



Advisory Circular (AC)

Flight In Icing Conditions - Performance

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this Advisory Circular (AC) is to provide guidance for acceptable means, but not the only means, of demonstrating compliance with the performance requirements of Chapter 523 dealing with approval of Commuter Category Aeroplanes for flight in icing conditions.

This AC is presently the subject of international harmonisation, and this AC is issued for use during type approval programs. When harmonisation is completed, this AC will be amended, or revoked and the corresponding harmonised advisory material adopted

1.2 Guidance Applicability

This document is applicable to all Transport Canada personnel, delegates and industry.

1.3 Description of Changes

This document, formerly AMA No. 523/2A, is reissued as an AC. With the exception of minor editorial changes, the content is unaltered.

1.4 Termination

This document does not have a terminating action. It will however, be reviewed periodically for suitability of content.

2.0 REFERENCES

2.1 Reference Documents

It is intended that the following reference materials be used in conjunction with this document:

- (a) Chapter 523 of the Airworthiness Manual (AWM) - *Normal, Utility, Aerobatic and Commuter Category Aeroplanes*, sections 523.45, 523.49, 523.51, 523.53, 523.55, 523.57, 523.59, 523.65, 523.67, 523.75, 523.77, 523.929, 523.1093, 523.1416, 523.1419, 523.1523, 523.1581; and
- (b) Chapter 525 Appendix C of the AWM - *Transport Category Aeroplanes*.

2.2 Cancelled Document

As of the effective date of this document, AMA No. 523/2A dated 29 October 1999 is cancelled.

3.0 BACKGROUND

The equipment design requirements for ice protection are contained in Chapter 523 sections 523.1093, 523.1416 and 523.1419. *Advisory Circular 20-73* contains information relating to substantiation of ice protection systems. The AC suggests that the full impact on aircraft performance should be determined for expected ice accretions on unprotected surfaces but does not give any clarifying procedures. Clearly an aircraft designed with extensive ice protection systems suffers less of a performance decrement than an aircraft with less extensive systems. In the past there has been uncertainty about how performance decrements should be determined and how they should be applied with respect to approved AFM procedures and performance.

4.0 PERFORMANCE DETERMINATION

In general, flight in icing conditions can include take-off and climb, cruise, descent and landing. During the take-off phase it may be assumed that there is negligible ice accumulation, but operation of the ice protection systems has to be considered. For the other flight phases it should be assumed that the ice protection systems are required and that there may also be ice accumulation on unprotected surfaces.

- (a) For take-off and climb into icing conditions the following should be considered:
 - (i) Take-off speeds should retain adequate margins above the minimum reference speeds appropriate to the operating procedures and conditions (e.g. boots cycling, wing bleed air exhaust);
 - (ii) thrust should be appropriate to the operating procedures and conditions (e.g. bleed loss, power extraction of electrical anti-ice loads);
 - (iii) Drag should be appropriate to the operating configuration (e.g. ice separator flaps open); and
 - (iv) take-off performance should be based on the speeds, thrust and drag established above.
- (b) For enroute flight in icing conditions or after an icing encounter, the following should be considered:
 - (i) Enroute climb speed should retain an adequate margin above the minimum reference speed appropriate to operating procedures, conditions and aerodynamic configuration (e.g. ice on unprotected surfaces);
 - (ii) Thrust should be appropriate to the operating procedures and conditions;
 - (iii) Drag and weight increments due to ice accumulation on the unprotected surfaces and drag increment due to ice protection system configuration; and
 - (iv) Enroute climb gradient and flight path data should be based on the speeds, thrust and drag established above.
- (c) Following flight in icing conditions, the approach and landing phases may be carried out with ice accumulation on the unprotected surfaces. For the aircraft landing with ice accumulation and possibly in icing conditions, the following should be considered:
 - (i) Approach climb, landing climb and landing reference speeds should retain adequate margins above the minimum reference speeds appropriate to the operating procedures, conditions, and aerodynamic configuration (e.g. ice on unprotected surfaces);
 - (ii) Thrust should be appropriate to the operating procedures and conditions (e.g. power available after 8 seconds with bleed load);
 - (iii) Drag and weight increments due to ice accumulation on the unprotected surfaces and drag increment due to ice protection system configuration (e.g. ice separator flaps open);
 - (iv) Approach and landing climb gradients and limiting weights should be based on the speeds, thrust and drag established above; and
 - (v) The landing distance should be established for the appropriate operating procedures (e.g. reference speed at 50 ft).

5.0 HEADQUARTERS CONTACT

For more information please contact:

Policy Standards Coordinator (AARDH/P)

Phone: (613) 990-3923

Facsimile: (613) 996-9178

E-mail: AARDH-P@tc.gc.ca

Original signed by Maher Khouzam

Maher Khouzam
Chief, Regulatory Standards
Aircraft Certification Branch