AEROSPACE RECOMMENDED PRACTICE

ARP4103™ REV. A

Issued 1989-02
Revised 2014-10
Reaffirmed 2019-09

Superseding ARP4103

(R) Flight Deck Lighting for Commercial Transport Aircraft

RATIONALE

This SAE Aerospace Recommended Practice (ARP) is revised to update and improve specification of technical requirements. This document recommends flight deck lighting design and performance criteria to ensure prompt and accurate readability and visibility, color identification and discrimination of needed information under all expected ambient lighting and electrical power conditions.

INTRODUCTION

This document is part of a family of documents relating to flight deck lighting as a whole. The family of documents consists of AS264, ARP1048, and ARP1161. It is the intent of the A-20A Aircraft Crew Station Lighting Committee to consolidate these documents into ARP4103 over time.

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1. SCOPE

This document recommends design and performance criteria for aircraft lighting systems used to illuminate flight deck controls, luminous visual displays used for transfer of information, and flight deck background and instrument surfaces that form the flight deck visual environment. This document is for commercial transport aircraft except for applications requiring night vision compatibility.

1.1 Purpose

The criteria specified herein are intended to provide guidance to equipment manufacturers, flight deck designers, and certification personnel in managing such factors as brightness, contrast, and color selection to create a flight deck environment that supports effective human visual perception in all the expected range of ambient illumination conditions. The factors to be managed include those that are known to affect sensory coding, spatial organization, visual search time, and visual information processing; the goal is to optimize visual interface of the flight crew to promote safe operation of the airplane. The purpose is to satisfy the end user and obtain certification.

The desired system for aircraft flight deck lighting and display optics is one that will furnish light of adequate intensity and distribution under all conditions of internal and external lighting so that the crew may read instrumentation, placards, check lists, manuals, maps, instrument color coding, distinguish controls, etc., without undue interference with their vision outside of the aircraft.

1.2 Mandating and Recommending Phrases

"Shall" - The word "shall" indicates a mandatory criterion for compliance to this ARP.

"Should" - The word "should" indicates a criterion for which an alternative, including non-compliance, may be applied if it is documented and justified.

1.3 Application

This ARP should be used in conjunction with ARP4101 and ARP4102.

ARP4103 includes general lighting and display optics requirements for all expected lighting conditions and in all expected electrical power conditions and pilot tasks. This document defines the recommended design and performance requirements for component and system level lighting. The document is organized as follows.

Section 3 provides general system level requirements and guidance for flight deck lighting design and certification. The flight deck lighting needs to be designed for the following top level system considerations:

a. Normal lighting systems

b. Non-normal lighting, back up, standby, and battery systems

c. Emergency evacuation

d. Service and maintenance

System level design considerations discussed include:

a. Human visual performance

b. Ambient lighting environment

c. The visual geometrical considerations include the pilot viewing angle and distance to the lighted components, window and display location for direct sun angles and night reflections.

d. The light source and display type, technology affects the reliability and visibility and must be considered for the following factors: luminance, illuminance, chromaticity, temporal characteristics, thermal characteristics, aging and end of life, luminous maintenance, contrast, and dimming.

e. The format and layout affects visibility by font, type, size, luminance, color, and shape.

f. Color appearance is a function of spectral characteristic, gloss, texture, and reflectance.

g. Glare and reflection

h. Regulation and certification

Section 4 provides component level requirements and guidance for flight deck lighting design. Each component and system visual factor sub-section provides: a definition, certification regulations, visual performance guidance, and compliance verification methods. The Section 3 general system level requirements and guidance shall be considered for each component level or subsystem. The components discussed are:

a. Lightplate, integrally lighted information panels

b. Switches, knobs

c. Annunciators, indicators

d. Control panel, keypads, and keyboards

e. Touchscreen

f. Electronic displays

g. Alphanumeric electronics displays

h. Head-up displays

i. Integrally lighted instruments. Conventional instruments, painted white on black.

j. Circuit breaker panel lighting

k. Markers, placards

l. General area and localized task and flood lighting

m. Windows, visors, shades, transparencies

Section 5 is about lighting control; Section 6 discusses light source considerations; Section 7 is on optical requirement compliance verification; and Section 8 provides the non-optical qualification and environmental requirements for flight deck lighting.

2. REFERENCES

2.1 Applicable Documents

This ARP should be used in conjunction with the ARP4101 and ARP4102 series of documents about flight deck design. In addition, the following publications form a part of this ARP to the extent specified herein.