

Technical Standard Order (TSO)C69c

Emergency Evacuation Slides

Presented to: TSO Workshop

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**Federal Aviation
Administration**

Escape Slides

- **Agenda**
 - Current TSO standard
 - Overview
 - Activity with SAE International
 - Clarifications
 - Additions
 - Removals
 - Summary

Technical Standard Order (TSO)

- **TSO-C69c Emergency Evacuation Slides, Ramps, Ramp/Slides, and Slide/Rafts**
- **Historical**
 - TSO-C69 initial revision 6/15/1961
 - TSO-C69a 6/3/1983
 - TSO-C69b 8/17/1988
 - TSO-C69c 8/18/1999

Overview

- **TSO-C69c last update was 8/18/1999**
- **SAE International S-9 Committee Cabin Safety Provisions:**
 - S-9A Safety Equipment and Survival System
 - S-9B Cabin Interiors and Furnishings

SAE Committee

- **S-9A Committee:**
 - Committee members from industry including slide and aircraft manufactures and regulatory bodies
- **AS8994 Emergency Evacuation Slides, Ramps, Ramp/Slides and Slide/Rafts:**
 - In work for over 5 years
 - Currently in balloting process

Clarification from TSO to AS

- **TSO uses Federal Test Method Standards (FTMS) FTMS 191A which is not maintained or updated:**
 - FTMS are for the material properties and testing apparatus
- **AS8994 places the FTMS material standards into Appendices:**
 - Accelerated Aging, Tensile, Tear, Puncture, hydrolysis, seam shear and pull, etc.

Clarification from TSO to AS

- **TSO Section 3.1.3 “The material must not support fungus growth”**
 - AS: Now references DO-160G
- **TSO Section 3.1.8 “...must be waterproof and resistant to sun penetration”**
 - AS: ...provide an Ultraviolet Protection (UPF) of 30 or greater as determined using AATCC Test Method 183-2000, or equivalent

Clarification from TSO to AS

- **TSO Section 3.1.9 ... must be constructed of materials which comply with requirements of 14 CFR 25.853(a)...**
 - AS: devices installed inside the pressurized cabin comply with 14 CFR 25.853 (a)...
 - AS: ...flammability requirement does not apply to devices outside of the pressurized cabin
 - Note: “outside the pressurized area” will become an installation limitation in the TSO

Clarification from TSO to AS

- **TSO Section 3.2 All metallic parts must be made of corrosion-resistant materials...**
 - AS: Metallic parts... inside cabin salt spray test in RTCA DO-160G, Section 14, Category S
 - AS: Metallic parts ... outside pressurized cabin salt spray test RTCA DO-160G, Section 14, Category T

Clarification from TSO to AS

- **TSO Section 4.4 Elimination of Static:**
 - TSO: The device and its fastening must be so constructed that static electricity will not be generated in sufficient quantity to cause a spark which would create a hazard if there is any fuel spillage nearby
 - AS: Section 4.1.3 ... Resistance measured from the fastening to the aircraft to where the inflatable contacts the ground shall be less than 2 mega-ohms

Clarification from TSO to AS

- **Additional areas of clarification from the TSO:**
 - 4.6 Length: added 100 pound weight for ground contact
 - 4.7 Elimination of Encumbrances: pointed to evacuation testing
 - 4.11 Inflation: separated inflation and deployment time requirements
 - 4.22 Device performance: added regulatory references for testing
 - 4.26 Raft Capacity: alternative capacity rating
 - 4.27 Buoyancy: pressure required for overload capacity
 - 4.35 Canopy wind: better defined wind speed, location and time

Clarification from TSO to AS

- **TSO 4.2 Function:**
 - TSO: Function for operating temperature (-40 to 160 degrees F)
 - AS Section 4.1.2: Same operating temperature (-40 to 160 degrees F) and added a section for Ground Survival Temperature (-67 to 185 degrees F)
- **TSO 4.14 Manual Inflation Actuation Controls:**
 - TSO: Uses a 30 pound pulling force for manual inflation
 - AS Section 4.6.5: Added alternative option to meeting 30 pound full force by using a fifth percentile female

Clarification from TSO to AS

- **TSO Section 4.19 Device Illumination:**
 - TSO: Addresses illumination per CFR 25.813 & safe evacuation in normal manner
 - AS Section 4.6.6: Same as TSO but added information on components of the emergency lighting system, including batteries, wiring, relays, lamps, and switches shall be capable of normal operation after having been subjected to the inertia forces listed in 14 CFR § 25.561(b) in accordance with 14 CFR § 25.812(k)

Clarification from TSO to AS

- **TSO Section 4.20 Wind:**

- TSO: The device must be shown, in 25-knot winds directed from the most critical angle... **significantly revised**
- AS: Section 4.6.7 and Appendix P:
 - Appendix P is now 25-Knot Wind Test Protocol.
 - Includes a cold/wind requirements for fuselage integrated devices.
 - Define wind test set up and allow more consistency between slide development and manufacturers

Clarification from TSO to AS

- **TSO Section 4.43 Sea Performance:**
 - TSO: Meet seaworthiness requirements of section 5.2.4 (17-27 knot wind and 6-10' waves). Seawater marine environment for 15 days
 - AS Section 4.3.17 and Appendix I:
 - Brings wind and wave requirements up to this section.
 - Adds Appendix I which define the water tests, including saltwater environment

Clarification from TSO to AS

- **Mock ups:**
 - TSO: Mentions throughout document
 - AS: Created Appendix K to provide clarification on Airplane representative mockups
- **AS section 4.2.2: Added off wing slide release**
- **AS section 4.3.18: Added survival kits**
- **AS section 4.6.12: Added ditching deployment**

TSO Removals

- **TSO Section 3.1.7 Seam Tape:**
 - Removed the requirement because seam construction, where the tape is being used (Seam shear and seam peel) is already being evaluated so test is not required
- **TSO Section 3.1.11 Molded nonmetallic fittings:**
 - All slide components must be capable of supporting the slide operation and storage temperature already. Vague requirement removed

TSO Removals

- **TSO Section 4.9 Use as re-entry device:**
 - This was an optional section to have a re-entry line. Review of operators indicated that flight attendants not trained or using them
- **TSO Section 4.17 Side Guards:**
 - Removed to focus on performance requirements not specific design definitions, this is demonstrated through testing
 - Requirement could result in test subject injury. More realistic at high sill height to sit down instead of jump

TSO Removals

- **TSO Section 4.24 Overpressure test:**
 - The 1.5 times maximum operating pressure test for 5 minutes was removed. This test is considered an acceptance test on each device
 - The 2 times maximum operating pressure test for 1 minute in qualification test evaluates the structural design and adequate to satisfy the maximum operating

TSO Removals

- **TSO Section 4.30 Lifeline:**
 - Removed the 0.06 inch minimum thickness requirement. This is not a critical factor for making design
 - Rest of the requirements are the same
 - Moved to AS Section 4.2.4 and 4.3.5

Summary

- **SAE International S-9A committee:**
 - Working with industry and regulatory agencies.
 - Ongoing activity to create standard AS8994
 - Providing clarifications, additions and removals as determined by the committee
 - AS8994 standard will go to final ballot this year

Questions?

