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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 172, *Optics and photonics,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 170, *Ophthalmic optics,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 7944:1998). It also incorporates the Technical Corrigendum ISO 7944:1998/Cor 1:2009, which has been technically revised.

The main changes are as follows:

— updated to the current format and drafting rules;

— clarification through rewording in 4.1 and deletion of Note;

— addition of wavelengths to Tables 1, 2 and 3, alignment of precision of the stated wavelengths with the sources and explanation of the source.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Optics and photonics — Reference wavelengths

1 Scope

This document specifies reference wavelengths to be used for the characterization of optical materials, optical systems and instruments, and ophthalmic lenses. It defines the associated principal refractive indices and principal dispersions, as well as the Abbe numbers with regard to these reference wavelengths and principal dispersions.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Reference wavelengths, principal dispersions and Abbe numbers[1)]

4.1 General

For ophthalmic lenses and many non-ophthalmic optical applications, the reference wavelengths are the mercury e-line 546,07 nm (see 4.2) and the helium d-line 587,56 nm (see 4.3).

For other non-ophthalmic optical applications, the appropriate reference wavelength shall be specified. Any reference wavelength is allowed (see Tables 1, 2, 3 as well as other wavelengths).

If nothing is specified, the mercury e-line shall be the reference wavelength.

4.2 Mercury e-line 546,075 nm

The associated principal refractive index n_e is the refractive index at the green mercury e-line and the associated principal dispersion is given by Formula (1):

$$n_{F'} - n_{C'} \tag{1}$$

where

$n_{F'}$ is the refractive index at the blue cadmium F'-line;

$n_{C'}$ is the refractive index at the red cadmium C'-line.

1) ISO 9802 gives the terms and definitions for principal dispersion and Abbe number.

The Abbe number v_e with regard to this reference wavelength and this principal dispersion is defined as given by Formula (2):

$$v_e = \frac{n_e - 1}{n_{F'} - n_{C'}} \tag{2}$$

4.3 Helium d-line 587,562 nm

The associated principal refractive index n_d is the refractive index at the yellow helium d-line and the associated principal dispersion is given by Formula (3):

$$n_F - n_C \tag{3}$$

where

n_F is the refractive index at the blue hydrogen F-line;

n_C is the refractive index at the red hydrogen C-line.

The Abbe number v_d with regard to this reference wavelength and this principal dispersion is defined as given in Formula (4):

$$v_d = \frac{n_d - 1}{n_F - n_C} \tag{4}$$

4.4 Wavelength tables

Table 1 — Reference wavelengths and recommended wavelengths in the visible and ultraviolet spectral ranges

Spectrum reference	Spectral line	Element	Wavelength nm
—	—	Hg	334,148
Ultraviolet mercury	i	Hg	365,016[a]
Violet mercury	h	Hg	404,657
Blue mercury	g	Hg	435,834
Blue cadmium	F'	Cd	479,991
Blue hydrogen	F	H	486,135
Green mercury	e	Hg	546,075
Yellow helium	d	He	587,562
Red cadmium	C'	Cd	643,847
Red hydrogen	C	H	656,279
Red helium	r	He	706,519

[a] This single line of the Hg-triplet should be used.

NOTE Data for standard air – see References [2][3]. For spectroscopic purposes, 'Standard Air' is defined as; 101,325 kPa, 15 °C, 0,033 % of CO_2, and no H_2O.

Table 2 — Recommended wavelengths in the infrared spectral range

Spectral line	Element	Wavelength nm
—	Rb	780,027
s	Cs	852,113
t	Hg	1 013,98
—	Hg	1 128,71
—	Hg	1 395,06
—	Hg	1 529,58
—	Hg	1 813,04
—	Hg	1 970,02
—	He	2 058,13
—	Hg	2 325,31
—	–	4 000
—	–	10 000

NOTE 1 Data for standard air – see References [2][3]. For spectroscopic purposes, 'Standard Air' is defined as; 101,325 kPa, 15 °C, 0,033 % of CO_2, and no H_2O.

NOTE 2 For the wavelengths 4 000 nm and 10 000 nm, usually a thermal source is used in conjunction with specific filters or diffraction gratings.

Table 3 — Recommended laser wavelengths

Active medium	He-Cd	He-Cd	He-Ne	He-Ne	Nd: YAG	CO_2
Wavelength nm	325	441,6	543,365	632,816	1 064,1	10 600

NOTE Data for standard air – see References [2][3]. For spectroscopic purposes, 'Standard Air' is defined as; 101,325 kPa, 15 °C, 0,033 % of CO_2, and no H_2O.

Bibliography

[1] ISO 9802, *Raw optical glass — Vocabulary*

[2] KRAMIDA A. RALCHENKO YU., READER J. NIST ASD Team *NIST Atomic Spectra Database, NIST Standard Reference Database 78* (Ver. 5.10), Available at: https://www.nist.gov/pml/atomic-spectra-database, [Accessed 2023-02-14] National Institute of Standards and Technology, Gaithersburg, MD, USA.

[3] NIST. *Atomic Spectra Database - Spectral Lines Help File*, National Institute of Standards and Technology, Gaithersburg, MD, USA. Available at: https://physics.nist.gov/PhysRefData/ASD/Html/lineshelp.html