
**Ergonomics of human-system
interaction —**

**Part 391:
Requirements, analysis and
compliance test methods for the
reduction of photosensitive seizures**

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Ergonomie de l'interaction homme-système —

*Partie 391: Exigences, analyses et méthodes d'essai de conformité
pour la réduction des saisies photosensibles*

<https://standards.iteh.ai/catalog/standards/sist/de3e00da-3271-4577-abdf-baccdf239245/iso-9241-391-2016>



iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 9241-391:2016

<https://standards.iteh.ai/catalog/standards/sist/de3e00da-3271-4577-abdf-baccd239245/iso-9241-391-2016>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

	Page
Foreword.....	iv
Introduction.....	vii
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	1
4 Image factors of photosensitive seizures.....	2
5 Ergonomic requirements and recommendations.....	3
5.1 General.....	3
5.2 Flashes.....	3
5.2.1 Potentially harmful flashes.....	3
5.2.2 Rapid changes of image sequences.....	4
5.2.3 Potentially harmful red flashes.....	4
5.2.4 Cumulative risk.....	4
5.2.5 Prior warning.....	4
5.3 Potentially harmful regular patterns.....	4
6 Conformance.....	5
6.1 General.....	5
6.2 Test methods.....	5
6.3 Procedure of conformance.....	6
Annex A (informative) Overview of the ISO 9241-series.....	7
Annex B (informative) Abbreviated terms.....	8
Annex C (informative) Clinical aspects of photosensitivity.....	9
Annex D (informative) Viewing environments.....	10
Annex E (informative) Saturated red.....	11
Annex F (informative) Typical relation between screen luminance and signal voltage.....	12
Annex G (informative) Sample procedure for assessing applicability and conformance.....	13
Bibliography.....	15

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).

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#).

The committee responsible for this document is ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

ISO 9241 consists of the following parts under the general title *Ergonomic requirements for office work with visual display terminals (VDTs)*:

- Part 1: General introduction
- Part 2: Guidance on task requirements
- Part 5: Workstation layout and postural requirements
- Part 6: Guidance on the work environment
- Part 11: Guidance on usability
- Part 12: Presentation of information
- Part 13: User guidance
- Part 14: Menu dialogues
- Part 15: Command dialogues
- Part 16: Direct manipulation dialogues

ISO 9241 also consists of the following parts, under the general title *Ergonomics of human-system interaction*:

- Part 20: Accessibility guidelines for information/communication technology (ICT) equipment and services
- Part 100: Introduction to standards related to software ergonomics [Technical Report]
- Part 110: Dialogue principles

- Part 112: Principles for the presentation of information¹⁾
- Part 129: Guidance on software individualization
- Part 143: Forms
- Part 151: Guidance on World Wide Web user interfaces
- Part 154: Interactive voice response (IVR) applications
- Part 161: Guidance on visual user-interface elements
- Part 171: Guidance on software accessibility
- Part 210: Human-centred design for interactive systems
- Part 220: Processes for enabling, executing and assessing human-centred design within organizations¹⁾
- Part 300: Introduction to electronic visual display requirements
- Part 302: Terminology for electronic visual displays
- Part 303: Requirements for electronic visual displays
- Part 304: User performance test methods for electronic visual displays
- Part 305: Optical laboratory test methods for electronic visual displays
- Part 306: Field assessment methods for electronic visual displays
- Part 307: Analysis and compliance test methods for electronic visual displays
- Part 308: Surface-conduction electron-emitter displays (SED) [Technical Report]
- Part 309: Organic light-emitting diode (OLED) displays [Technical Report]
- Part 310: Visibility, aesthetics and ergonomics of pixel defects [Technical Report]
- Part 331: Optical characteristics of autostereoscopic displays [Technical Report]
- Part 391: Requirements, analysis and compliance test methods for the reduction of photosensitive seizures
- Part 392: Ergonomic recommendations for the reduction of visual fatigue from stereoscopic images
- Part 400: Principles and requirements for physical input devices
- Part 410: Design criteria for physical input devices
- Part 411: Evaluation methods for the design of physical input devices [Technical Specification]
- Part 420: Selection of physical input devices
- Part 910: Framework for tactile and haptic interaction
- Part 920: Guidance on tactile and haptic interactions
- Part 940: Evaluation of tactile and haptic interactions¹⁾
- Part 960: Framework and guidance for gesture interactions¹⁾

The following parts are under preparation:

- Part 125: Guidance on visual presentation of information

1) To be published.

ISO 9241-391:2016(E)

— *Part 333: Stereoscopic displays using glasses*

For the other parts under preparation, see [Annex A](#).

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 9241-391:2016

<https://standards.iteh.ai/catalog/standards/sist/de3e00da-3271-4577-abdf-baccdf239245/iso-9241-391-2016>

Introduction

Recent progress of technology enables us to watch high-definition images, some of which can be stereoscopic. When those images are projected onto the retina of both eyes and processed as visual information, undesirable biomedical effects, such as photosensitive seizures, visually induced motion sickness, and visual fatigue from stereoscopic images can be induced. These undesirable biomedical effects need to be reduced where feasible. The prevention of these undesirable biomedical effects on human health has been referred to as “image safety”.

Image safety was first discussed by the ISO in the ISO/COPOLCO with respect to the users of image products. Then, in 2004, the ISO/International Workshop on Image Safety was held and resulted in the publication of ISO/IWA 3:2005 as the international workshop agreement.^[1] Following those discussions, the study group (ISO/TC 159/SC 4/SG on Image Safety) continued to evaluate strategies of the international standardizations until 2009. The basic concept of Image Safety is common with ISO/IEC Guide 71:2014^[18], in which the idea is that accessibility to and usability of products and services should be available to all people.

This part of ISO 9241 will help promote the production of safer images by reducing the risk of photosensitive seizures, and thereby result in the wider distribution of images that are free from constraints on which consumers can view them. A small proportion of the population is susceptible to seizures and other neurological effects when watching motion picture and video content with certain display features. Since these reactions depend on individual susceptibility have been documented with programming viewed through cathode-ray tube (CRT) displays, there is as yet less experience with high-definition displays.

This part of ISO 9241 belongs to a family of human-system interaction standards. Readers who need guidance on other aspects of human-system interaction should refer to the ISO 9241-series.

iTeH STANDARD PREVIEW
(standards.iteh.ai)

ISO 9241-391:2016
<https://standards.iteh.ai/catalog/standards/sist/de3e00da-3271-4577-abdf-baccdf239245/iso-9241-391-2016>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 9241-391:2016

<https://standards.iteh.ai/catalog/standards/sist/de3e00da-3271-4577-abdf-baccdf239245/iso-9241-391-2016>

Ergonomics of human-system interaction —

Part 391:

Requirements, analysis and compliance test methods for the reduction of photosensitive seizures

1 Scope

This part of ISO 9241 provides requirements and recommendations for reducing photosensitive seizures (PSS), while viewing images on electronic displays.

The requirements and recommendations in this part of ISO 9241 are designed to be applied to image contents. By image contents, reference is made to the images independent of the device or environment in which they are displayed.

The requirements and recommendations in this part of ISO 9241 are for the protection of the vulnerable individuals in the viewing population who are photosensitive and who are therefore liable to seizures triggered by flashing lights and regular patterns, including certain repetitive images.

NOTE 1 ITU considers the image safety issues in relation to broadcasting. Some of these are described in ITU-R BT.1702.^[2]

NOTE 2 There are some related recommendations in ISO/IEC 40500:2012, *W3C Web Content Accessibility Guidelines (WCAG) 2.0*, for web contents accessibility.

NOTE 3 Photosensitive seizures and photosensitive epilepsy, that is, chronic conditions characterized by those repeated seizures are medical conditions. Clinical aspects of photosensitivity appear in [Annex C](#). Visually induced seizures are equivalent to PSS.

2 Normative references

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

ISO 9241-302, *Ergonomics of human-system interaction — Part 302: Terminology for electronic visual displays*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9241-302 and the following apply.

3.1

flash

pair of opposing changes in relative luminance

Note 1 to entry: A “pair of opposing changes” is an increase followed by a decrease or a decrease followed by an increase.

3.2

electroencephalogram

EEG

record of electrical changes caused by neuronal activities in the brain through electrodes attached to the scalp

3.3
photoparoxysmal response
PPR

EEG (3.2) response to *flash* (3.1) or pattern, consisting of spikes, spike-waves, or intermittent slow waves, which include spike-waves at around 3 Hz that can be detected bilaterally and simultaneously in all areas of the scalp

3.4
photosensitivity

human individual sensitivity to flashing or intermittent light stimulation and/or visual patterns, evidenced by the occurrence of a *photoparoxysmal response* (3.3) in the *EEG* (3.2)

Note 1 to entry: Visual sensitivity is a term recently sometimes used as an alternative to the term “photosensitivity.”

3.5
photosensitive seizure
PSS

epileptic seizure [3] triggered by visual stimulation as a result of *photosensitivity* (3.4) in a human individual

3.6
photosensitive epilepsy

chronic neurological condition characterized by recurrent *photosensitive seizures* (3.5), either convulsive or non-convulsive seizures, such as absence seizures

4 Image factors of photosensitive seizures

iTech STANDARD PREVIEW
(standards.iteh.ai)

A photosensitive seizure may be produced in susceptible individuals by flashing lights or certain regular patterns. [3][16] A visual stimulus tending to provoke a seizure is bright light flashes of a certain number per second. [4] The light must also fill a large part of the visual field. For the light flashes, colour changes to or from saturated red, instead of luminance changes, also tend to provoke a seizure. [5][12]

Another potentially provocative visual stimulus for some individuals with photosensitivity is regular patterns with a certain number of bright stripes per a certain area. [6] The pattern must also fill a large part of the visual field, while the provocation depends on whether the patterns are stationary or oscillating (including flashing). [7][16][17]

PSS can be reduced, to some extent, by considering factors such as those shown below. [3][14] These factors need to be considered at the same time in an appropriate balance. [13][15]

- Potentially harmful flashes:
 - Luminance and contrast
 - Area of visual field
 - Number of flashes per unit time
- Rapid changes of image sequences
- Potentially harmful red flashes:
 - Colour
 - Area of visual field

- Number of flashes per unit time
- Cumulative risk:
 - Duration of flashing
- Potentially harmful regular patterns:
 - Clearly discernible stripes
 - Number of stripes and area of visual field occupied
 - Moving/stationary
 - Luminance and contrast
 - Duration of patterns

5 Ergonomic requirements and recommendations

5.1 General

To obtain the condition that will sufficiently reduce the possibility of PSS, visual content, viewing environment, and characteristics of viewers need to be considered. However, in this part of ISO 9241, characteristics of visual content, such as flashing and regular patterns, are the principal concern. For viewing environment to be considered, [Annex D](#) provides the information.

The requirements in [5.2.1](#) to [5.2.3](#) are based on a wide range of flash rates and differences in brightness that have been demonstrated to cause PPRs in almost all photosensitive individuals, although each such individual is likely to respond to a narrower set of flash rates and brightness changes within that range. A small number of subjects, however, recorded PPRs at slower flash rates and others may be susceptible to smaller changes in brightness. A photosensitive individual's susceptibility to visual stimuli may vary with environmental factors and changing individual physical conditions. Therefore, even if visual content complies with the requirements in this part of ISO 9241 that does not preclude the possibility that some photosensitive individuals may have a PPR or PSS when viewing that content. The purpose of this part of ISO 9241 is to reduce the incidence of such events substantially through a framework for producers of the content that is reasonably practical to comply with.

NOTE 1 The following principles in [5.2](#) and [5.3](#) are easier to apply in the case of pre-recorded content, which can be analysed frame-by-frame. Interactive media, such as video games, may afford essentially limitless sequences through the game, depending upon user actions. In the case of video games, the requirements and recommendations apply to typical sequences of play, but cannot cover every eventuality of play.^[8]

NOTE 2 The requirements and recommendations are based on the data obtained with the maximum screen luminance of 200 cd/m² and below, and the maximum screen size of 60 in.^[15]

5.2 Flashes

5.2.1 Potentially harmful flashes

Potentially harmful flashes shall be avoided. Potentially harmful flashes are defined as those satisfying all the following conditions.

- a) A pair of opposing changes in luminance (i.e. an increase in luminance followed by a decrease or a decrease followed by an increase) of 20 cd/m² or more when the luminance of the darker image is below 160 cd/m².
- b) The combined area of flashes, satisfying (a) above, occurring concurrently, occupies more than one quarter of the displayed screen area.