
PROPOSED AIRWORTHINESS DIRECTIVE

This Proposed Airworthiness Directive (PAD) is issued by the Civil Aviation Safety Authority with a view to address the unsafe condition detailed below. The Airworthiness Directive (AD) will require that the action set out in the requirement section (being action that the delegate considers necessary to correct the unsafe condition) be taken in relation to the aircraft or aeronautical product mentioned in the applicability section: (a) in the circumstances mentioned in the requirement section; and (b) in accordance with the instructions set out in the requirement section; and (c) at the time mentioned in the compliance section.

Aircraft - General

PAD/GENERAL/87 Amdt 1

Primary Flight Control Cable Terminals - Detailed Visual Inspections

Applicability: All aircraft fitted with primary flight control cable assemblies using swaged terminal fittings made from SAE-AISI 303 Se or SAE-AISI 304 stainless steel, except those aircraft:

- (a) Certificated in the Transport Category (FAR 25/CS-25), or
- (b) Whose approved maintenance schedule or system of maintenance makes provision for detailed inspections of cable end terminals equivalent to the intent of this airworthiness directive (AD), and which use the inspection interval specified by the aircraft manufacturer.

Note 1: Primary Flight Controls control the aircraft around the pitch, roll and yaw axis.

Note 2: Detailed Inspection means: An intensive examination to detect damage, failure or irregularity (including corrosion). Available lighting is normally supplemented with a direct source of good lighting. Inspection aids such as mirrors, magnifying lenses, borescopes etc. may be necessary. Surface cleaning may be required.

- Requirements:
1. Primary flight control cable terminal inspection, by:
 - a) Preparing each cable terminal for inspection by:
 - i. Removal of any safety lock-wire/clips, rubber sleeves, tape or any coverings on the stainless steel swaged terminals, and
 - ii. Cleaning the surface of the terminals as necessary to remove any contaminants on the surface prior to their inspection.
 - b) Examining each cable terminal using a 10X magnifier or borescope, looking for any pitting corrosion or damage.
 2. Repeat the inspection detailed in Requirement 1 of this AD.
 3. Remove from service any primary flight control cable assembly which is found to have any evidence of pitting corrosion or cracking on its cable terminal.
 4. Report to CASA any defects found during compliance with this AD using the CASA Defect Reporting System.

Aircraft - General

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Note 3: Refer to the applicable aircraft manufacturer's maintenance manual for cable tensions and additional information, procedures and cautions relevant to the aircraft type. In some cases, disassembly of turnbuckles and loss of cable tension will be required to complete the detailed inspections.

Note 4: Additional guidance, background and references are provided in CASA Airworthiness Bulletin 27-001 and ATSB report AE-2012-028.

Compliance: For requirement 1: Initial Inspection

- a) For cables with more than 15 years time in service (TIS) or unknown TIS at the effective date of this AD - before 1 September 2018.
- b) For cables with less than 15 years TIS at the effective date of this AD - before 15 years TIS.

For requirement 2: At intervals not exceeding 12 calendar months following the initial inspection detailed in requirement 1 of this AD.

For requirement 3: Before further flight after the commencement date of this AD.

For requirement 4: Within two days of the discovery of the defect.

Background: AD/GENERAL/87 was introduced in early 2015 to manage an unsafe condition associated with failure of primary flight control cables as a consequence of stress corrosion cracking at the cable terminals. Failure of a primary flight control cable terminal in-flight is likely to prevent the pilot from maintaining normal control of the aircraft which may lead to loss of the aircraft.

Seven cases of terminal failures were reported in Australia in the six years preceding release of AD/GENERAL/87 with no fatalities recorded. CASA deemed industry practice at the time insufficient to reliably detect or manage the failure mode.

AD/GENERAL/87 introduced mandatory replacement of primary flight control cable assemblies on most non-transport category aircraft manufactured with terminals made from SAE-AISI 303 Se or SAE-AISI 304 Stainless Steel with 15 years or more TIS before 1 January 2018.

AD/GENERAL/87 does not apply to aircraft maintained to Maintenance Steering Group 3 (MSG-3) methodology or for aircraft which specify a life limit for primary flight control assemblies of less than 15 years.

In developing AD/GENERAL/87 CASA consulted options with industry to address the unsafe condition. Notice of Proposed Rule Making 1303MS 'Proposed Airworthiness Directive to Mandate Inspection or Retirement of Control Cable Assemblies with Terminals Manufactured from SAE-AISI 303 Se Stainless Steel' dated February 2014 proposed, in summary:

- a. Mandatory inspection of cable terminals, involving cable disassembly and removal from the aircraft, every 100 hours or annually (whichever comes first), applicable to cable assemblies with a TIS of more than 15 years, or
- b. Mandatory retirement of cable assemblies at 15 years.

Thirty three industry comments were received with varying feedback.

Aircraft - General

PAD/GENERAL/87 Amdt 1 (continued)

Remarks: Initiator for PAD/GENERAL/87 Amdt 1

Industry feedback into the 2014 Notice of Proposed Rule Making process was relatively low given the number of aircraft affected. Since then CASA has received a significant level of interest in regards to this matter, particularly expressing concerns with the cost and waste associated with replacement of serviceable cable assemblies with no discretion available to the maintainer to determine serviceability.

PAD/GENERAL/87 Amdt 1 aims to more readily take into account contemporary feedback by empowering the maintainer to exercise their competency and determining serviceability through the use of enhanced inspections rather than mandatory replacement regardless of condition.

Additionally, CASA acknowledges the extensive labour costs associated with mandatory replacement, which could itself lead to unsatisfactory safety outcomes, due to the diversion of limited Australian maintenance capacity away from other safety-critical maintenance activities.

Changes introduced by PAD/GENERAL/87 Amdt 1

PAD/GENERAL/87 Amdt 1 proposes enhanced inspection of primary flight control cables rather than mandatory retirement life. CASA believes the proposed inspection regime, if performed correctly, would offer an acceptable level of safety at lower material cost to industry than mandatory cable replacement.

The statement of applicability is amended to refer to aircraft certified in the transport category (FAR25/CS-25) rather than aircraft maintained under the MSG-3 methodology. Safety risk associated with failure of a cable terminal in these aircraft is adequately managed through the certification of the aircraft which requires the capability for continued safe flight following failure in the flight control system.

The statement of applicability is further amended to include aircraft whose maintenance schedule or system of maintenance adequately provides for detailed inspections equivalent to the intent of the requirements of the AD, rather than specifically identifying the MSG-3 methodology. The latter approach was unintentionally applying the requirements of the AD to aircraft that already incorporate detailed cable terminal inspections.

Enhanced inspection procedure

AD/GENERAL/87 remarks 'inspection of primary flight control cable terminals can be difficult and problematic. Surface indication of stress corrosion cracking, such as corrosion pitting or cracking can be very difficult to see, even under 10x magnification and can sometimes emanate from within the sleeve of the terminal'.

Therefore PAD/GENERAL/87 Amdt 1 proposes the removal of lock wire, clips, sleeves or tape etc., which can hold corrosive contaminants against the terminal, prior to the cleaning of the terminals in order to aid in the inspection. A terminal cleaned of surface grime and oxides helps the maintainer to make a clear determination as to the serviceability of the stainless steel terminal (standard maintenance practices).

Furthermore, good lighting and magnification is expected. Use of a borescope is considered acceptable for the visual inspection and usually provides for adequate magnification where necessary.

Aircraft - General

PAD/GENERAL/87 Amdt 1 (continued)

In some cases, disassembly of terminals and therefore slackening of cable tension will be required to complete the detailed inspections. However this is not proposed to be mandated. The level of disassembly required for both access and inspection is to be determined by the maintainer. CASA believes that mandatory slackening of cable tensions for every inspection on every aircraft will unnecessarily increase the likelihood of maintenance induced error disproportionate to the risk the inspection regime intends to manage.

While it is possible that corrosion can begin internally of the terminal sleeve and remain undetected on the surface, evidence from reported defects indicates surface corrosion was present and visible on all terminal failures attributed to internal corrosion. Therefore, CASA believes that thorough, targeted and timely inspection of terminal surfaces for evidence of surface corrosion is adequate to manage this failure mode.

Where the maintainer is uncertain or not able to adequately inspect the cable terminals in order to make a determination of serviceability, the maintainer is expected to take further action to gain the appropriate access.

Inspection interval

The inspection procedure of the cable assemblies commences at 15 years TIS. All reported incidents of stress corrosion cracking have occurred on cables older than 15 years.

Evidence to support the one-year inspection interval period is variable. On some aircraft no corrosion may ever be present. On others it may form more quickly. Nevertheless a demonstrated unacceptable level of risk exists associated with failure of cable terminals as a result of stress corrosion cracking. Management of the risk is achieved through routine inspections at a defined interval. The annual interval period is designed to align with the aircraft's annual inspection. CASA is unaware of any solid evidence to support a period longer than this that satisfactorily manages the risk across all aircraft types.

Corrosion tends to progress as a function of time. While stress corrosion in control cables is influenced by the level of tension inherent in the design, there is no specific evidence to support an inspection interval associated with anything other than calendar time in service.

Previous cable replacement

Mandatory retirement of control cables at 15 years almost entirely removes the likelihood of failure of flight control cable terminals due to stress corrosion cracking in the medium term. As a result where flight control cables have been replaced, whether to satisfy the requirements of AD/GENERAL/87 or otherwise, the enhanced inspection procedures associated with PAD/GENERAL/87 Amdt 1 are alleviated for a period of 15 years from the date of cable replacement.

Other cable damage

The enhanced inspection procedures proposed in PAD/GENERAL/87 Amdt 1 is not intended to address cable assembly failure modes other than stress corrosion cracking of cable terminals.

Aircraft - General

PAD/GENERAL/87 Amdt 1 (continued)

Evidence exists around the world of control cable assembly failure modes associated with wear, fraying and fatigue. In some cases these are managed by type-specific Airworthiness Directives. Evidence does not support the conclusion that a general fleet-wide unsafe condition exists due to such failures. CASA proposes to continue to raise awareness of the risks of such failures through its suite of Airworthiness Bulletins.

Applicability Date

To allow for industry to adequately plan for the enhanced inspection regime the applicability date of PAD/GENERAL/87 Amdt 1 will be at least 12 months following publication. Applicability date will therefore be likely around the start of the fourth quarter of 2018.

Consultation period

This PAD is open for consultation for a period of four weeks. The consultation period will close on 28th June 2017.

Enquiries or feedback regarding this PAD should be made by email to airworthiness.directives@casa.gov.au.