INTERNATIONAL STANDARD 3059

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Non-destructive testing — Method for indirect assessment of black light sources

Essais non destructifs — Méthode d'évaluation indirecte des sources de lumière noire

First edition — 1974-06-01

UDC 620.179.1 : 535.37

Ref. No. ISO 3059-1974 (E)

Descriptors : tests, non-destructive tests, black light, luminous intensity, determination.

Price based on 6 pages

ISO 3059-1974 (E)

FOREWORD

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Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3059 was drawn up by Technical Committee ISO/TC 135, *Non-destructive testing*, and circulated to the Member Bodies in April 1973.

It has been approved by the Member Bodies of the following countries :

Australia	Germany	Romania
Austria	Ireland	South Africa, Rep. of
Belgium	Israel	Sweden
Bulgaria	Mexico	Thailand
Chile	Netherlands	Turkey
Czechoslovakia	New Zealand	United Kingdom
France	Norway	U.S.S.R.

The Member Body of the following country expressed disapproval of the document on technical grounds :

Egypt, Arab Rep. of

Printed in Switzerland

Non-destructive testing – Method for indirect assessment of black light sources

0 INTRODUCTION

0.1 The application of penetrant and magnetic particle flaw detection methods of non-destructive testing in which fluorescent materials are employed involves the use of black light illumination. Experience has shown that a standard is required by which black light illumination can be assessed as, in addition to variation due to different types of lamps and filters, the output of an individual black light lamp may vary due to a number of causes, for example :

1) mechanical displacement and tarnishing of the reflector;

2) the effect of the environment and dirt on the filter;

3) decrease in the output of the lamp due to ageing;

4) variation in output due to voltage fluctuations.

0.2 While there are units and standards for visible light, there are no units or standards in common use for black light. It has, therefore, been necessary to devise a method for assessing black light output by comparative means.

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard specifies a procedure which is primarily intended for assessing by comparative methods the output of black light lamps used in fluorescent magnetic particle and penetrant flaw detection techniques. It applies to both new lamps and lamps in service and, in the latter case, it is recommended that the output of lamps be assessed at regular intervals.

1.2 The method specified may also be used both for checking that specified levels of black light illumination at the surface of the material or component under inspection are achieved and maintained.

1.3 A control test for checking the fluorescence of penetrant liquids is specified in annex A.

2 DEFINITIONS

For the purposes of this International Standard, the following definitions apply.

2.1 black light : Near ultra-violet radiation, 320 to 400 nm, used for exciting fluorescence.

2.2 fluorescence : Property of emitting light as the result of, and only during absorption of, radiation from some other energy source.

Other definitions relating to penetrant and magnetic particle flaw detection are given in ISO ..., *Glossary of terms used in non-destructive testing.* (In preparation.)

3 SAFETY PRECAUTIONS

3.1 The black light filter, either as an integral part of the lamp or as a separate component, shall always be maintained in good condition. It shall be ensured that the emission of unfiltered radiation other than black light is kept to a minimum.

3.2 Care shall be taken to ensure that under no circumstances can unfiltered radiation from a black light source be directed at the eyes.

4 TEST APPARATUS

4.1 General

The test apparatus shall consist of a fluorescent screen and a photometer disposed as shown in figure 1. The plane of the photometer photo-electric cell shall be parallel with the plane of the screen and its centre shall be 70 mm along the normal from the centre of the screen. The support plate for the photometer shall be designed to accommodate the active area of the photo-electric cell without a reduction of the aperture. An example of a black light monitor is shown in figure 2. The use of an alternative type of apparatus, for example consisting of an open framework, is not precluded and is preferred for checking large (multi-unit) lamps, but the dimensional requirements shown in figure 1 shall be maintained.

4.2 Components

The individual components of the test apparatus shall comply with the following requirements.

4.2.1 *Fluorescent screen*

The fluorescent screen shall consist of a dispersion of an inorganic fluorescent pigment in a polystyrene binder, in the form of a thin sheet encapsulated between two sheets of clear polyester film (see annex B).

4.2.2 *Photometer*

The photometer shall comply with the requirements of relevant national standards and CIE[1)] publications and should read over the range, 0 to 500 lx. The limits of error in indication over 1/4 to 3/4 of the scale range (or ranges) shall not be greater than ± 7,5 %. The light entry aperture shall not be larger than can be accommodated in the 80 mm × 80 mm support plate (see also 4.1). Certain types of photometer for this application should preferably be assembled with the photo-electric cell and meter back-to-back. The meter shall be fitted with a colour correction filter conforming to the CIE standard observer response.

5 TEST CONDITIONS

5.1 Prior to the assessment of black light output, the lamp shall be switched on for not less than 15 min in order to allow it to achieve full intensity.

5.2 The procedure shall be carried out in a darkened area with background illumination of visible light, as measured at the point of inspection, not exceeding 10 lx.

6 CHECKING INDIVIDUAL LAMPS

6.1 The apparatus described in clause 4 shall be supported at a distance, *d* (figure 1), from the accessible surface of the black light source in the lamp under test. With the apparatus directed towards the source, the distance, *d*, shall be selected so that the appropriate scale reading of the photometer is at approximately 50 % of full scale deflection. The apparatus shall then be moved in a plane at right angles to the beam of the lamp until a maximum reading for the distance, *d*, is obtained on the photometer.

The distance, *d*, from the centre of the fluorescent screen in the apparatus to the accessible surface of the lamp shall be measured and preferably marked on the lamp as the testing distance to be used when further checks are carried out.

The maximum scale reading in lux associated with this testing distance, *d*, shall be recorded and regarded as the datum for the particular lamp under test. (Reading 1.)

6.2 For checking individual lamps in service for consistency of light output, the above procedure shall be repeated at the testing distance, *d*, for the lamp under test and a further reading obtained on the photometer. (Reading 2.)

6.3 The difference between readings 1 and 2 will indicate whether there has been any diminution in the output of the black light source.

7 CHECKING BLACK LIGHT AT THE SURFACE UNDER INSPECTION

A procedure similar to that described in clause 6 may be used for checking the output of the black light lamp at the surface of the material or component under inspection. For this check, the apparatus described in clause 4 is placed at the surface under examination, and with the black lamp positioned at the maximum working distance a meter reading is obtained.

It is recommended that the meter reading obtained from this check should be not less than 50 lx.

NOTE — The maximum working distance may not be the same as the distance, *d*, established in 6.1.

1) Commission Internationale d'Éclairage (International Commission of Illumination), Publication No. 18 — Principles of light measurement.

ANNEX A

CONTROL TEST FOR CHECKING FLUORESCENCE OF PENETRANT LIQUIDS

A.1 As a control test for checking the fluorescence of penetrant liquids the following procedure may be used :

1) A sample of the "standard" penetrant and of the penetrant under test are respectively diluted by adding 1 part of penetrant to 9 parts of methylene chloride (dichlormethane), or other suitable solvent, and mixed thoroughly.

2) Filter papers having the same dimensions as the standard fluorescent screen in the testing apparatus are soaked in each penetrant liquid and are then dried for approximately 10 min at 80 to 100 °C using a hot-air dryer.

3) Each paper in turn is then placed in the apparatus under the conditions described in clause 5 and the respective readings on the photometer are taken. (Reading 1 = liquid under test. Reading 2 = "standard" liquid.)

4) A clean blank filter paper from the same batch as used in 2) is now placed in the apparatus and a further reading taken. (Reading 3.)

A.2 The efficacy of the liquid under test relative to the "standard" liquid may be expressed as a percentage as follows :

$$\frac{\text{Reading 1} - \text{Reading 3}}{\text{Reading 2} - \text{Reading 3}} \times 100$$

ANNEX B

NOTES ON FLUORESCENT SCREENS

B.1 A type of fluorescent screen which has proved suitable for the test apparatus described in clause 4 complies with the following.

B.1.1 The fluorescent pigment is a silver-activated zinc-cadmium sulphide of the type used as the yellow component of monochrome television screens. It can be further specified as follows :

Emission peak	550 ± 10 nm
Decay time to 10 %	20 to 100 μs
Body colour	pale yellow
Particle size	weight median size 8 to 12 μm
Photolysis	the phosphor is treated to inhibit photolysis.

B.1.2 The screen is cut from cast sheet having the following specification :

Phosphor pigment to binder solids ratio : 2 : 1

Sheet thickness : 20 ± 2 mg/cm^2

Binder : clear polystyrene resin.

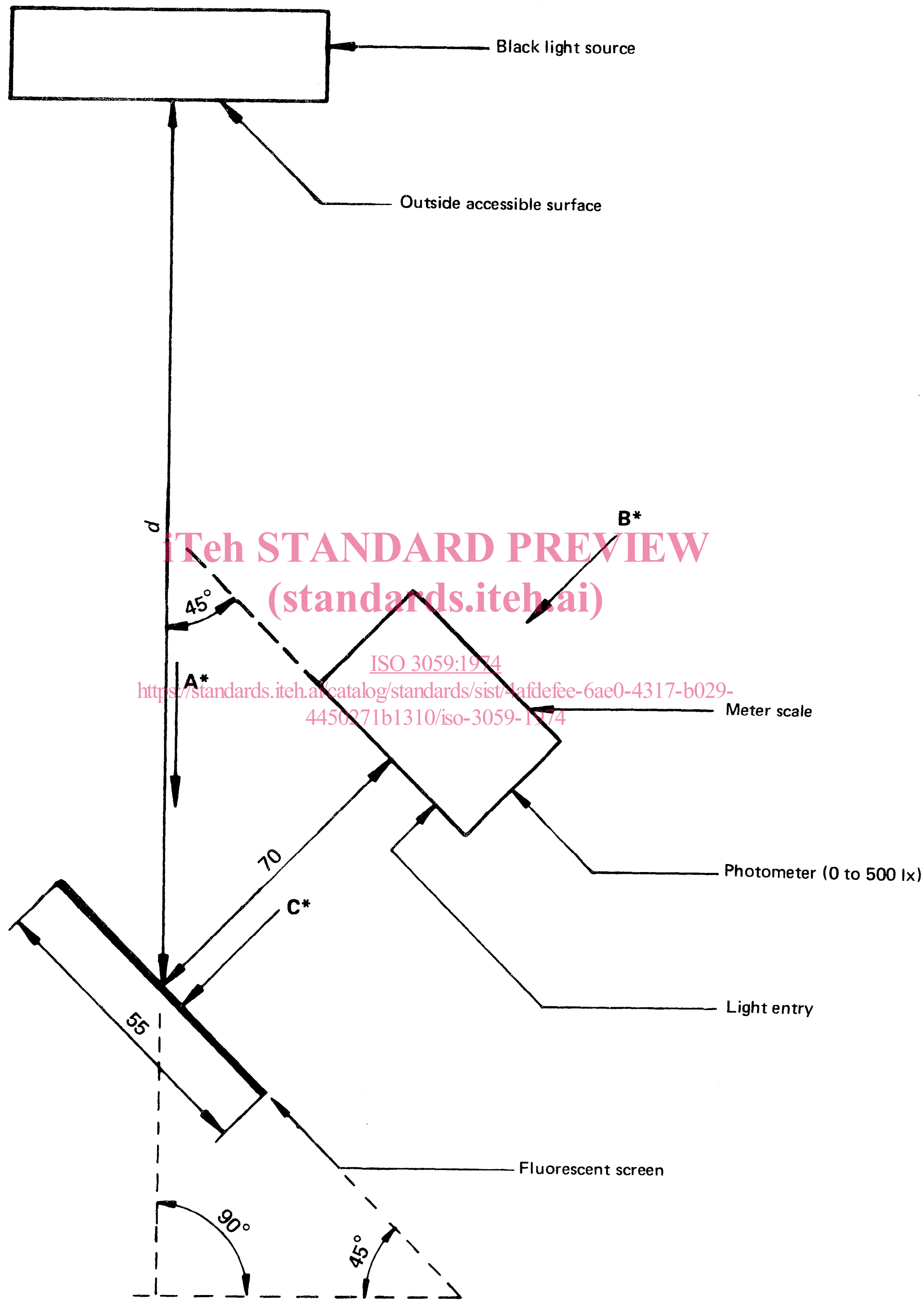
B.1.3 The screen is mounted together with a sheet of white photographic card cut to the same dimensions between two pieces of clear polyester film of thickness 0,05 mm (0.002 in) using polyester electrical grade pressure sensitive tape to bind the edges.

B.2 The fluorescent screen should always be kept covered until measurements are made and should never be left exposed for a long period to black light or strong direct sunlight.

B.3 Part of the screen is masked under normal use. At intervals of 1 to 6 months, depending on the frequency of use, it is recommended that the mask be removed and the whole screen inspected under black light radiation. If there is any sign of blackening or reduced fluorescence in the working area compared with the mask area, the screen should be replaced. In any case, the screen should be replaced when the change in intensity, as measured by an instrument, is 5 %[1] or greater.

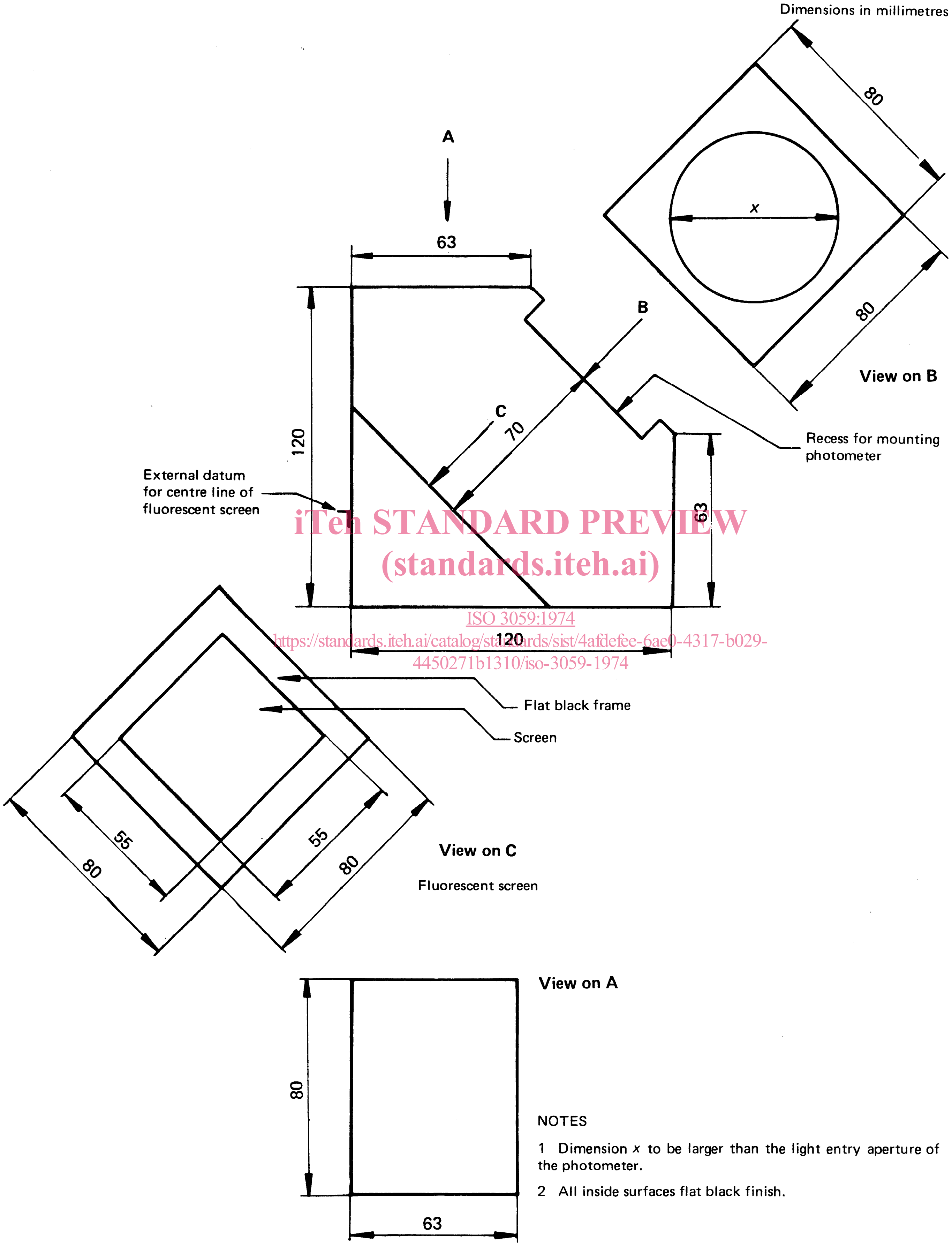
1) Experience has shown that this will correspond to a period of 2 years in normal service.

Dimensions in millimetres



* See figure 2

FIGURE 1 — **Indirect assessment of black light**



NOTES

1 Dimension *x* to be larger than the light entry aperture of the photometer.

2 All inside surfaces flat black finish.

FIGURE 2 — **Example of black light monitor**