BS ISO 14490-8:2011

BSI Standards Publication

Optics and optical instruments — Test methods for telescopic systems

Part 8: Test methods for night-vision devices

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National foreword

This British Standard is the UK implementation of ISO 14490-8:2011.

The UK participation in its preparation was entrusted to Technical Committee CPW/172/4, Optics and Photonics - Telescopic Systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Optics and optical instruments — Test methods for telescopic systems —

Part 8: Test methods for night-vision devices

Optique et instruments d'optique — Méthodes d'essai pour systèmes téléscopiques —

Partie 8: Méthodes d'essai pour dispositifs de vision de nuit

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Contents

Page

Foreword ... v

1 Scope ... 1

2 Normative references ... 1

3 General requirements for the test conditions and preparation of tests ... 1

4 Test method for measuring magnification and difference in magnification ... 2
4.1 General ... 2
4.2 Requirements for the test arrangements and their principal parts ... 3
4.3 Sequence of measurements ... 5
4.4 Assessment of results ... 5

5 Test method for measuring night-vision device gain ... 6
5.1 General ... 6
5.2 Requirements for the test arrangement and principal parts ... 6
5.3 Sequence of measurements ... 7
5.4 Assessment of results ... 7

6 Test method for measuring the angular field of view in object space ... 7
6.1 General ... 7
6.2 Requirements for the test arrangement and principal parts ... 7
6.3 Sequence of measurements ... 8
6.4 Assessment of results ... 8

7 Test method for measuring exit pupil diameter and eye relief ... 9
7.1 General ... 9
7.2 Requirements for the test arrangement and its principal parts ... 9
7.3 Sequence of measurements ... 10

8 Test method for measuring the error of zero-position of the dioptre scale ... 10
8.1 General ... 10
8.2 Requirements for the test arrangement and its principal parts ... 10
8.3 Sequence of measurements ... 11
8.4 Assessment of results ... 11

9 Test method for measuring the angle of image rotation around the optical axis relative to the object and the difference of image rotation angles ... 12
9.1 General ... 12
9.2 Requirements of the test arrangement and its principal parts ... 12
9.3 Sequence of measurements ... 13
9.4 Assessment of results ... 13

10 Test method for measuring non-parallelism of the axes of bundles of rays emerging from the eyepieces of the night-vision device ... 13
10.1 General ... 13
10.2 Requirements of the test arrangement and its principal parts ... 13
10.3 Sequence of measurements ... 15
10.4 Assessment of results ... 15

11 Test method for measuring the limit of resolution ... 15
11.1 General ... 15
11.2 Requirements for the test arrangement and its principal parts ... 15
11.3 Sequence of measurements ... 16
11.4 Assessment of results ... 16

12 Test method for measuring working resolution and for determining range of vision ... 16
12.1 General ... 16
12.2 Requirements for the test arrangement and its principal parts ... 17
12.3 Sequence of measurements ... 17

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12.4 Assessment of results 18

13 Test method for measuring the close distance of observation 19
13.1 General 19
13.2 Requirements for the test arrangement and its principal parts 19
13.3 Sequence of measurements 20
13.4 Assessment of results 20

14 Test method for imperfections in the field of view 20
14.1 General 20
14.2 Requirements for the test arrangement and its principal parts 20
14.3 Sequence of measurements 21
14.4 Assessment of results 22

15 Test method for measuring the continuous work time of a night-vision device 22
15.1 General 22
15.2 Requirements for the test arrangement and its principal parts 22
15.3 Sequence of measurements 22
15.4 Assessment of results 22

Bibliography 23

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14490-8 was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 4, *Telescopic systems*.

ISO 14490 consists of the following parts, under the general title *Optics and optical instruments — Test methods for telescopic systems*:

— *Part 1: Test methods for basic characteristics*

— *Part 2: Test methods for binocular systems*

— *Part 3: Test methods for telescopic sights*

— *Part 4: Test methods for astronomical telescopes*

— *Part 5: Test methods for transmittance*

— *Part 6: Test methods for veiling glare index*

— *Part 7: Test methods for limit of resolution*

— *Part 8: Test methods for night-vision devices*

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INTERNATIONAL STANDARD ISO 14490-8:2011(E)

Optics and optical instruments — Test methods for telescopic systems —

Part 8:
Test methods for night-vision devices

1 Scope

This International Standard describes the test methods for determining the performance of night-vision devices as specified in ISO 21094.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5725-1, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

ISO 11664-2, *Colorimetry — Part 2: CIE standard illuminants*

ISO 14490-1, *Optics and optical instruments — Test methods for telescopic systems — Part 1: Test methods for basic characteristics*

ISO 14490-7, *Optics and optical instruments — Test methods for telescopic systems — Part 7: Test methods for limit of resolution*

ISO 21094, *Optics and photonics — Telescopic systems — Specifications for night vision devices*

3 General requirements for the test conditions and preparation of tests

Measurements shall be carried out under the normal conditions of the work area, namely:

— air temperature: (20,0 ± 5,0) °C;

— relative humidity of the air: 40 % to 60 %.

During measurements, the temperature shall not vary by more than ± 2 °C and the relative humidity shall not vary by more than 4 %.

The measurements should be carried out in conditions in which the test specimen is protected from stray light and electrical and strong magnetic fields.

The recommended illuminance in the test room is 0,01 lx to 0,04 lx.

Measurements of the basic characteristics of night-vision devices shall be carried out with the aid of a dedicated power supply.

The use of an external power supply is acceptable subject to its voltage not departing from the nominal voltage of the dedicated power supply by more than ± 0,1 V.

The testing of instruments equipped with a source of radiation shall be carried out while the source is switched off.

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The source of radiation used in collimators and other instruments for measuring the characteristics of production prototypes of night-vision devices shall be incandescent lamps which have a filament colour temperature, T_C, of (2 856 ± 50) K, unless otherwise stated. The instability of the voltage on incandescent lamps, at the time of measurement, shall not exceed 0,3 %.

It is important that the spectral characteristics of the source of radiation cover the full range of spectral sensitivity of the image intensifier. The transmission spectrum of filters placed in collimators or in front of a night-vision device shall correspond to the sensitivity spectral region of the test specimen.

When measuring the characteristics of production samples, the use of incandescent lamps, where the filament colour temperature, T_C, is different from the one specified above, is acceptable.

The objectives of collimators used in test arrangements may be lens, mirror or catadioptric systems.

Integrating spheres may be used for uniform illumination of scales and reticles in collimators.

During all measurements of the characteristics of night-vision devices, the luminance of the image intensifier screen shall be the optimum for the observer.

In the assessment of results (see 4.4, 5.4, 6.4, 7.4, 8.4, 9.4, 10.4, 11.4, 13.4 and 14.4), repeatability shall be stated in accordance with ISO 5725-1. The assessment of the correctness of the average value obtained, i.e. the assessment of the systematic error, shall be carried out either analytically or by comparison of the measurement results obtained in different test laboratories.

4 Test method for measuring magnification and difference in magnification

4.1 General

The measurement of magnification is based on the measurement of the image size of an object within the field of view of the night-vision device.

The magnification, Γ, is calculated in accordance with the following equation:

$$\Gamma = \frac{\tan w'}{\tan w} \tag{1}$$

where w and w' are the angles between the conjugate rays and the optical axis in object space and in image space respectively.

For night-vision devices with variable magnification, Γ shall be measured for the maximum and minimum magnifications.

Depending on the value of magnification and the size of the field of view of the night-vision device, the measurements of Γ shall be carried out in accordance with the arrangements shown in Figure 1 or Figure 2.

The diameter of the collimator lens used in these arrangements shall exceed by 15 % to 20 % the lens diameter of the test specimen.

The diameter of the telescope objective lens used shall exceed by 15 % to 20 % the diameter of the pencil of light that emerges from the test specimen.

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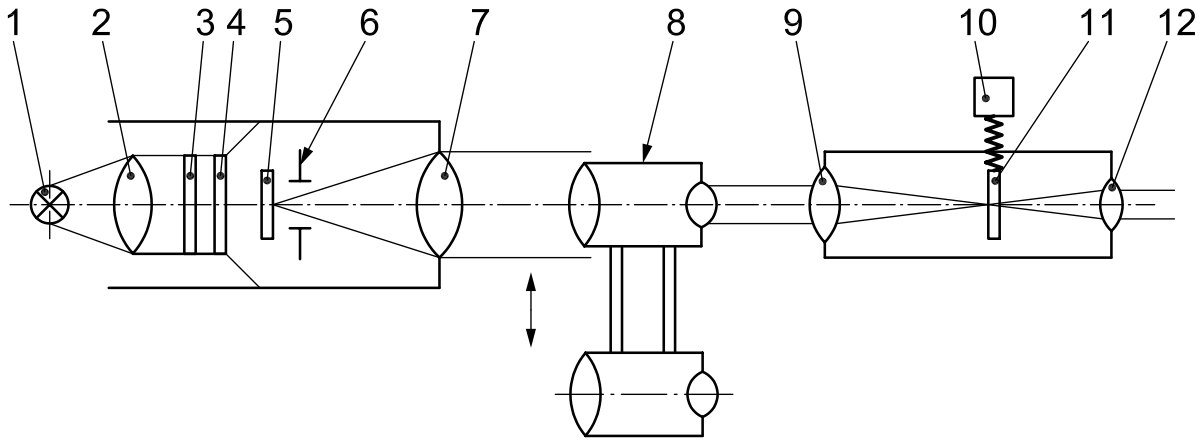
4.2 Requirements for the test arrangements and their principal parts

4.2.1 Requirements for the test arrangement shown in Figure 1



Key

1 source of radiation
2 condenser
3 filter
4 diffusing plate
5 collimator scale with cross-lines [a]
6 opaque diaphragm with aperture
7 collimator lens
8 test specimen
9 telescope objective lens
10 telescope read-out device
11 reticle
12 telescope eyepiece

[a] For this method, a scale without cross-lines may be used. When testing as specified in other test methods, the use of a cross-line can be indispensable. For the sake of unification, it is recommended that a scale with cross-lines be used in all test arrangements.

Figure 1 — Arrangement for measurement of the magnification and difference in magnification of night-vision devices with fields of view up to 12° and magnifications up to 1,5×

The linear size of the collimator scale shall be such that the size of the image of the scale at the image intensifier screen of the night-vision device would cover 1/5 to 2/5 of the diameter of image intensifier screen.

For the scale (5), the line widths and the spaces between them shall have dimensions that are at least 2½ times greater than the limit of resolution of the test specimen, so that they can be clearly resolved.

The marginal part of the scale (5) shall be opaque; this is achieved by means of a diaphragm (6).

The range of the scale of the telescope read-out device (10) (see Figure 1) shall be at least 25 mm with a read-out error of no more than 0,05 mm.

Aberrations of the optical systems of the collimator and telescope shall be within the limits that allow for the specified precision of measurements.

NOTE The requirements for the aberrations of the optical systems might be less severe if corrections for the real angular sizes of the scale divisions and of the telescope scale movement read-out mechanism are applied to the measurement results.

It is important that the spectral characteristics of the source of radiation cover the long-wavelength cut-off of the image intensifier.

It is recommended that the support beneath the test specimen allows for its movement normal to the collimator axis, in order to enable successive measurements to be made of the magnification in each channel of the night-vision device.

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