors affect the wear that takes place in an engine, the most important of these include: the efficiency of the air intake filter, the techniques used in engine handling, particularly during starting, the quality of the fuel and oil used in the engine and the conditions under which the aircraft is housed when not in use. Conditions of operation are also relevant; the length of flights, the atmospheric conditions during flight and on the ground, and the type of flying undertaken. Many of these factors are outside the province of the maintenance engineer, but meticulous compliance with the approved Maintenance Programme and any instructions provided in the form of service bulletins or constructor's recommendations will undoubtedly help to prolong the life of an engine.

2.2 The inspections and tests that may be necessary to assess the condition of an engine in compliance with this DR are detailed in the following paragraphs.

3. Inspection and Maintenance

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.

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

3.2 Internal Condition. 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 that the engine is unacceptable for further service.

3.3 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, if the overhaul period were to be extended.

3.4 Compression Check. Piston ring or cylinder wear, or 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. This should be carried out in accordance with the manufacturer's recommendations. In the absence of any published recommendations for a particular engine type, one of the methods of 3.4.1 to 3.4.3 should be used.

3.4.1 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.

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.

An alternative method, which will give a more accurate result, is to fit a pressure gauge (reading up to 1400 kPa (200 lbf/in2)) 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.

3.4.2 Another method of carrying out a direct compression test is by the use of a proprietary type of compression tester equipped with a means of recording cylinder pressure 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 charge sealing can be judged by assessment of the graph records obtained.

3.4.3 A further method of checking engine compression is the differential pressure test. In this test a regulated air supply (normally 560kPa (80 lbf/in2)) 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 condition 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 with the previous tests, it is usually recommended that the differential pressure test is carried out as soon as possible after running the engine.

4. Power Output of Aero plane 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 a comparison can be made during subsequent power checks. The reference engine speed is the observed engine speed obtained using specified power settings and conditions, corrected, by means of graphs supplied by the engine constructor (or those contained in Civil Aircraft Airworthiness Information and Procedures (CAASLIP), CAP 562, Leaflet 70-70 Piston Engine Overhaul - Correcting Engine Test Results), to the figure which would be obtained at standard sea-level atmospheric temperature and pressure; changes in humidity do not produce large changes of power and are ignored for the purpose of establishing a reference engine speed or subsequently checking engine power. Power checks should be corrected in the same way.

4.1 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 significantly 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.

4.1.1 Normally-aspirated engines are tested at full throttle and, where a controllable-pitch propeller is fitted, with fully 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 or, if this is not available, from the graph shown in CAASLIP (CAP 562) Leaflet 70-70 Piston Engine Overhaul - Correcting Engine Test Results (Figure 1). The observed full throttle speed multiplied by the correction factor will give the corrected speed.

4.1.2 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 governed to a constant speed 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.

4.1.3 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.

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

5. 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 to check the power output of a helicopter engine separately specifically for the purpose of complying with this DR.

6. Power Loss

If the power check (paragraph 4) or normal engine operation reveal an unacceptable loss of power or rough running, it may be possible to rectify this by carrying out certain 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 that may result in smoother running and improve engine power.

7. Servicing

If the engine proves to be suitable for further service, a number of servicing operations will normally be due, in accordance with the approved Maintenance Programme. Unless carried out previously (paragraph 6) these operations should be completed before the engine is returned to service.

8. 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 provision of this DR. The log book entry made should also specify any restriction on further use (see paragraph 3.1.2 of this Directive).

9. Maintenance Schedule and Programme Amendments

The aircraft maintenance programme should reflect the maintenance requirements required and their periodicity, to operate the aircraft engine beyond its recommended overhaul period as detailed in this Directive.