Inspectie Verkeer en Waterstaat
Ministerie van Verkeer en Waterstaat

Maintenance Directive

NL-2010-001

THIS MAINTENANCE DIRECTIVE IS PUBLISHED BY THE CAA-NL: • Acting as Airworthiness Authority (ICAO Annex 8) as the State of Registry	
Type Approval Holder's Name	Not applicable
Supersedure	Supersedes OAL 1987-30/4 dated 30 November 2001 for the aircraft to which this MD applies, ref. Applicability
Subject	**Maintenance –On Condition Maintenance**
Manufacturer(s)	All
Applicability	All Dutch registered aircraft: 1. with an EASA CofA, or 2. with an ICAO Standard CofA, for which on condition maintenance (O/C) is applied instead of any hard time interval specified by the TC-holder.
TCDS number	Not applicable
Reason	With the entry into force of Part-M for non-commercial air transport on 28 September 2009 the regulations regarding Aircraft Maintenance Programs (AMP) have changed. At that time also it had become apparent to CAA-NL that a substantial number of O/C programmes did not meet the intent of the then current regulations, either because of poor programme content, poor execution or both. Therefore, in order for CAA-NL to continue supporting the O/C maintenance concept, changes were required. This directive is issued in order to 1. align the requirements for O/C programmes with the new European context, 2. provide in more detail requirements for O/C programmes and 3. provide guidance and acceptable means of compliance for O/C programmes.

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Caution
This Maintenance Directive is issued by the Minister of Transport, Public Works and Water Management in accordance with the Aviation Act 2001 (Wet Luchtvaart), Article 3.22. Maintenance Directives affect aviation safety. These are regulations which require immediate attention. No person may operate an aircraft to which a Maintenance Directive applies, except in accordance with the requirements thereof, unless otherwise agreed with the Authority of the State of Registry (EC2042/2003, M.A.201 & M.A.302 and M.A.303).

	Note: The Dutch "Besluit Luchtvaartuigen" in article 12.1 mandates EC 2042/2003 Annex I (Part-M) compliance with respect to maintenance, of Dutch registered aircraft with an ICAO-standard CofA. Part M, in M.A.302(d)(i) states that the competent authority may issue instructions that the AMP must establish compliance with. This MD is issued to provide flexibility to operators, in line with AMC M.A.302(d)2. It provides a framework for alternative instructions that needs to be complied with in case O/C is applied instead of hard time intervals specified by the TC-holder. If an O/C programme is applied, then the AMP needs to include the O/C programme, refer to M.A.302(d)(iii).
Effective date	01 July 2010
Compliance	On Condition Maintenance shall comply with the requirements as published in Appendix B of this MD, when applied as an alternative to TC-holder instructions.
Appendix A	Application and Approval
Appendix B	On Condition Maintenance Requirements
Appendix C	Acceptable Means of Compliance and Guidance Material

Appendix A: Application and Approval

1. Approval
Only CAA-NL may approve O/C programmes for PH-registered aircraft.

Generic approvals may be issued for types or groups of aircraft or components. The CAA-NL approval, which specifically refers to the O/C programme and specifies any limitations and conditions, is then considered to be 'approved data'. This means that a CAMO with the privilege to indirectly approve AMP's for PH-registered aircraft may incorporate such approved O/C programme in an AMP for an aircraft for which it is approved, without further CAA-NL involvement.

The owner/operator may contract a CAMO to set up and control an O/C programme, except in cases where the operator is required to have its own CAMO-approval. When a CAMO is contracted, the CAMO takes over the responsibility from the owner for the tasks contracted. It must be noted, however, that the responsibility for the use of O/C programmes instead of hard time intervals specified by the TC-holder remains with the owner/operator.

2. Application
Application for approval of O/C programmes should be submitted to CAA-NL using the specific application form 'Aanvraagformulier Alternative Maintenance' as provided by CAA-NL via the CAA-NL website (www.ivw.nl). Substantiating documentation must be included.

CAA-NL will charge fees in accordance with the Regeling Tarieven Luchtvaart (www.ivw.nl) for the handling of O/C programme approval applications.

It is possible to apply for a generic approval for a certain type and/or model of aircraft or for several registrations. The application must specify the range of the approval applied for and substantiation must be provided to cover that range.

If you are considering applying for an O/C programme, you are advised to check first if already a generic approval exists for your configuration and utilisation. On the CAA-NL website you will find the list of approvals issued: "Lijst met goedgekeurde On-Condition Programma's". If your aircraft complies with the conditions of such approval (approval range, utilisation, configuration), then you could contact the O/C programme approval holder, who is also indicated in the same list.

3. Temporary exemption
Temporary approval until 01 January 2011 may be provided for O/C programmes that are not fully compliant, if this is deemed justified by CAA-NL.

Appendix B: On Condition Maintenance Requirements

1. General Requirements

a) The content of the O/C programme substitutes specific instructions from the TC-holder, as indicated in the O/C programme; all other instructions must be complied with.

b) The O/C programme(s) must be incorporated in the aircraft AMP:
- In the preface section of the AMP all deviations from TC-holder's instructions, which includes the use of O/C, must be specifically stated.
- The additional instructions that replace the TC-holder's instructions must be included in the relevant task lists. Note that the replaced TC-holder's instructions must be removed from the AMP.
- The O/C programme approval must be included in the list of source documents.
  Note: the approval refers to the specific O/C programme.
- Any limitations or conditions specified in the O/C programme approval must be incorporated in the AMP.

c) Directives of the competent Authority have to be executed as intended. For example: An Airworthiness Directive which should be executed at the first overhaul, should be executed at the time (flight hours, cycles, etc.) or date that the overhaul should have taken place according to the design holder's instructions.

d) Airworthiness Limitations may not be replaced by O/C programmes under this Directive. Deviations from Airworthiness Limitations require EASA approval.

e) The person or organisation managing the AMP agrees to the use of the specified O/C programme. N.B.: CAA-NL approval of the O/C programme does not relieve the owner/operator from ensuring that the O/C programme meets the needs of the aircraft.

f) The condition determination must be such that, with a reasonable certainty, it is established if the component will remain airworthy until the next periodic condition determination.

g) If, during application of the O/C programme, it cannot be established with a reasonable certainty that the component will remain airworthy until the next periodic condition determination, then maintenance action is required to:
- ensure, through additional maintenance action, the airworthiness until the next periodic condition determination, or
- to replace the component.

  Note: when the component deterioration cannot be attributed to anything other than normal wear, then the O/C programme should be terminated for this component and the component should be replaced for overhaul. Normal wear takes place throughout the component; replacing only the monitored parts does not keep components in service indefinitely.

h) When an AMP containing an O/C programme has been approved by a CAMO, the CAMO must be able to show (a copy of) the O/C programme approval.

i) When an AMP containing an O/C programme has been approved by CAA-NL, the aircraft owner must be able to show (a copy of) the O/C programme approval.

2. Technical Requirements

The following failure conditions must be accounted for:

a) Fatigue;
b) Wear;
c) Material degradation (corrosion, drying out, hardening, etc.).

3. Trend Monitoring Requirements

If use is made of trend monitoring, then the following must be taken into account:

a) In some cases obtaining the data to be analysed may not be feasible prior to release to service of the aircraft. This may be the case if special tools, equipment and/or skills are required, for example when use is made of Spectrographic Oil Analysis. If it is technically justifiable to release the aircraft to service before the data is available and the analysis is performed, then the O/C programme should specify this, and include a maximum time between release to service and subsequent analysis of the data. Obtaining the sample may require maintenance action, which requires a release to service. Analysis of the data to establish if the component can be allowed to continue in operation until the next analysis can be regarded as another (type of) release to service. Both tasks are required.
b) Trend analysis needs to be performed by an organisation or person competent to perform such monitoring. Note that this is a specialist task.
c) Evidence of their involvement and responsibility is to be provided by signing off on each sample analysis, in such a way that the person signing can be identified.
d) Note that when a CAMO is contracted, the responsibility already rests with that CAMO.
e) Sample and trend data and the required follow-up actions are part of the aircraft technical records.
f) Individual samples of which the trend is composed must be comparable; effects on the trend of different circumstances, such as aircraft utilisation, must be taken into account in the analysis.
g) The aircraft technical records must link the analysis and the corresponding, subsequent actions.

Appendix C: Acceptable Means of Compliance and Guidance Material

0. GM Acceptable Means of Compliance

By complying with the AMC the corresponding requirement is considered complied with. Deviations may be accepted by CAA-NL, provided that the applicant demonstrates that an equivalent level of safety is obtained.

1. GM Abbreviations

AD	Airworthiness Directive
AMC	Acceptable Means of Compliance
AML	Aircraft Maintenance License
AMP	Aircraft Maintenance Programme
AIC-B	Aeronautical Information Circular-B
BvL	Bewijs van Luchtwaardigheid (Certificate of Airworthiness)
CAA-NL	Civil Aviation Authority of The Netherlands
CAMO	Continuing Airworthiness Management Organization
CofA	Certificate of Airworthiness
EASA	European Aviation Safety Agency
GM	Guidance Material
ICAO	International Civil Aviation Organisation
MD	Maintenance Directive
O/C	On Condition Maintenance
TC	Type Certificate
TCDS	Type Certificate Data Sheet
w.o.f.	whichever occurs first

2. GM Alternative Maintenance

Alternative maintenance can consist of (a combination of) the following elements:

a) On Condition: hard-time intervals for restoration tasks (such as overhaul) are replaced by maintenance based on condition determination.
b) Escalation: interval increase, without changes to maintenance task content. Refer to EASA Maintenance Review Board Steering Committee International Policy IP44 for escalation guidelines.
c) Changes to maintenance task content, resulting in an equivalent or improved maintenance standard. Refer also to 145.A.45(d).
d) Alleviation of maintenance requirements justified by decreasing the effects of possible failure, through utilisation limitations, adding system redundancy, etc.

CAA-NL uses one application form for alternative maintenance approval, enabling also applications for approval of combinations of alternative maintenance elements.

This Directive only deals with on condition maintenance.

3. GM On Condition Maintenance, Definition

On Condition Maintenance (O/C) is the maintenance philosophy in which:

a) the condition of a component is periodically determined, and
b) during such condition determination it is established that the component will not fail before the next periodic condition determination.

If O/C is applied instead of hard time intervals specified by the TC-holder, then it may be required to perform additional maintenance tasks, other than the periodic monitoring mentioned above, in order to ensure continuing airworthiness. The instructions for this periodic monitoring and, as applicable, for the additionally required maintenance tasks are referred to as “O/C programme” in this publication.

N.B.:

- In some cases the TC-holder provides an O/C programme, as part of its instructions for continuing airworthiness. This publication does not apply to such cases, but only addresses situations where one deviates from TC-holder instructions.
- O/C aims to prevent component failure, the same as the hard time interval it replaces. It therefore fundamentally differs from Condition Monitoring, where component failure is allowed. Obviously, applying the Condition Monitoring philosophy to flight critical systems is not allowed.

4. AMC Components excluded from O/C

	Component Excluded	Reason
1	Fuel injection system	No reliable condition determination is known to CAA-NL.
2	Constant-speed (variable pitch) propellers and constant-speed propeller parts and systems.	Critical failures can develop from the inside. No reliable condition determination is known to CAA-NL.
3	Fixed pitch metal blade propellers	All O/C programmes known to CAA-NL basically contain the same instructions as applicable to overhaul, therefore no added value.
4	Flexible hoses carrying flammable liquids.	Critical failures can develop from the inside. No reliable condition determination is known to CAA-NL.
5	Pitot Static System (incl. flexible hoses)	No reliable condition determination is known to CAA-NL.

5. AMC Piston Engines for which O/C is permitted

The following engines are allowed on O/C programmes:

1	Lycoming, Textron: all engines
2	Teledyne Continental Motors (TCM): all engines
3	Rolls-Royce (de Havilland) Gipsy Major, under the following conditions: i. 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. ii. In accordance with Rolls-Royce technical News Sheet G15, engines must not exceed an overhaul period of 1000 hours unless Modification 2495 is embodied.

Other engine types have yet to (accumulate sufficient service experience to) demonstrate acceptable reliability when operating at the manufacturer’s recommended overhaul period.

6. AMC to Requirements

6.1 AMC to General Requirements
Ad e) This agreement is implicitly provided by accepting responsibility for the AMP.

6.2 AMC to Technical Requirements
a) Fatigue is managed through Airworthiness Limitations (life limits). Complying with these Airworthiness Limitations is considered sufficient to adequately address fatigue.

b) Below, O/C programmes are provided for various components, which are accepted by CAA-NL when applied together with the Airworthiness Limitations as well as any other instructions for continuing airworthiness issued by the TC-holder, other than overhaul.

For many of the tasks listed below, the TC-holder may have already provided instructions and intervals. The most restrictive, of the TC-holder intervals / instructions and the ones listed below, must be applied.

Note that many of the tasks listed below must also be complied with, when the component is not maintained on an O/C programme. Please observe the TC-holder's manuals and service publications to keep the aircraft, including its components, in good condition.

Component

	Task	**Interval**	**Details and Remarks**
Engine			
1	Operate engine in flight	1 flight of 1 hour duration each month as a minimum	Engine deterioration in the form of corrosion (rust) and the drying out and hardening of composition materials such as gaskets, seals, flexible hoses and fuel pump diaphragms can occur if an engine is out of service for an extended period of time. [1] This utilisation requirement must be stated in the AMP.
2	Operate engine in flight	15 hours per 6 months as a minimum	Engine reliability and the possibilities for adequate engine monitoring are adversely affected when engine utilisation is lowered. Therefore, for operations beyond TC-holders recommended overhaul intervals, in the AMP the aircraft utilisation must be set with a minimum as stated on the left.
3	Oil Change	50 flight hours or 6 months, w.o.f.	Oil degrades over time and gets contaminated with particles during engine operation.

[1] Lycoming Service Instruction No. 1009

4	External Condition Inspection	50 flight hours or 6 months, w.o.f.	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.
5	Examination of oil filters and magnetic plugs	50 flight hours or 6 months, w.o.f.	Such examination may be sufficient to show that serious wear or breakdown has taken place and that the engine is unacceptable for further use. [1]
6	Oil contamination check by means of oil analysis	50 flight hours or 6 months, w.o.f.	Particle content is determined for various materials, which provides indication of specific engine wear. Requirements: a) At least 10 flight hours are required per oil sample, to ensure representative data. b) Analyse the trends for the various materials' particle content to detect anomalies. Besides trending the individual material's particle content, also trending the ratios between the contents of the various materials provides valuable information and should be included. Note: several organisations monitor large numbers of engines and are able to compare individual results with a fleet average, enabling an even more reliable analysis. c) Trend analysis and determination of follow-up action (which may include maintenance action to further determine the condition), must have been accomplished before the next sample is taken. d) Refer to manufacturer data for additional criteria or guidelines.
7	Oil consumption analysis	50 flight hours or 6 months, w.o.f.	If engine wear increases oil consumption usually increases. Tasks: a) Ensure that the maximum absolute value is not exceeded; and b) Monitor the trend to detect anomalies.
8	Differential compression test or "dynamic" compression test	50 flight hours or 6 months, w.o.f.	Tasks: a) Ensure that the minimum and maximum absolute values and ratios are not exceeded; and b) Monitor the trend to detect anomalies to the individual cylinders, pistons and valves.
9	Power check	50 flight hours or 6 months, w.o.f.	Tasks: a) Monitor the trend of maximum obtained power to detect anomalies. b) Monitor the trend of at least one parameter that indicates carburettor dynamic performance, if the carburettor is included in the O/C programme. c) Check the engine for smooth and constant running throughout the power check.

Notes:

a) These requirements are not applicable for periods during which the engine is preserved in accordance with the TC-holder's instructions. Such preservation must be recorded in the relevant logbook.
b) For non-direct drive engines (geared engines) additional tasks need to be incorporated to cover the additional gearbox failure modes.

6.3 AMC to Trend Monitoring Requirements

Ad b) The continuing airworthiness of the aircraft is managed by an organisation approved in accordance with Part M Subpart G (a CAMO), or, when the use of a CAMO for the continuing airworthiness management is optional:
The analyses are performed, and follow-up action is decided, by an organisation approved in accordance with Part-145, or Part M Subpart F, and endorsed for the aircraft type concerned, or by a person holding a Part-66 AML endorsed for the aircraft type concerned.

For trend analyses a minimum number of 6 samples is required.

- So if the O/C programme includes trend monitoring, then the O/C programme must be started at least 6 appropriate samples before the maintenance task that is replaced by the O/C programme was due to be performed according to the design holder's instructions. In this initial period no minimum number of samples for trend analysis applies.
- The trend data must clearly show the trend and must be kept together for at least the last 6 samples.

Note that, to adequately address all Appendix B.2 failure causes, the use of trend monitoring as an element in the O/C programme is hardly avoidable.