INTERNATIONAL STANDARD

ISO 3059

Third edition
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Non-destructive testing — Penetrant testing and magnetic particle testing — Viewing conditions

Essais non destructifs — Contrôles par ressuage et contrôles par magnétoscopie — Moyens de vérification des conditions d'observation

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

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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 3059 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 138, *Non-destructive testing*, in collaboration with ISO Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee SC 2, *Surface methods*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 3059:2001) which has been technically revised.

Changes from the second edition include:

— updating of the normative references;

— addition of a terms and definitions clause;

— review of requirements for colour contrast and fluorescent techniques;

— reduction of verification period of irradiation and illuminance meters to 12 months;

— an editorial review of the text.

Introduction

Both penetrant and magnetic particle testing require controlled conditions for viewing indications, e.g.:

— adequate white light to achieve reliable testing with colour contrast techniques;

— adequate UV-A irradiance with minimal light for fluorescent systems.

Non-destructive testing — Penetrant testing and magnetic particle testing — Viewing conditions

1 Scope

This International Standard specifies the control of the viewing conditions for magnetic particle and penetrant testing. It includes minimum requirements for the illuminance and UV-A irradiance and their measurement. It is intended for use when the human eye is the primary detection aid.

This International Standard does not cover the use of actinic blue light sources.

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 9712, *Non-destructive testing — Qualification and certification of personnel*

ISO 12706, *Non-destructive testing — Penetrant testing — Vocabulary*

ISO 12707, *Non-destructive testing — Terminology — Terms used in magnetic particle testing*

IEC 60050-845, *International electrotechnical vocabulary — Chapter 845: lighting*

EN 1330-1, *Non-destructive testing — Terminology — Part 1: List of general terms*

EN 1330-2, *Non-destructive testing — Terminology — Part 2: Terms common to the non-destructive testing methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12706, ISO 12707, EN 1330-1, and EN 1330-2 apply.

4 Safety precautions

All relevant international, regional, national and local regulations including health and safety shall be taken into account (e.g. optical radiation directives).

Care shall be taken to minimize exposure of personnel to harmful optical radiation. Exposure to UV radiation below 330 nm shall be avoided (e.g. from damaged or cracked filters) and exposure to high levels of other potentially harmful radiation (e.g. 365 nm or visible radiation from white light LEDs, which have a high proportion of blue light) should be minimized. The eye is particularly at risk.

5 Colour contrast techniques

5.1 Light sources

Inspection shall be carried out in daylight or artificial white light. Where artificial sources are used, the colour temperature shall not be below 2 500 K and it is recommended to use sources above 3 300 K. Consult the information from the lamp manufacturer to confirm the colour temperature.

Lighting conditions affect detection capability. The best conditions are when the surrounding area has some background light. Light reaching the inspector's eyes directly or indirectly from the light source or as a result of the limited screening of other sources should be avoided.

Sources may not reach a steady state immediately and shall be allowed to stabilize before use. The light output can vary, e.g. due to ageing of the light source or deterioration of the reflector.

The test surface shall be illuminated evenly. Glare and reflections shall be avoided.

NOTE Failure of a single LED within an array can cause uneven illumination.

5.2 Measurements

The illuminance at the test surface shall be determined by means of an illuminance meter under working conditions. The response of the meter shall be similar to the photopic response of the human eye (as specified in IEC 60050-845).

NOTE CIE 069[1] provides further information on evaluation of light meters.

5.3 Requirements

The level of illuminance for removal of excess penetrant shall be at least 350 lx.

For inspection, the illuminance at the test surface shall be 500 lx or greater.

In some cases, a minimum of 1 000 lx may be required.

Permanently tinted spectacles, neutral density glasses or those which darken under inspection conditions shall not be worn, except for techniques involving white background and very high levels of daylight (generally above 20 000 lx) which can reduce indication detectability. In this case, the use of neutral density glasses are permitted. Care shall be taken under such conditions.

6 Fluorescent techniques

6.1 Ultraviolet radiation

Testing shall be carried out with UV-A radiation using a source with a maximum intensity at (365 ± 5) nm and a full width at half maximum (FWHM) of 30 nm. It is important to minimize visible background light incident upon the component or light reaching the inspector's eyes directly or indirectly from the UV-A source or as a result of the limited screening of other sources. Sources may not reach a steady state immediately and shall be allowed to stabilize before use. The UV-A irradiance can vary, e.g. due to ageing of the light source or deterioration of the reflector or filter.

The test surface shall be irradiated evenly.

NOTE Failure of a single LED within an array can cause uneven irradiation.

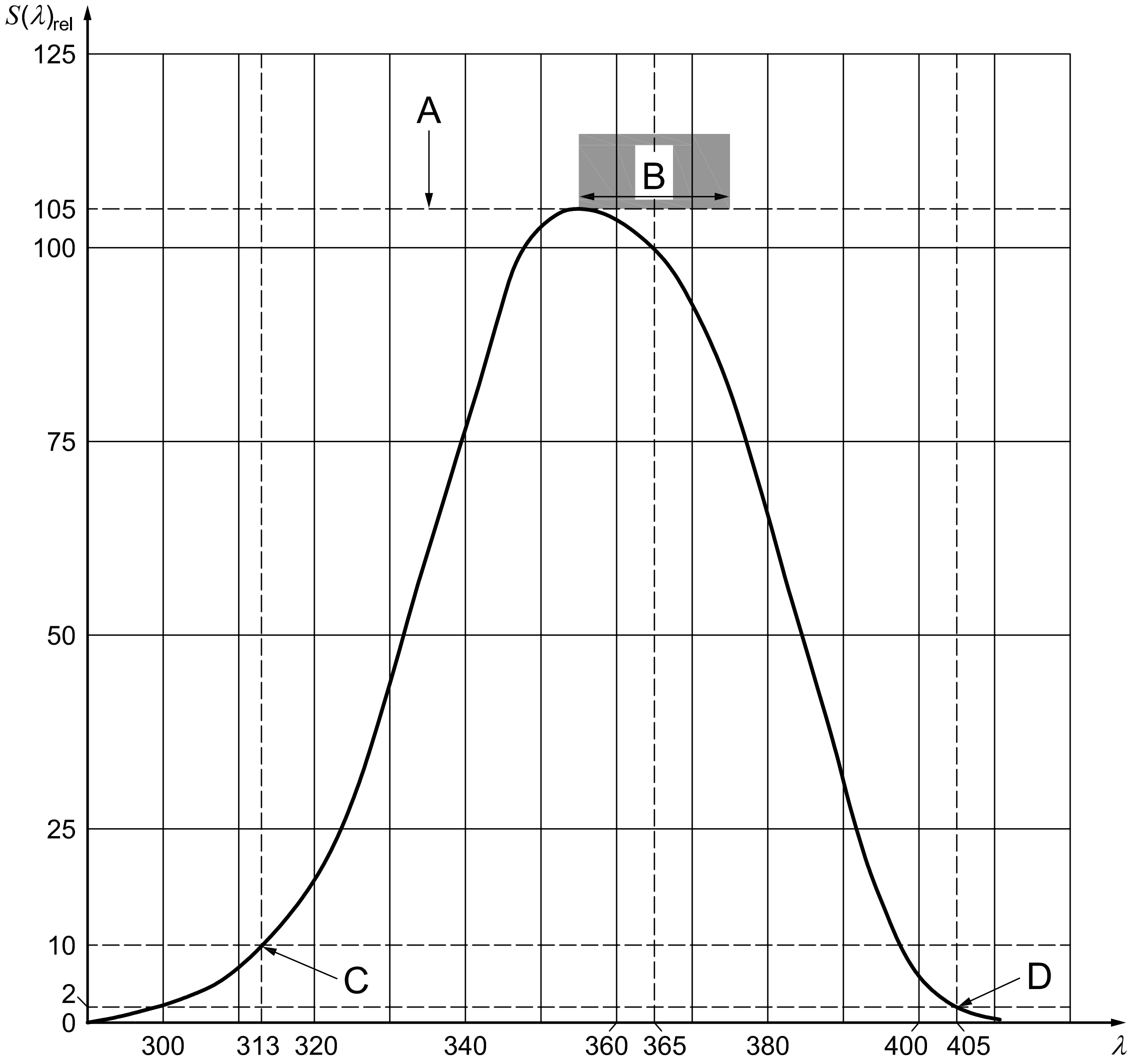
Typical examples of light sources are mercury discharge lamps, halogen lamps, xenon lamps, and LED arrays.

6.2 Measurements

The UV-A irradiance shall be measured under working conditions on the test surface by means of a UV-A radiometer having a sensitivity response as defined in Figure 1.

Measurements shall be carried out when the lamp output has stabilized (for mercury discharge lamps, this shall not be less than 10 min after switching on).

For measurement of illuminance, see 5.2. The reading from the illuminance meter shall not be affected by UV-A irradiance.



Key

$S(\lambda)_{rel}$ relative spectral response

λ wavelength

Relative spectral response is the ratio of the response of the sensor to radiation of a given wavelength, λ, to the response at 365 nm.

The relative spectral response curve for a suitable sensor shall not enter the shaded area. A, B, C and D in the figure denote limits corresponding to the following requirements:

A the relative spectral response shall not exceed 105 % for any wavelength;

B the peak relative spectral response shall occur between 355 nm and 375 nm;

C the relative spectral response at a wavelength of 313 nm shall be less than 10 %;

D the relative spectral response at a wavelength of 405 nm shall be less than 2 %.

The curve shown is an example of one produced by an acceptable meter.

Figure 1 — Spectral response of UV-A irradiation meters

6.3 Requirements

For the removal of excess penetrant, the UV-A irradiance shall be at least 1 W/m^2 (100 $\mu W/cm^2$) and the illuminance shall be less than 100 lx.

For inspection, the UV-A irradiance shall be 10 W/m^2 (1 000 $\mu W/cm^2$) or greater and the illuminance 20 lx or less on the test surface. The measurements shall be carried out under working conditions with the UV-A source turned on and stabilized.

Permanently tinted spectacles or those which darken under inspection conditions shall not be worn.

For penetrant testing, the combination of high level and long duration of UV-A irradiance should be avoided, generally not more than 50 W/m^2 (5 000 $\mu W/cm^2$).

There shall be no glare or other source of visible light or UV-A radiation within the operator’s field of vision. Ambient visible light levels shall be 20 lx or less.

7 Visual acuity

The visual acuity of NDT personnel shall be adequate for the NDT task carried out and shall meet the requirements of ISO 9712.

8 Calibration

The working range of irradiation and illuminance meters shall be calibrated at the frequency recommended by the manufacturer using equipment and a system which is traceable to a national, European or International Standard. This period shall not exceed 12 months. The calibration of the UV-A irradiation meter shall be carried out with narrow band radiation at a wavelength of 365 nm. Maintenance of or damage to the meter shall necessitate calibration. When detachable sensors and readout units are used, calibration shall be carried out on the entire system (readout unit and sensors).

The calibration shall be documented by a certificate.

Bibliography

[1] CIE 069, *Methods of characterizing illuminance meters and luminance meters: Performance, characteristics and specifications*

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