



# Advisory Circular

**Subject: Stall, Compliance**

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## 1.0 Introduction

- (1) This Advisory Circular (AC) is provided for information and guidance purposes. It is complementary to the guidance presented in the Federal Aviation Administration (FAA) AC 25-7D, and both documents, in conjunction, present an acceptable means, but not the only means, of demonstrating compliance with regulations and standards. In case of any inconsistency, conflict, or ambiguity among both documents, this AC takes precedence. This AC on its own does not change, create, amend or permit deviations from regulatory requirements, nor does it establish minimum standards.

### 1.1 Purpose

- (1) The purpose of this AC is to provide guidance to outline a method of compliance with existing standards dealing with stall demonstration.

### 1.2 Applicability

- (1) This document applies to all Transport Canada Civil Aviation (TCCA) employees, to individuals and organizations when they are exercising privileges granted to them under an External Ministerial Delegation of Authority. This information is also available to the aviation industry for information purposes.

### 1.3 Description of changes

- (1) This document, formerly AC 525-020, Issue 01 with an effective date of 2004-12-01 has been updated to reflect current practice and harmonize guidance with other authorities:
  - (a) Format to reflect the latest template for AC, with new subsections;
  - (b) Revision to Sections 1.0 Introduction and 1.1 Purpose following the new format;
  - (c) Added FAA AC 25-7D as reference document in Section 2.1; and
  - (d) Most of paragraph 5.0 from AC 525-020 Issue 01 was removed, given equivalent guidance is found in FAA AC 25-7D and other available guidance. Only Canadian specific guidance was kept in renumbered and revised paragraphs 4.1, 4.2 and 4.3.

## 2.0 References and requirements

### 2.1 Reference documents

- (1) It is intended that the following reference materials be used in conjunction with this document:
  - (a) [Aeronautics Act](#) (R.S.C., 1985, c. A-2);
  - (b) Chapter 525 of the Airworthiness Manual (AWM) — Transport Category Aeroplanes; and
  - (c) FAA AC 25-7D – Flight Test Guide for Certification of Transport Category Airplanes – 05/04/2018.

### 2.2 Cancelled documents

- (1) By default, it is understood that the publication of a new issue of a document automatically renders any earlier issues of the same document null and void.

## 2.3 Definitions and abbreviations

- (1) The following **definitions** are used in this document:
  - (a) **Stall Identification System:** system which activates at the stall and includes all applicable elements contributing to the automatic control actuation device (e.g. stick pusher) as well as any tactile, visual and/or audible indications;
  - (b) **Stall Protection System:** elements of the stall warning system and the stall identification system; and
  - (c) **Stall Warning System:** system which provides advance warning of the stall and consists of all elements contributing to and including the tactile, audible and visual functions.
- (2) The following **abbreviations** are used in this document:
  - (a) **AC:** Advisory Circular;
  - (b) **AWM:** Airworthiness Manual;
  - (c) **C.G.:** Center of Gravity;
  - (d) **FAA:** Federal Aviation Administration; and
  - (e) **TCCA:** Transport Canada, Civil aviation.

## 3.0 Background

- (1) Depending on the aircraft configuration, natural aerodynamic characteristics recognizable by a flight crew of an impending stall, with sufficient margin as defined by AWM 525.207, might not be present. For such a situation, an artificial stall warning system may be required. Likewise, some airplanes might not exhibit acceptable indications of stall as defined in AWM 525.201 or the stall characteristics defined in AWM 525.203, requiring an artificial stall identification system to be installed.
- (2) Regulations and standards harmonization efforts have been considered to minimize differences with FAA guidance material, therefore simplifying the certification process for applicants with both Transport Canada and the FAA.

## 4.0 Acceptable means of compliance

### 4.1 Stall Warning (525.207)

- (1) A clearly distinguishable stall warning under expected conditions of flight must be provided to the pilot with sufficient margin to prevent inadvertent stalling. Such a warning is one which cannot be misinterpreted or mistaken for other warnings.
  - (a) AWM 525.207(b) requires that artificial stall warning devices must include means to provide a clearly audible warning to the flight crew. This rule recognizes that, with the advent of modern automatic flight control systems, a stick shaker with purely tactile characteristics may not provide the required clear and distinct warning. A tactile device with suitable audible characteristics may be found acceptable.
  - (b) In evaluating the acceptability of the audible characteristics of a stall warning system, the following operating conditions should be taken into consideration:
    - (i) pilot wearing good quality exterior sound reducing earphones;

- (ii) pilot workload such as monitoring VHF, navigation/approach aids, crew briefings (during evaluation, continuous audio should be present at normal volume levels);
- (iii) presence of other audio warnings such as gear horn; and
- (iv) any other flight deck pilot distractions, appropriate to the type being assessed (such as air conditioning duct or blower noise).

#### **4.2 System Tolerances**

- (1) In addition to considerations for testing in FAA AC 25-7D §8.1.9.2, when executing stall testing, flaps should be rigged in the most critical position including the maximum tolerated asymmetry if such an asymmetry could produce an appreciable adverse effect.

#### **4.3 Stall Protection System Design Considerations**

##### **(1) System Design – Inhibition, Arming and Disarming**

- (a) Although desirable that full stall protection should be available immediately at lift-off, inadvertent operation of the system should not cause catastrophic ground contact and thus it would normally be acceptable for a stall identification system to be inhibited during the take-off rotation, typically 5 to 10 seconds. In addition, it has previously been found acceptable to have an inhibition of the stall identification system below a specified radio altimeter height of 400 ft, based on the aerodynamic stalling characteristics of the aircraft involved and the design philosophy of the stall identification system installed. Note that this supersedes guidance in FAA AC 25-7D, which states that inhibition during this phase of flight would not be an acceptable means of compliance.
- (b) Although a similar inhibition of any phase advance on the stall warning system would normally be acceptable, inhibition of the stall warning system itself is not normally acceptable, except at low speeds during the take-off roll when the angle of attack sensors may be improperly aligned.
- (c) A means of disarming the stall identification system should be provided and should be capable of being readily selected by the pilots. It should be effective at all times and should be capable of preventing the system from making any input to the longitudinal control system, and of removing any input which has already been applied (whether as a result of failures or normal operation of the system). Additional means to permanently disable the stall identification system following a system failure are acceptable provided these means are not subject to inadvertent operation.

##### **(2) System Safety Assessment**

- (a) If the stall identification system is installed solely for the purposes of identifying the stall, and the stall characteristics would otherwise meet the requirements of Subchapter B with the stall identification system disabled, the probability of the stall identification system failing to operate should be on the order of 10<sup>-3</sup> per flight hour or less. Otherwise, the probability of the stall identification system failing to operate should be on the order of 10<sup>-4</sup> per flight hour or less.
- (b) The probability of failure of stall warning together with the stall identification system failing to operate should be on the order of 10<sup>-7</sup> per flight hour or less.
- (c) If unwanted operation of the stall identification system would result in the total normal acceleration of the aeroplane becoming negative, or limit loads being exceeded in any part of the aeroplane structure, the probability of inadvertent operation should be on the order of 10<sup>-7</sup> per flight hour or less.

- (d) Even when failures resulting in unwanted (inadvertent) operation are only critical for a particular phase of flight, the probability should be calculated considering the entire expected average flight duration (i.e. not using “at risk” time).

## **5.0 Information management**

- (1) Information pertaining to the AWM – Transport Category Airplane is saved under RDIMS file classification No. A 5009-6-525.

## **6.0 Document history**

- (1) AC 525-020 Issue 01, RDIMS 528401 (E), 530278 (F), dated 2004-12-01 – Stall, Compliance.

## **7.0 Contact us**

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