



Australian Government
Civil Aviation Safety Authority

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Magnetic particle inspection of engine components as per AD/ENG/4

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This Civil Aviation Advisory Publication (CAAP) provides guidance, interpretation and explanation on complying with the Civil Aviation Regulations 1988 (CAR) or a Civil Aviation Order (CAO).

This CAAP provides advisory information to the aviation industry in support of a particular CAR or CAO. Ordinarily, the CAAP will provide additional 'how to' information not found in the source CAR, or elsewhere.

Civil Aviation Advisory Publications should always be read in conjunction with the relevant regulations/orders.

Purpose

This Civil Aviation Advisory Publication (CAAP) provides guidance and information as to the applicability of SI 1285B with regard to AD/ENG/4 Amdt 7 and the use of CAO 108.8 to satisfy the requirements of SI 1285B.

For further information

For further information on this CAAP, contact CASA's Airworthiness and Engineering Branch (telephone 131 757).

Status

This version of the CAAP is approved by the Branch Manager, Airworthiness and Engineering.

Note: Changes made in the current version are not annotated. The document should be read in full.

Version	Date	Details
v1.1	November 2022	Administrative review only.
(0)	March 2001	Initial CAAP.

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1 Reference material

1.1 References

Legislation

Legislation is available on the Federal Register of Legislation website <https://www.legislation.gov.au/>

Document	Title
CAO (ANO) Part 108, Section 108.8, AD/ENG/4 Amdt 7 dated 11/98.	Process Control — Magnetic Particle Inspection, dated 1 September 1971

Other

Document	Title
Australian Standard AS 1171 — 1998	Non-destructive testing — ferromagnetic products, components and structures
Textron Lycoming Service Instructions	<ul style="list-style-type: none">• Textron Lycoming Service Instruction No.1285 dated 5 October 1973 (SI 1285)• Textron Lycoming Service Instruction No.1285A dated 5 March 1993 (SI 1285A)• Textron Lycoming Service Instruction No.1285B dated 23 May 1997 (SI 1285B)

2 Preamble

- 2.1.1 It is a requirement of the regulation 42V of CAR 1988 that “a person carrying out maintenance on an Australian aircraft must ensure that the maintenance is carried out in accordance with approved maintenance data”. Aero engines are maintained and overhauled in accordance with either the manufacturers published engine maintenance requirements, or, in accordance with an approved system of maintenance. This also applies to NDI requirements.
- 2.1.2 Most engine manufacturers have, in the past, produced NDI procedures for the inspection of their engines. Many of these procedures contained excellent illustrations and comprehensive detail for the person to conduct inspections. However, it is becoming increasing common for the manufacturers to withdraw such procedures, and to direct the owners of the aircraft, via Service Instructions etc., to contract a suitably qualified person (generally a NDI Level II or III) to develop and approve (a delegate under subregulation 2A(4) of CAR 1988) written NDI procedures for the inspection of engine components. Only the manufacturer or a CASA delegate may approve such procedures for use as “approved data”. CASA or a delegate may approve such procedures under subregulation 2A (4).
- 2.1.3 In the absence of manufacturers procedures, CASA has in the past permitted, and, in some cases have advised the use of CAO 108.8. The use of Annex 1 to CAO 108.8 as “approved data “for magnetic particle inspection is no longer permitted. Legal advice suggests that Annex 1 to CAO 108.8 does not constitute an approved procedure and has not been formally approved for use as “approved maintenance data”.
- 2.1.4 Textron Lycoming is one of the manufacturers who has withdrawn NDI procedures from their overhaul and repair manuals and is requiring the aircraft owner to have procedures developed and approved. This removes, from the manufacturer, some responsibility in the event that after inspection, a failure occurs. A brief description of how CASA has examined and dealt with the issues raised by the absence of manufacturers procedures and the use CAO 108.8 are further explained in this CAAP.

3 Background

3.1.1 In October 1973, Textron Lycoming issued Service Instruction No. 1285. This SI contained NDI information suitable for the magnetic particle inspection of the main ferrous engine components contained in “all Avco Lycoming engines”. Contained within the SI was the following statement:

“The following list is intended to provide a guide for magnetic particle inspection of various steel parts used in Avco Lycoming engines”.

3.1.2 SI 1285 was superseded by SI 1285A, issued in March 1993, which contained changes to the recommended inspection current values (amperes). In the broadest sense of the definition, SI 1285 and SI 1285A could be described as techniques/procedures.

3.1.3 SI 1285A was superseded on 23 May 1997 by SI 1285B which removed all references to individual components, direction of magnetisation and amperes.

3.1.4 Personnel qualifications cited in SI 1285B requires inspection techniques/ procedures, “be approved by a person who is qualified and certified to Level III, in accordance with ASNT Personnel Qualification SNT-TC-1A or MIL-STD-410.”

3.1.5 As a consequence of the issue of SI 1285B engine maintenance organisations, often on advice of the Authority (CASA), used CAO 108.8 as an approved procedure, quoting requirement 5.1 of CAO 108.8 as justification.

3.1.6 Requirement 5.1 of CAO 108.8 reads:

“The inspection procedures used for a given inspection shall be in accordance with those specified in the relevant Air Navigation Order or approved maintenance document. When no inspection procedures are specified in these documents, Appendix 1 to this section constitutes approved procedures”.

3.1.7 When CAO 108.8 was developed and issued in 1971 by the predecessor of the current Authority, the author was qualified as an NDI level II person not an NDI level III person.

3.1.8 In October 1990, in a CASA (then CAA) Specialist Report No. X14-90, the author of CAO 108.8 wrote the following:

“CAO 108.8 (which is obsolescent) permits an inspector to compute the required magnetising values for parts of an essentially simple shape. This was intended to assist small GA organisations in avoiding having to apply for procedures for simple parts such as wheel bolts”.

3.1.9 CAO 108.8 was not intended to be used for complex components such as crankshafts, camshafts, conrods etc.

3.1.10 The issue of CASA Airworthiness Directive AD/ENG/4 Amdt 7 in November 1998 carried the following requirements:

“Para 2.5. Magnetic Particle Inspection - At each engine overhaul, major ferrous components, as listed in the engine manufacturer’s published overhaul procedures, shall be subjected to a magnetic particle inspection (MPI) in accordance with the engine manufacturers published MPI procedure.”

4 The question of compliance

4.1.1 The question has been raised by a number of engine overhaul organisations as to the validity of CAO 108.8 in satisfying the requirements of SI 1285B and subsequently the issue of compliance with AD/ENG/4.

4.1.2 Advice from the CASA legal office is, CAO 108.8 does not meet the requirements of SI 1285B and consequently if CAO 108.8 has been used, AD/ENG/4 has not been complied with.

Compliance with AD/ENG/4 is mandatory.

4.1.3 The Authority has in the past, advised industry to use CAO 108.8 to satisfy the requirements of SI 1285B and AD/ENG/4. Obviously many organisations followed this advice and used CAO 108.8. CAO108.8 has not been “independently approved by a Level III person.”

4.1.4 The Authority has approved procedures under subregulation 2A (4) of the Civil Aviation Regulations 1988 (CAR 1988) as “approved maintenance data”, for Lycoming engines, which will comply with the requirements of AD/ENG/4.

4.1.5 Approved procedures for Lycoming engines are available from:

Australian NDT Services

20 Morwell Road,
Morwell
Victoria 3840
Telephone: (03) 5134 8255
Fax: (03) 5133 7752

Aerospace NDI Pty Ltd

76 Goddard Street
Lathlain
WA 6100
Telephone/Fax: (08) 9361 1907
Mobile: 0418 943 285

ETRS Pty Ltd

40 Reginald Street
Rocklea
Brisbane
Qld 4106
Telephone: (07) 3275 2633
Fax: (07) 3277 3823

4.1.6 Approved procedures for engines other than Lycoming may also be available from the above companies.

4.1.7 Other NDT organisations may apply to have procedures approved by the CASA NDI Level III person and a delegate under subregulation 2A (4) of CAR 1988 by contacting their local CASA office for details.

5 What are the consequences of this determination?

- 5.1.1 It is considered likely that many of the Lycoming engines which have been overhauled in Australia since the issue of AD/ENG/4 Amdt 7, in November 1998, do not comply with the requirements of SI 1285B and consequently do not comply with the requirements of the AD.
- 5.1.2 It could be reasoned that if an airworthiness problem exists, a large number of engine failures would be occurring, or that statistically the number of component failures relating to Lycoming Engines would be greater than for comparable engines.
- 5.1.3 A search of the CASA Major Defect Reporting (MDR) system indicates that this is not the case. Therefore it appears that no “safety of flight” issue has resulted, however, we need to address the administrative and legal aspects of the issue by using correctly approved procedures.

6 The future

- 6.1.1 The introduction of the new CASA regulations, will permit suitably qualified and experienced persons to be appointed as NDI Aircraft Engineering Representatives (AERs). NDI AERs will effectively act as Level III persons for General Aviation. Some AERs will be permitted to develop and approve procedures for NDI as a representative of the Authority as per CASR Part 183. These changes will ensure NDI services can be delivered to industry in a more efficient and timely manner.
- 6.1.2 Many of the current ADs, including AD/ENG/4 Amdt 7 are under review by CASA.
- 6.1.3 CAO 108.8 will be replaced by Australian Standard AS 1171- 1998, titled, Non-destructive Testing - ferromagnetic products, components and structures.

Warning:

The use of contact prods for the current flow method, as described in AS 1171 - 1998, is strictly forbidden for use on aircraft structure and aircraft components. Electrical arcing between the aircraft structure and/or component and the prod tip can result in defects such as to render the part unserviceable.

7 In conclusion

- 7.1.1 Compliance with AD/ENG/4 Amdt 7 is mandatory.
- 7.1.2 CAO 108.8 cannot be used as a written procedure, as required by SI 1285B, to satisfy the requirements of AD/ENG/4 Amdt 7.
- 7.1.3 Procedures which have been approved by CASA and meet the requirements of both SI 1285B and AD/ENG/4 Amdt 7 are available from the companies listed in para 3.5 of this document.
- 7.1.4 There appears to be no safety of flight issue.
- 7.1.5 CAO 108.8 will be replaced by Australian Standard AS 1171 – 1998, titled, Non-destructive Testing – ferromagnetic products, components and structures. The use of contact prods for the current flow method, as described in AS 1171 – 1998, is strictly forbidden for use on aircraft structure and aircraft components.
- 7.1.6 In the absence of manufacturer’s written procedures, all engines covered by the “Applicability” section of AD/ENG/4 Amdt 7 will be required to have written procedures developed and approved for magnetic particle inspection of components.