EASA European Union Aviation Safety Agency	**Equivalent Safety Finding**	Doc. No.: **ESF-D25.812-01** Issue : 3 Rev. 1 Date : 22 November 2022 Proposed ☐ Final ☒ Deadline for comments: 22 MAR 2022

SUBJECT	:	**Photoluminescent ~~Symbolic~~ Exit Signs**
REQUIREMENTS incl. Amdt.	:	**CS 25.812(b)(1)(ii), CS 25.812(i) Amdt. 26**
ASSOCIATED IM/MoC[1]	:	Yes☐ / No ☒
ADVISORY MATERIAL	:	**N/A**

INTRODUCTORY NOTE:

The following Equivalent Safety Finding (ESF) has been classified as important and as such shall be subject to public consultation in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) which states:

"*2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency.*"

IDENTIFICATION OF ISSUE:

The current CS 25.812(b)(1)(ii) requires that: "*Each passenger emergency exit sign required by CS 25.811(d)(3) must have red letters on a white background or a universal symbol, of adequate size (See AMC 25.812(b)(1)). These signs must be internally electrically illuminated or self-illuminated by other than electrical means and must have an initial brightness of at least 1.27 candela/m^2 (400 microlamberts). The colours may be reversed in the case of a sign that is self-illuminated by other than electrical means.*"

Also, in accordance with CS 25.812(i): "*The energy supply to each emergency lighting unit must provide the required level of illumination for at least 10 minutes at the critical ambient conditions after emergency landing.*"

A common need exists to use such signs on moveable class dividers (MCD) that prevent fore and/or aft vision to electrically illuminated exit signs.

Due to the practicalities inherent in achieving the easy movement of MCDs in different aircraft configurations, self-illumination technology has been selected by the applicant in a current project. The photoluminescence technology is already used in other areas of design by industry (e.g. floor path marking).
Photoluminescence technology does not fully comply with certain parts of CS 25.812(b)(1)(ii) and 25.812(i).

[1] In case of SC, the associated Interpretative Material and/or Means of Compliance may be published for awareness only and they are not subject to public consultation.

The non-compliances can be summarized as follows:

1. *CS 25.812(b)(1)(ii) requires that some of the areas of the sign be white.*

The color appears pale yellow in normal ambient light levels and appears glowing pale green in low ambient light levels.

2. *CS 25.812(b)(1)(ii) requires that the illuminated sign has "an initial brightness" of at least 1.27 candela/m^2 (400 microlamberts)".*

Photoluminescent material meets this requirement, but the initial brightness is dependent on cabin light intensity and charging duration. Also, for the universal symbol signs, the green areas are opaque (no light is emitted by the sign). Similarly, for the language based signs the red areas are opaque.

3. *CS 25.812(i) requires that the "energy supply" to the sign "must provide the required level of illumination for at least 10 minutes at the critical ambient conditions after emergency landing".*

Compliance with this requirement is not obvious for a photoluminescent sign that shows a varying brightness level over time.

Background to the Compensating Factors used

The intent of CS 25.812(b)(1)(ii) is to provide a sign that guides the evacuee along the aisle up to an electrically operated exit marker or locator further down the aisle.

The specification for the self illuminated signs to have an initial brightness of 1.27 candela/m² has been developed for the radioactive "Tritium" signs as they degrade over time. The output of the photoluminescent signs depends on the charging level which itself depends on the duration and the intensity of the charge. The means to charge the photoluminescent sign is to expose it to ambient light, which is mainly supplied by the cabin lighting. When sufficiently charged, the photoluminescent sign does meet the initial brightness requirement of 1.27 candela/m^2 (400 microlamberts) as stated in the CS.

To achieve this, the signs must receive an appropriate amount of charge, based on a combination of light intensity (lux level) and charging duration.

Therefore, a pre-installation lighting compliance check must be performed to determine the lux levels at the area of installation of the sign; when combined with the appropriate charging duration, the initial brightness requirement is met for the 'first flight of day charge'.

The intent of CS 25.812(i) regarding the level of brightness to be supplied for at least 10 minutes is to provide egress guidance during at least 10 minutes. The "energy supply" is the ambient light which must provide the charge necessary to comply with the specification.

The sign needs to operate at emergency lighting levels and in normal cabin lighting for situational awareness. Photoluminescent exit signs provide this performance with the glowing areas providing better performance by giving greater uniformity of contrast between the opaque and light emitting areas.

Photoluminescent signs, both the ones with conventional 'EXIT' wording and the ones with the universal symbol, are already used by the industry. Applicants may take credit from test results to substantiate that their design provides the necessary compensating factors for a safe use in the applicants aeroplane. As identified under item 3.f) of the below ESF, all limitations/conditions derived from the test results have to be respected.

In general the portions of the aisle where the MCDs obscure partially or fully the electrical exit locator signs depend on the size of the person moving towards the next exit. The aisle length where such MCD obscures the view on electrical exit locators is limited and most adversely affects the 95th percentile male population. This distance will decrease with the body size of the occupants. In addition to the potoluminescent exit sign, the flow of passengers will automatically guide to the next available emergency exit.

Considering all the above, the following Equivalent Safety Finding is proposed:

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Equivalent Safety Finding to CS 25.812(b)(1)(ii), CS 25.812(i) at Amdt. 26

Photoluminescent ~~Symbolic~~ Exit Signs

1. Applicability

This ESF may be applied to large aeroplanes.

1.1 Affected CS

CS 25.812(b)(1)(ii) and CS 25.812(i) at Amendment 26

2. Equivalent Safety Finding

In lieu of direct compliance with CS 25.812(b)(1)(ii) and CS 25.812(i), and provided that the below compensating factors are fulfilled, photoluminescent ~~symbolic~~ exit signs may be used on moveable class dividers (MCDs) that prevent fore and/or aft view on electrically illuminated exit signs in parts of the cabin.

3. Compensating Factors

a) The photo luminescent exit signs used on MCDs that prevent fore and/or aft view on electrically illuminated exit signs are legible by any passenger approaching along the aisle and after initial charging provide guidance to the emergency exits considering the maximum flight time plus at least 10 minutes after a possible emergency landing at the critical ambient conditions.

b) The minimum required charging time and lighting condition to ensure the initial brightness have to be established in the Aeroplane Flight Manual operating procedures.

c) The background of the photo luminescent exit signs shall not decrease the legibility of the sign in comparison to a sign that is in compliance with 25.811 and 25.812.

d) In an emergency evacuation situation, the electrical emergency lighting system shall be powered "ON" and provide a level of illumination which ensures that the photoluminescent exit signs are legible from the maximum viewing distance. In addition, testing conducted under worst case scenario conditions, i.e. no emergency lighting operational (black out), demonstrated an additional safety benefit provided by photoluminescent signs.

e) In case where MCDs obscure the view on electrical exit locators, information about the next emergency exit(s) will be provided to the passengers through photo luminescent exit signs on the MCD. The aisle length where such MCD partially or fully obscure the view on electrical exit locators shall not exceed 70% (for the 95th percentile male population) of the distance between two required electrically illuminated emergency exit locator signs [as per CS 25.811(d)(1)].

f) When credit is taken from photoluminescent sign test results, the following limitations/ conditions derived from the test results must be respected:

- Minimum lighting conditions and exposure time for the charging of the photoluminescent sign considering also possible MMEL conditions.
- The photoluminescent signs must be consistent with the existing emergency exit sign design (universal symbol signs / 'EXIT')
- The photoluminescent signs will be installed in locations where the viewing distance respects the worst case of tested viewing distance considering the maximum distance as defined in above point (e).