

SAFETY OF LASER PRODUCTS –

Part 1: Equipment classification and requirements

INTERPRETATION SHEET 1

This interpretation sheet has been prepared by committee 76: Optical radiation safety and laser equipment.

The text of this interpretation sheet is based on the following documents:

ISH	Report on voting
76/415/ISH	76/418/RVD

Full information on the voting for the approval of this interpretation sheet can be found in the report on voting indicated in the above table.

Subclauses 9.2 and 9.3

These subclauses are clarified by the following:

Introduction

For emissions in the wavelength range of 400 nm to 1 400 nm, the need to perform measurements for Condition 2 (eye loupe viewing) can be greatly reduced by recognising that Condition 3 (unaided viewing) in many cases will be the most restrictive criterion.

Interpretation

The following table outlines the process in this interpretation of IEC 60825-1, subclauses 9.2 and 9.3.

IF	THEN
Angular Subtense > 1,5 mrad @ 100 mm from the reference point	Condition 2 need not be considered
Angular Subtense ≤ 1,5 mrad @ 100 mm; or the angular subtense is not determined	Use simplified Condition 2, C ₆ = 1
<i>Optional for intermediate sources:</i> Angular Subtense ≤ 1,5 mrad @ 100 mm AND > 1,5 mrad using Figure 5	CAN use Figure 5 (with C ₆ determined using Figure 5) if simplified Condition 2 is too restrictive for the application

Rationale

Based on independent studies (see for instance reference [1]), it is found that for extended sources and for radiation in the wavelength range of 400 nm to 1 400 nm, Condition 3 will in most cases be more restrictive than Condition 2 for extended sources (Figure 5). The main reason for this is the magnification of the source obtained with Condition 2. Also, the aperture stop of Condition 2 is limited to 3,5 mm since it simulates a case where there is a high level of ambient lighting, while Condition 3 uses a 7 mm aperture stop, as it simulates a general viewing condition including accidental exposure.

Row 1 in the table above:

If it can be shown that the apparent source is extended ($\alpha > 1,5$ mrad) for unaided viewing at 100 mm distance from the reference point, Condition 2 does not have to be considered.

Row 2 in the table above:

If the source is not extended for unaided viewing (i.e. the angular subtense of the apparent source is less than 1,5 mrad at 100 mm distance from the reference point), or if the angular subtense of the apparent source is not determined (default simplified evaluation), Condition 2 needs to be considered, as it could be more restrictive than Condition 3.

Row 3 in the table above:

For the case that the optional application of Condition 2 for extended sources (Figure 5) is considered, the following cases can be distinguished:

- a) if the angular subtense of the apparent source is determined to be less than 1,5 mrad at 100 mm from the reference point, but appears extended ($\alpha > 1,5$ mrad) using Condition 2 for extended sources (Figure 5) (due to the magnification of the eye loupe), Condition 2 for extended sources may be less restrictive than the simplified Condition 2 and can be applied for the test. If Condition 2 for extended sources (per Figure 5) is used, the corresponding angular subtense is also to be determined using this measurement setup. It should be noted that in this case Condition 3 (where $C_6 = 1$) can be more restrictive than Condition 2 for extended sources (Figure 5) and has to be considered.
- b) if the angular subtense of the apparent source is determined to be less than 1,5 mrad at 100 mm from the reference point, and is also less than 1,5 mrad using Condition 2 for extended sources (Figure 5), the simplified Condition 2 (Table 11) is applicable.

NOTE For the default (simplified) evaluation described in 9.3.2 of the standard, it is not necessary to determine the angular subtense of the apparent source. The apparent source can be assumed to be a small source to simplify the analysis, since this would be the most restrictive case. The simplified measurement conditions listed in Table 11 would apply (Row 2 in the table above).

References

[1] *Influence of magnifiers on ocular exposure levels*, G Veas, R Gilber and K Schulmeister, ILSC Paper 503, ILSC 2009 Proceedings (Laser Institute of America)