

Certification Authorities for Transport Airplane Products (CATA)

CATA Worklist Item, CWI TCCA-006

Date Raised:	16-Nov 2020	Status:	Closed
Date Revised:	N/A		
Subject:	Evacuation slide system installed in non-pressurized compartment		
Reference Requirements	(RBAC 25.810/CS 25.810/14 CFR 25.810/AWM 525.810 (RBAC 25.1309 / CS 25.1309 / 14 CFR 25.1309 / AWM 525.1309)		

Description of Issue(s):

(Give a brief description of issue(s))

For the evacuation slide system that is installed in a non-pressurized compartment, resulting in the evacuation slide system being exposed to extreme cold temperatures on every flight, certain authorities require applicants to demonstrate that the system function properly in the combination of the cold soak associated with long flight at altitude **and** a 25-knot wind from the critical angle.

In addition, inconsistencies exist between Authorities on the way the combined requirement needs to be substantiated with. Some only accept compliance by testing whereas others may accept an analysis of the design performance of the system.

Therefore, there is a need to develop harmonized guidance to provide acceptable means of compliance for evacuation slide system installed in a non-pressurized compartment.

Safety Impact:

Evacuation slide materials and system components perform substantially differently when cold-soaked vs. typical operating temperatures (typically, evacuation slide systems are installed within the pressurized cabin environment). The risk for evacuation slide systems installed in a non-pressurized compartment, if not tested to required conditions while cold-soaked, is that cold-soaked slides would be unusable in a critical wind environment within the expected timeframe for an emergency evacuation. This would reduce evacuation capability.

Background:

(Give a brief background of issue(s))

The existing TSO/ETSO requires evacuation slides (equipment in general) be qualified towards various environmental conditions separately. During recent certification programs, authorities required applicants to apply simultaneously certain environmental conditions (cold and wind) to evacuation slide systems installed in a non-pressurized compartment.

There is no guidance existing (authorities raised a method of compliance paper to 25.810/25.1309). The compliance finding depends on the authority (from the rationale to the certification test campaign).

References:

The certification of emergency assisted means includes among others:

- For non-overwing evacuation slides, CS 25.810(a)(1)(iv)/ 14 CFR 25.810(a)(1)(iv)/ AWM 525.810(a)(1)(iv) / RBAC 25.810(a)(1)(iv) -
(iv) It must have the capability, in 25-knot winds directed from the most critical angle, to deploy and, with the assistance of only one person, to remain usable after full deployment to evacuate occupants safely to the ground.
- For overwing slides, CS 25.810 (d)(2) / 14 CFR 25.810(d)(2)/ AWM 525.810(d)(2) / RBAC 25.810(d)(2) -
(2) The assisting means must be usable and self-supporting with one or more landing gear legs collapsed and under a 46 km/hr (25-knot) wind directed from the most critical

Certification Authorities for Transport Airplane Products (CATA)

CATA Worklist Item, CWI TCCA-006

angle.

- For evacuation slide systems, CS 25.1309(a)(1) / 14 CFR 25.1309(a) and (e) / AWM 525.1309(a) and (e) / RBAC 25. 1309 (a) and (e) –

These specifications / standards identify the need to consider the environmental conditions / the foreseeable operating conditions that the system would be exposed to during service.

And

- TSO C69c (or equivalent), Appendix I para. 4.2.

4.2 Function. The device, including its inflation system, must be demonstrated to be capable of fully functioning when subjected to temperatures from -40 to +160 degrees F. If the device is intended for installation outside the pressurized cabin, the device must be capable of functioning after being stowed at -65 degrees F. The function of the device must be demonstrated in accordance with the hot and cold soak test procedures described in paragraph 5.9 of this appendix.

SME Recommendation

(Recommendations from SME Working Group; may contain links and/or embedded documents)

The working group recommends issuance of the guidance paper shown in Appendix A. The guidance paper does not supersede regulatory requirements or existing policies.

Final CATA Position (Phase 5 Completion)

(Explain agreement, dissent or conclusion on the SME recommendation)

The CATA accept the SME team's recommendation and proposed guidance paper. The guidance paper is appended directly to this CWI.

The CWI represents an agreement that the guidance paper is harmonized and accepted by all CMT authorities.




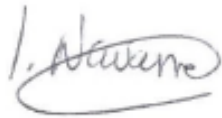


The CWI form, including the appended paper, document a CMT member authority agreement that member authorities may reference when they are acting as the certifying authority (CA). Following CA endorsement for a particular project, the other CMT member authorities, when acting as validating authority, will accept the approach.

If any member-authority under CATA becomes aware of circumstances that make it apparent that following the guidance paper would not result in compliance with the member-authority's applicable airworthiness standards, then the use of this guidance paper is non-binding, and the member-authority may require additional substantiation or design changes as a basis for finding compliance.

Certification Authorities for Transport Airplane Products (CATA)

CATA Worklist Item, CWI TCCA-006

CATA Signatures:

CATA Representative	Name	Signature	Date
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Certification Authorities for Transport Airplane Products (CATA)

CATA Worklist Item, CWI TCCA-006

Appendix A

**CATA Worklist Item TCCA-006
Subject Matter Expert Panel
Guidance**

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**Cold Soaked Inflatable Emergency Egress Assist
Means Performance Under Wind Conditions**

Certification Authorities for Transport Airplane Products (CATA)

CATA Worklist Item, CWI TCCA-006

1.0 Introduction

The CATA Worklist Item TCCA-006 was created to develop harmonized guidance on acceptable means and methods of compliance with 14 CFRs 25.810 and 25.1309 for inflatable emergency egress assist means installed in unpressurized and unheated compartments.

There is currently no harmonized guidance to the standards of airworthiness addressing the performance of inflatable emergency egress assist means during deployment and inflation under wind conditions when installed in unpressurized unheated compartments.

TSO-C69c, Emergency Evacuation Slides, Ramps, Ramp/Slides, and Slide/Rafts, dated August 18, 1999, requires qualification for cold soak and wind conditions separately. At the same time, 14 CFR 25.1309 requires that equipment and systems must be designed to perform their intended function under any foreseeable aeroplane operating and environmental condition. Differently from inflatable emergency egress assist means installed in pressurized and heated compartments, assist means installed in unpressurized and unheated compartments are exposed to extreme environmental conditions (cold temperatures) during each flight.

Therefore, for this kind of installation, the combination of cold temperature and wind is a foreseeable operating and environmental condition.

2.0 Standard of Airworthiness:

2.1 14 CFR 25.810 Amendment 25-114:

2.1.1 Partial Reproduction of the Standard:

Only the parts related to emergency egress assist means are reproduced.

(a) Each non over-wing Type A, Type B or Type C exit, and any other non over-wing landplane emergency exit more than 6 feet from the ground with the airplane on the ground and the landing gear extended, must have an approved means to assist the occupants in descending to the ground.

(1) The assisting means for each passenger emergency exit must be a self-supporting slide or equivalent; and, in the case of Type A or Type B exits, it must be capable of carrying simultaneously two parallel lines of evacuees. In addition, the assisting means must be designed to meet the following requirements—

(i) It must be automatically deployed and deployment must begin during the interval between the time the exit opening means is actuated from inside the airplane and the time the exit is fully opened. However, each passenger emergency exit which is also a passenger entrance door or a service door must be provided with means to prevent deployment of the assisting means when it is opened from either the inside or the outside under nonemergency conditions for normal use.

(ii) Except for assisting means installed at Type C exits, it must be automatically erected within 6 seconds after deployment is begun. Assisting means installed at Type C exits must be automatically erected within 10 seconds from the time the opening means of the exit is actuated.

(iii) It must be of such length after full deployment that the lower end is self-supporting on the ground and provides safe evacuation of occupants to the ground after collapse of one or more legs of the landing gear.

Certification Authorities for Transport Airplane Products (CATA)

CATA Worklist Item, CWI TCCA-006

- (iv) It must have the capability, in 25-knot winds directed from the most critical angle, to deploy and, with the assistance of only one person, to remain usable after full deployment to evacuate occupants safely to the ground.*
- (v) For each system installation (mockup or airplane installed), five consecutive deployment and inflation tests must be conducted (per exit) without failure, and at least three tests of each such five-test series must be conducted using a single representative sample of the device. The sample devices must be deployed and inflated by the system's primary means after being subjected to the inertia forces specified in Sec. 25.561(b). If any part of the system fails or does not function properly during the required tests, the cause of the failure or malfunction must be corrected by positive means and after that, the full series of five consecutive deployment and inflation tests must be conducted without failure.*
- (b) Assist means from the cabin to the wing are required for each Type A or Type B exit located above the wing and having a stepdown unless the exit without an assist means can be shown to have a rate of passenger egress at least equal to that of the same type of non over-wing exit. If an assist means is required, it must be automatically deployed and automatically erected concurrent with the opening of the exit. In the case of assist means installed at Type C exits, it must be self-supporting within 10 seconds from the time the opening means of the exits is actuated. For all other exit types, it must be self-supporting 6 seconds after deployment is begun.*

[...]
- (d) Means must be provided to assist evacuees to reach the ground for all Type C exits located over the wing and, if the place on the airplane structure at which the escape route required in paragraph (c) of this section terminates is more than 6 feet from the ground with the airplane on the ground and the landing gear extended, for all other exit types.*

 - (1) If the escape route is over the flap, the height of the terminal edge must be measured with the flap in the takeoff or landing position, whichever is higher from the ground.*
 - (2) The assisting means must be usable and self-supporting with one or more landing gear legs collapsed and under a 25-knot wind directed from the most critical angle.*
 - (3) The assisting means provided for each escape route leading from a Type A or B emergency exit must be capable of carrying simultaneously two parallel lines of evacuees; and, the assisting means leading from any other exit type must be capable of carrying as many parallel lines of evacuees as there are required escape routes.*
 - (4) The assisting means provided for each escape route leading from a Type C exit must be automatically erected within 10 seconds from the time the opening means of the exit is actuated, and that provided for the escape route leading from any other exit type must be automatically erected within 10 seconds after actuation of the erection system.*

[...]

Certification Authorities for Transport Airplane Products (CATA)

CATA Worklist Item, CWI TCCA-006

2.2.1 Partial Reproduction of the Standard:

Only the part pertinent to the subject under discussion is reproduced.

(a) The equipment, systems, and installations whose functioning is required by this subchapter, must be designed to ensure that they perform their intended functions under any foreseeable operating condition.

[...]

3.0 Guidance:

The following are acceptable means of compliance to demonstrate that an inflatable emergency egress assist means installed in non-pressurized compartment complies with RBAC 25.810 / CS 25.810 / 14 CFR 25.810 / AWM 525.810 and RBAC 25.1309 / CS 25.1309 / 14 CFR 25.1309 / AWM 525.1309.

3.1 Cold Soak Conditions:

Before the wind test, thermally condition the inflatable emergency egress assist means for at least 16 hours at -54°C. Any component not installed in the non-pressurized compartment does not need to be conditioned. For example, an inflatable emergency egress assist means installation with the pressure reservoir located in the pressurized cabin does not need to have the reservoir cold soaked before wind testing.

Regardless of where the pressure reservoir of the inflation system is located, set the pressure of the inflation system to the nominal pressure. For pressure reservoirs using mixed gases, maintain the ratio of the gas mix.

Alternatively, a less severe cold soak conditioning temperature may be used if the actual lowest temperature of the unpressurized unheated compartment is above -54°C. To use this alternative, collect and present acceptable aeroplane flight test thermal survey data to the certifying authority.

Deploy and inflate the emergency egress assist means within 10 minutes after removal from the conditioning chamber.

3.2 25-Knot Wind Test Protocol:

Follow the test protocol in draft SAE AS8994 Appendix P, which is expected to be released soon, to establish the wind test setup, determine the critical wind angle, and conduct the test.

3.3 25-Knot Wind Test with Cold Soaked Inflatable Egress Means:

Perform the test with the fuselage attitude correspondent to all landing gears extended. Complete all the following tasks within 10 minutes after removal from the conditioning chamber:

- (a) Transport the inflatable emergency egress assist means from the conditioning chamber to the aeroplane or representative mock-up. Maintain the aeroplane or representative mock-up at ambient temperature (15° to 35°C).
- (b) Install the inflatable emergency egress assist means on the aeroplane or representative mock-up.
- (c) Turn on the wind machines to create the required wind field flow in the target area.
- (d) Validate or correct, if necessary, the wind field flow to meet the test protocol.
- (e) Deploy and inflate the emergency egress assist means.

3.4 Test Pass/Fail Criteria:

Certification Authorities for Transport Airplane Products (CATA)

CATA Worklist Item, CWI TCCA-006

The inflatable emergency egress assist means successfully passes the test if it deploys and inflates into a usable condition within the time specified in the paragraphs (a), (b) and (d) of the standard.

A usable condition is one where:

- (i) The inflatable emergency egress assist means is fully formed and extended;
- (ii) The inflatable emergency egress assist means angle is at or below horizontal;
- (iii) The unoccupied inflatable emergency egress assist means appears safe for use prior to anyone sliding down when viewed from the exit; and
- (iv) The inflatable emergency egress assist means is capable of being safely used by the evacuees.

When the result of this test is to be used to substantiate the installation of the assist means on the aeroplane, the determination whether the assist means reached a usable condition as per the criteria above should be made by the civil aviation authority or its delegate responsible for witnessing the test.

When assessing criterion (iv), only send an evacuee down the egress means, or a sandbag used as a substitute for an evacuee, after the civil aviation authority or its delegate has made the determination that criterion (iii) was met. When a sandbag is used, another person on the ground who did not come from the aeroplane and with anthropometric measurements not exceeding those of a 50th percentile female, may reposition and/or hold the bottom end of the slide on the ground to demonstrate that other occupants would be able to evacuate the aeroplane.

Analyze the deployment mechanism to determine the stopwatch starting point for measuring deployment plus inflation times. The starting point is the point of no return of the deployment mechanism.

When the inflatable emergency egress assist means is not able to meet the times specified in the standard (25.810), the applicant may contact the certifying authority to discuss the need for redesign or other solution. Formally document the discussions with and decisions of the certifying authority.