



# Advisory Circular (AC)

## Flight In Icing Conditions - Flight Characteristics

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<b>File No.</b>	5009-6-523	<b>AC No.</b>	523-005
<b>RDIMS No.</b>	528385-V3	<b>Issue No.</b>	01
<b>Issuing Branch</b>	Aircraft Certification	<b>Effective Date</b>	2004-12-01

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## **1.0 INTRODUCTION**

### **1.1 Purpose**

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

This advisory material 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. 523/4A, 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 143, 145, 147, 149, 153, 171, 173, 175, 177, 181, 201, 203, 205, 207, 233, 251, 1093, 1416, 1419, 1523, 1581;
- (b) Chapter 525 Appendix C of the AWM — *Transport Category Aeroplanes*;
- (c) Transport Canada Advisory Circular (TC AC)-523-003 — *Flight in Icing Conditions - Performance*; and
- (d) Federal Aviation Administration Advisory Circular (FAA AC) 20-73 — *Aircraft Ice Protection*

### **2.2 Cancelled Document**

As of the effective of this document, AMA No. 523/4A 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. *FAA Advisory Circular 20-73* contains information relating to substantiation of ice protection systems and TC AC 523-003 (formerly AMA 523/2A) provides additional advisory information for Performance aspects of flight in icing conditions. This AC provides additional advisory information for the Flight Characteristics aspects of flight in icing conditions.

## **4.0 PROCEDURES**

- (a) 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 normal and abnormal operation of the airframe ice protection system as well as ice build-up on the unprotected surfaces have to be considered. Approval of flight in icing conditions requires compliance with:

- (i) Flight characteristics with ice accumulations appropriate to 45 min in Chapter 525 Appendix C conditions (3 inch maximum) on the unprotected surfaces and normally expected ice on the protected surfaces prior to anti-icing system operation or during system operation.
  - (ii) Provision of adequate AFM procedures including de-icing system failure conditions. Probable single failure conditions should be considered and the ice accumulation may be assumed to be 1/2 of the accumulation specified in (i) above.
- (b) The following items have been found to be significant in past certification programs. It is recognised that for a particular aircraft the list may not be complete.
- (i) Demonstration of adequate stall warning before stall characteristics.
  - (ii) Demonstration of adequate stability and control in the approach and landing configurations. This includes  $\pm 0.5$  'g' longitudinal control capability, and positive static lateral/directional stability, static longitudinal stability and dynamic stability at  $1.3 V_S$  to  $V_{FE}$ .
  - (iii) Demonstration of safe procedures for configuration changes for approach, landing and go-around.
  - (iv) Demonstration of adequate static longitudinal stability and dynamic stability in the cruise configuration.
  - (v) Demonstration of freedom from vibration and buffet with boot operation at speeds up to  $V_{FC}$ .
  - (vi) Demonstration of no adverse fluctuations of altitude or airspeed (e.g. caused by ice build-up on nose radome).
  - (vii) Demonstration of no hazard associated with ice shedding (e.g. props, inner wing boots).
  - (viii) Establishment of adequate AFM procedures for de-icing system failures (e.g. boot failure). Tests should be carried out in simulated failed condition to ensure no hazardous characteristics.
  - (ix) Establishment of any systems limitations/procedures when operating in icing conditions (e.g. autopilot).

## **5.0 HEADQUARTERS CONTACT**

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