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## Cinematography — Screen luminance and chrominance for the projection of film motion pictures

*Cinématographie — Luminance et chrominance des écrans pour la  
projection de films sur pellicule*

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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.

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 documents 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](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 36, *Cinematography*.

This fourth edition is a minor revision and the title changed to include the word film.

# Cinematography — Screen luminance and chrominance for the projection of film motion pictures

## 1 Scope

This document specifies the screen luminance level and chrominance white point for theatrical projection of 70 mm, 35 mm and 16 mm motion-picture prints at a rate of 24 frames per second.

It can also be applicable to the non-theatrical presentation of 70 mm, 35 mm and 16 mm motion-picture prints intended for projection at 24 frames per second.

NOTE Throughout this document, the term “screen” means the screen-picture area appropriate to the film format and projection system in use.

## 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 terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

## 4 Measurement method

### 4.1 Operating conditions

Measure the luminance and chrominance with the projector operating at a nominal projection speed of 24 frames per second with the shutter running and without film in the gate.

NOTE Measured luminance and chrominance are affected by the lens in use as well as other optical components.

### 4.2 Luminance measuring device

The screen luminance shall be measured with a photometer having an acceptance angle not greater than 2° (recommended value 1,5°), having the spectral sensitivity of a Standard Observer<sup>[1]</sup> agreed by the International Commission on Illumination in 1924, and adopted in 1933 by the International Committee of Weights and Measures.

### 4.3 Chrominance measuring device

The screen chrominance shall be measured with a colour temperature meter or a spot spectroradiometer with an acceptance angle not greater than 2°.

#### 4.4 Position of measuring device in theatres

In theatres, the measurements shall be taken with the suitable meter located approximately 1 m above the floor on the longitudinal axis of the theatre at a position two-thirds of the distance from the screen to the back row of seats (measured from the screen). To ensure satisfactory performance in all parts of the theatre, measurements shall also be taken with the meter located at two points at a distance of one-third of the theatre width to each side of the single position.

### 5 Luminance level of screen centre

The reference luminance level shall be 55 cd/m<sup>2</sup> for each format. See [Annex A](#) for further recommendations.

### 6 Chrominance

The light reflected from the screen shall have a reference spectral distribution comparable to that of a black body at a colour temperature of 5 800 K. See [Annex A](#) for further recommendations.

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## Annex A (informative)

### Recommended distributions, limits and tolerances for luminance and chrominance

#### A.1 Recommended acceptable limits of screen luminance

The range of screen luminance acceptable for indoor theatres is based on practical experience and limitations. It should be understood that the reference light level has been established at 55 cd/m<sup>2</sup> for all formats (see [Clause 5](#)). However, satisfactory performance can be obtained within certain limits. A lower limit of 35 cd/m<sup>2</sup> is dictated by the need to maintain sufficient luminance to perceive colour and detail, especially in dark scenes. An upper limit of 65 cd/m<sup>2</sup> is the maximum before significant perception of flicker occurs (assuming 48 interruptions per second by the projector shutter). For non-theatrical use, a lower limit of 25 cd/m<sup>2</sup> may be dictated by light output limitations of portable projection equipment, especially 16 mm.

NOTE Previous versions of this document referred to a reference illumination of 50 cd/m<sup>2</sup>. In most countries, 55 cd/m<sup>2</sup> is representative of reference practice. Therefore this number has been adopted here.

#### A.2 Recommended acceptable luminance distribution

##### A.2.1 Measurement of screen edges

The luminance of the screen edges should be measured on the horizontal centre-line of the screen at a distance from the screen edges equal to 10 % of the width of the screen. When measured from the points specified in [4.4](#), the two edge measurements should be within 10 % of each other, and not less than 50 % and not more than 85 % of that at the centre, with a recommended value of 75 %.

##### A.2.2 Evenness of luminance distribution

Over the complete screen area, the luminance should appear to be even, and substantially symmetrical about the screen centre. This should be checked from multiple positions of the seating area, especially along the extremes when using “high gain” screens.

#### A.3 Recommended multiple projector luminance tolerance

##### A.3.1 Luminance match for projector units of same formats

The luminance resulting from all projectors intended for use in the continuous viewing of material of the same format should not vary by more than 7 cd/m<sup>2</sup> at the screen centre.

##### A.3.2 Luminance match for projector units of different formats

The luminance resulting from projectors intended for use in the sequential viewing of materials of different formats should not vary by more than 14 cd/m<sup>2</sup> at the screen centre.

## A.4 Recommended acceptable range of chrominance

### A.4.1 Absolute value of chrominance

The acceptable range of screen chrominance for indoor theatres is based on practical experience and limitations. It should be understood that the reference chrominance has been established at 5 800 K for all formats (see [Clause 6](#)). However, satisfactory performance single projector performance can be obtained within a range of  $\pm 400$  K.

**NOTE** Previous versions of this document referred to a reference chrominance of 5 400 K. This number was inherited from early versions of the document, drafted when most projectors used carbon arcs, which have a native colour temperature of around 5 400 K. Almost all projectors currently in use employ xenon lamps, which have a native colour temperature of around 6 100 K. The reference chrominance and recommended tolerance in this document allows for an orderly transition to native xenon characteristics. It is anticipated that a further revision of this document will see a change to 6 100 K, thus moving carbon arcs out of an acceptable range.

### A.4.2 Two projector chrominance match

The difference in correlated colour temperature of the light reflected from the screen when using projectors intended for sequential operation should not be more than 400 K.

## A.5 Recommended acceptable limit to stray light

**A.5.1** No stray light or illuminated source with a luminance in excess of 3,5 cd/m<sup>2</sup> should be visible from the standard observing area of a review room.

**A.5.2** Light on the screen from stray light or flare should be kept as low as possible. In review rooms, stray light on the screen should not exceed 0,4 % of the screen luminance from the projector. In theatres, the stray light should not exceed 1,0 %.

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## Bibliography

- [1] Publication CIE 15: 2004, Colorimetry, 3rd edn

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