
**Time-measuring instruments —
Photoluminescent deposits — Test
methods and requirements**

*Instruments de mesure du temps — Dépôts photoluminescents —
Méthodes d'essai et exigences*

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Time-measuring instruments — Photoluminescent deposits — Test methods and requirements

1 Scope

This International Standard specifies the test methods of various aspects of the photoluminescent deposits applied to time-measuring instruments, together with the requirements related to them.

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 3157:1991, *Radioluminescence for time measurement instruments — Specifications*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

photoluminescent deposit

non-radioactive substance applied to a support, which is able to accumulate energy and release it as light

3.2

luminance

ratio of the light intensity to the surface unit of emission for a remote observer

NOTE This is expressed as nanocandelas per square centimetre (ncd/cm²).

3.3

luminance degradation coefficient

decrease of luminance as a function of time

3.4

legibility

ability of the luminescent item to be seen distinctly

3.5

legibility limit

minimum luminous intensity with which the luminescent item can be seen distinctly

3.6

luminous intensity

the light intensity for a remote observer

NOTE This is expressed in ncd.

4 Test methods and requirements

4.1 Tests on sample

4.1.1 Test sample

(30 ± 1) mg of the photoluminescent deposit shall be applied evenly to a surface area of (1 ± 0,03) cm² at the end of a white-coated metallic support.

The white colour shall be the safety white No. 9003 of the RAL (Reichsausschuss für Lieferbedingungen) colour range.

4.1.2 Colours

The standardized colours shall be those defined in 4.2.1 of ISO 3157:1991. Checking of colour shall be done by visual examination in daylight, not in direct sunlight. Measurements according to CIE 1976 L*a*b* are a possible alternative.

4.1.3 Luminous intensity and luminance

Luminous intensity of the test sample shall be checked according to the following procedures:

- a) Store the test sample at ambient temperature for at least 8 h in the dark.
- b) Irradiate the test sample under the D65 light source at 200 lx for 30 min or 400 lx for 20 min, and then store it in the dark.
- c) Measure the luminous intensity of the test sample 30 min, 90 min and 180 min after its storage. If the time required for reaching the legibility limit or the luminance degradation coefficient is needed, the curve may be extrapolated down to a luminance of 40 ncd/cm². A photometer shall be used for the measurement.

Throughout the test periods b) and c), the ambient temperature shall be (23 ± 2) °C and the relative humidity shall be (50 ± 15) %.

4.1.4 Ageing resistance

Ageing resistance of the test sample shall be checked according to the following procedures:

- a) Measure the luminous intensity of the test sample according to 4.1.3.
- b) Expose the test sample to UV light, humidity and temperature as described in 4.4.2 of ISO 3157:1991. The duration of the exposure shall be extended to 48 h.
- c) Visually inspect the test sample; no discoloration, crack, damage, breakage or exfoliation shall be allowed.
- d) Measure again the luminous intensity (according to 4.1.3) after 24 h of storage in the dark. The luminous intensity loss shall be less than 10 %.

4.1.5 High/low temperature resistance

High/low temperature resistance of the test sample shall be checked according to the following procedures:

- a) Measure the luminous intensity of the test sample according to 4.1.3.
- b) Store the test sample in the dark at (80 ± 5) °C and (50 ± 15) % relative humidity for 1 h.
- c) Store the test sample in the dark at (−20 ± 5) °C for 1 h; the time to pass from (80 ± 5) °C to (−20 ± 5) °C shall be at least 30 min.

- d) Visually inspect the test sample; no discoloration, crack, damage, breakage or exfoliation shall be allowed.
- e) Measure again the luminous intensity (according to 4.1.3). The luminous intensity loss shall be less than 10 %.

4.2 Test on components

4.2.1 General

While the test is intended to be carried out for a set of components, it may be carried out for only one component or for a set of components or for a complete time-measuring instrument.

4.2.2 Legibility

Legibility of a photoluminescent deposit-coated component shall be checked according to the following procedures:

- a) Store the photoluminescent deposit-coated component at ambient temperatures for at least 8 h in the dark.
- b) Irradiate the photoluminescent deposit-coated component under the D65 light source at 200 lx for 30 min or at 400 lx for 20 min, and then store it in the dark.
- c) Visually inspect the photoluminescent deposit-coated component for its legibility in the darkroom after a 3 h storage, then every hour. The legibility criteria shall be:
 - 1) Hour and minute hands shall be clearly identified (seen and distinguished).
 - 2) The 12 o'clock direction on the dial shall be clearly identified (seen and distinguished).

The legibility limit shall comply with the luminous intensity measured by ncd specified in d), e) and f) of 3.2.1 of ISO 3157:1991 after the prescribed time.

Throughout the test periods b) and c), the ambient temperature shall be $(23 \pm 2) ^\circ\text{C}$ and the relative humidity shall be $(50 \pm 15) \%$.

Legibility can depend on visual acuity of the inspector. In this case, a photometer shall be used for the measurement. It is recommended that the inspector enter the dark room at least 10 min before attempting the visual inspection. Recommended distances necessary for visual inspection are 25 cm for watches, 50 cm for table clocks and 150 cm for wall clocks.

4.2.3 Adhesion

Adhesion of the photoluminescent deposit on the components shall be checked through visual inspections before and after the test to be run according to 4.5.1 and 4.5.2 of ISO 3157:1991. There shall be no cracks, damages, breakage or exfoliation in the photoluminescent deposit.

NOTE The adhesive tape test described in ASTM D3359-97 is often used as a practical adhesion test.

4.2.4 Test on empty cavities

The tests defined in 4.1.4 and 4.1.5 may be used in some specific cases, particularly when the photoluminescent deposits fill empty cavities.

Annex A
(informative)

Test report

The test report should include at least the following information:

- a) identification of the sample, including origin, date of receipt and form;
- b) sampling method;
- c) reference to this International Standard;
- d) measurement values and observations;
- e) any deviation from the test procedures, if necessary;
- f) any unusual events observed during the inspection;
- g) date of the test;
- h) signature of the operator.

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