



AEROSPACE RECOMMENDED PRACTICE

ARP4822™**REV. A**

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Superseding ARP4822

Night Vision Imaging System (NVIS) Compatible Illuminated Pushbutton Switches and Indicators

RATIONALE

Warning, caution and advisory push-button switches and indicators are considered by pilots to be one of the most important items in the aircraft crew station. With well defined and historical application of aviation color requirements, these push-button switches and indicators can be particularly difficult to achieve in an NVG green-lighted compatible crew station with chromaticity limits now defined by military specifications that are lacking in most FAR documents. This specific technology, which is utilized to deal with the design of these devices is covered in this document. The most recent revision to is update the references, add Class C response curve and to correct some photometric and radiometric requirements.

1. SCOPE

This SAE Aerospace Recommended Practice (ARP) reviews the basics of NVIS compatibility and discusses the specific illuminated pushbutton switch and indicator requirements for sunlight readability, color, luminance, and NVIS radiance when used in NVIS compatible cockpits.

The recommendations and special considerations set forth in this document are made to give the design engineer a better understanding of MIL-L-85762A and MIL-STD-3009 NVIS compatibility requirements and to provide information on the visual characteristics of NVIS compatible pushbutton switch and indicators. The recommendations are primarily for military aircraft since civilian aircraft FAR requirements typically do not cover NVIS applications with the exception of those covered by RTCA/DO-275.

1.1 Purpose

The purpose of this document is to recommend the design requirements and considerations which the design engineer should observe when selecting and using NVIS compatible illuminated pushbutton switches and indicators.

NVIS compatible lighting is defined as any lighting whose spectral radiance has been selectively filtered to meet the NVIS radiance and chromaticity requirements of MIL-L-85762A or MIL-STD-3009 when dimmed to the specified luminance value. With the introduction of LEDs as a lighting technology, the use of filtering for NVIS compatibility is lessened or not required. In addition, LEDs now allow NVIS radiance limits to be achieved with more saturated chromaticity coordinates thereby allowing color selections that are closer to or within the original Aviation colors requirements. For example, using LEDs would allow warning lights that can meet the Aviation Red requirements but not the NVIS Red requirements since the chromaticity coordinates are now outside the 1976 CIE circle limits but still meet the NVIS requirements. Since the original NVIS requirements were based on filtered incandescent lamps, they had to allow changes in the Chromaticity limits to achieve pushbutton switches that would not impact the visual acuity of the Night Vision Goggle (NVG).

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Documents

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2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 U.S. Military Specifications and Standards

Copies of these documents are available at <http://quicksearch.dla.mil>.

MIL-L-85762A	Lighting, Aircraft, Interior, Night Vision Imaging System (NVIS) Compatible
MIL-PRF-22885J	Switches, Push Button, Illuminated, General Specification for
MIL-S-38039D	Systems, Illuminated, Warning, Caution, and Advisory, General Specification for
MIL-STD-3009	Lighting, Aircraft, Night Vision Imaging System (NVIS) Compatible, 2 Feb, 2001
MIL-STD-411F	Aircrew Station Alerting Systems, 10 Mar 1997

3. NVIS COMPATIBILITY BASICS

3.1 Night Vision Imaging System (NVIS)

NVIS are devices that provide aircrew members with the ability to see at night by greatly amplifying outside scenes illuminated by the night sky.

3.1.1 Image Intensifiers

NVIS use third generation (GEN III) image intensifier tubes having a gallium-arsenide photocathode and microchannel plate to produce the amplification necessary to operate in starlight.

3.1.2 Mechanics of NVIS Operation

The night sky irradiates objects with photons which are reflected as photon images. These photon images are focused by the objective lens onto the photocathode which emits electrons in direct proportion to the number of photons striking its surface. These electrons are greatly multiplied by the microchannel plate and are directed onto a phosphor screen where the amplified image is viewed through the ocular lens (see Figure 1).

3.2 Classification

NVIS compatible lighting requirements are stated based on the type and class NVIS being used.

3.2.1 NVIS Types

3.2.1.1 Type I

These are direct view image NVIS which display the intensified image on a phosphor screen in the user's direct line of sight.

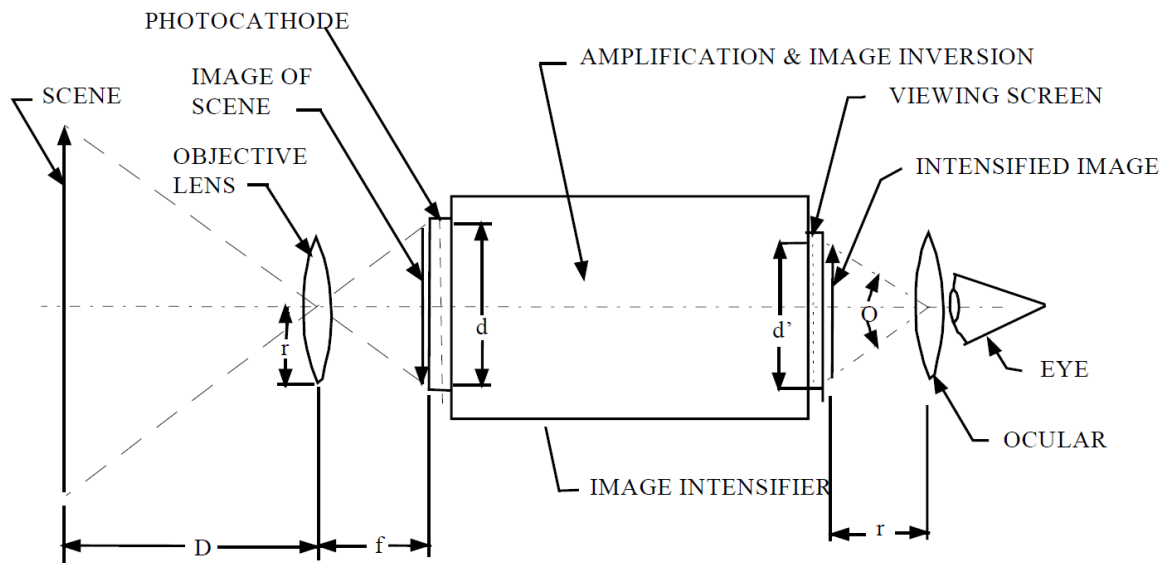


Figure 1

3.2.1.2 Type II

These are projected image NVIS which project the intensified image on a see-through medium in the user's line of sight. An example of type II goggles are Cats Eyes (see Figure 2)



Figure 2 - Cat's eye goggles

3.2.2 NVIS Classes

3.2.2.1 Class A

Any NVIS utilizing a 625 nm minus blue objective lens filter conforming to the specifications in Figure 3 are Class A. The relative spectral response of the Class A NVIS is shown in Figure 3 and the tabulated values are listed in Table 6 of MIL-L-85762A or Figure C-4 from MIL-STD-3009.

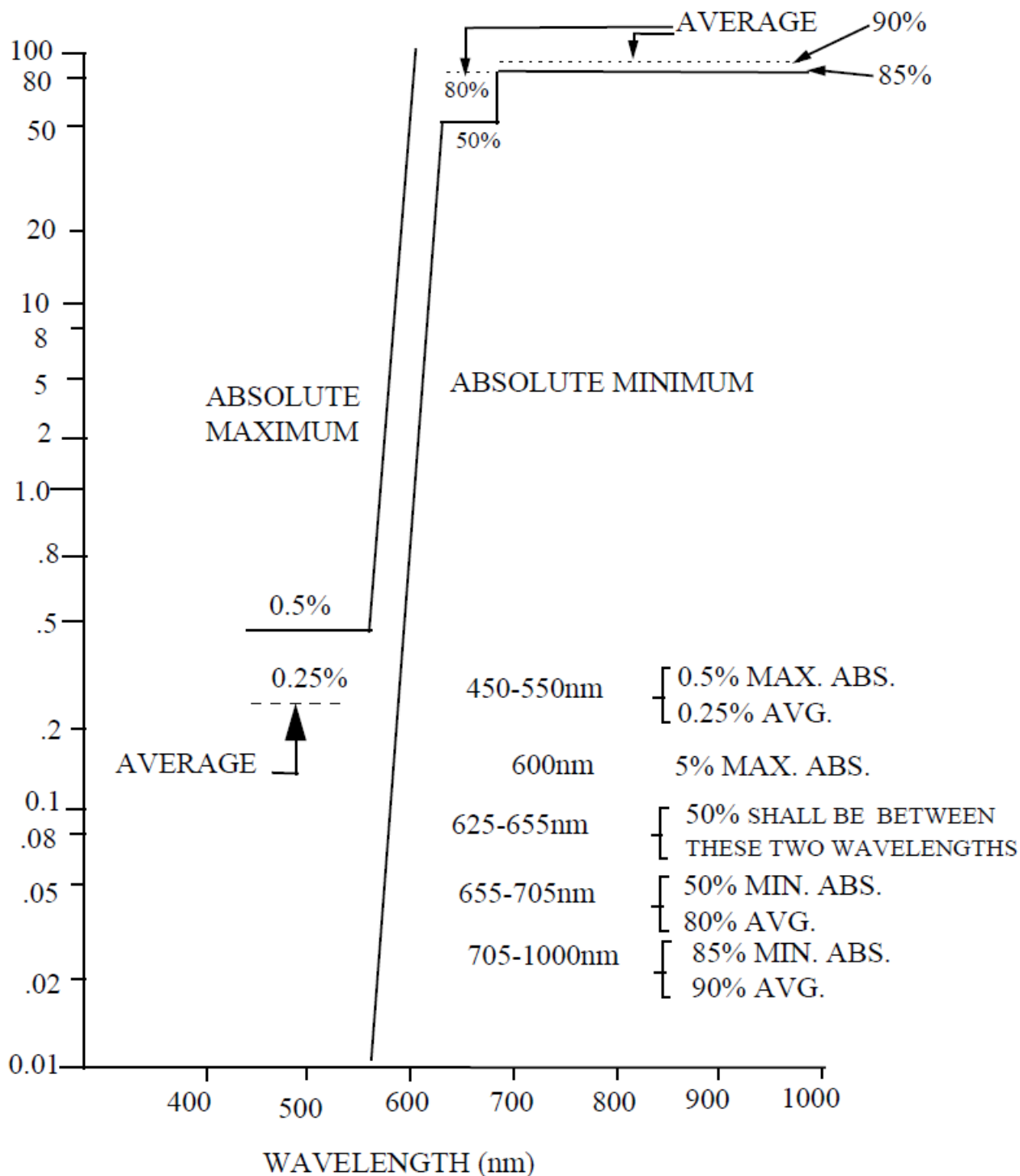


Figure 3 - (Class A) 625 NM minus blue filter specification

3.2.2.2 Class B

Any NVIS utilizing a 665 nm minus blue objective lens filter conforming to the specifications in Figure 4 are Class B. The relative spectral response curve of the Class B NVIS is shown in Figure 5 and the tabulated values are listed in Table 7 of MIL-L-85762A or Figure C-5 from MIL-STD-3009.

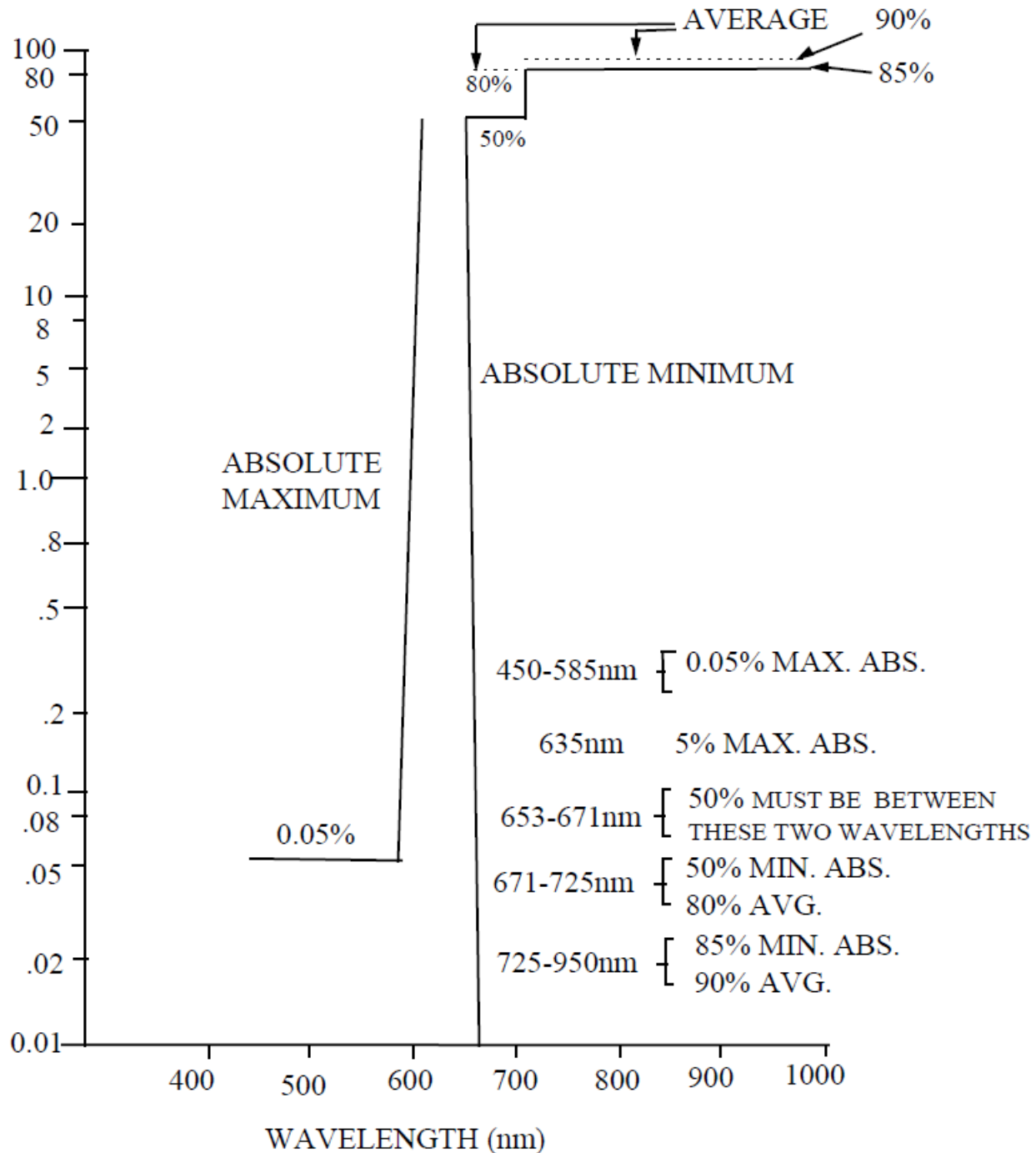


Figure 4 - (Class B) 665 NM minus blue filter specification