

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Nuclear power plants – Instrumentation and control systems – Requirements for coordinating safety and cybersecurity

Centrales nucléaires de puissance – Systèmes d'instrumentation et de contrôle-commande – Exigences pour coordonner sûreté et cybersécurité

[IEC 62859:2016](https://standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/iec/a5d57f99-15c1-40bd-9ea6-98f107f7adda/iec-62859-2016>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Nuclear power plants – Instrumentation and control systems – Requirements for coordinating safety and cybersecurity

Centrales nucléaires de puissance – Systèmes d'instrumentation et de contrôle-commande – Exigences pour coordonner sûreté et cybersécurité

[IEC 62859:2016](https://standards.iteh.ai/standards/iec/a5d57f99-15c1-40bd-9ea6-98f107f7adda/iec-62859-2016)

<https://standards.iteh.ai/catalog/standards/iec/a5d57f99-15c1-40bd-9ea6-98f107f7adda/iec-62859-2016>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 27.120.20

ISBN 978-2-8322-7484-2

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

REDLINE VERSION

VERSION REDLINE



Nuclear power plants – Instrumentation and control systems – Requirements for coordinating safety and cybersecurity

Centrales nucléaires de puissance – Systèmes d'instrumentation et de contrôle-commande – Exigences pour coordonner sûreté et cybersécurité

[IEC 62859:2016](https://standards.iteh.ai/standards/iec/a5d57f99-15c1-40bd-9ea6-98f107f7adda/iec-62859-2016)

<https://standards.iteh.ai/catalog/standards/iec/a5d57f99-15c1-40bd-9ea6-98f107f7adda/iec-62859-2016>

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	8
2 Normative references	8
3 Terms and definitions	9
4 Symbols and abbreviations	11
5 Coordinating safety and cybersecurity at the overall architecture level	12
5.1 General.....	12
5.2 Fundamental and generic principles.....	12
5.3 Thematic requirements and recommendations	13
5.3.1 Delineation of security zones.....	13
5.3.2 Provisions for coping with common cause failures (including diversity)	13
5.3.3 Separation provisions	14
5.3.4 Data communications	14
6 Coordinating safety and cybersecurity at the individual system level.....	14
6.1 General.....	14
6.2 Fundamental and generic principles.....	14
6.3 Safety and cybersecurity coordination during the I&C system lifecycle.....	15
6.3.1 General	15
6.3.2 Requirements and planning activities.....	15
6.3.3 Design activities	15
6.3.4 Implementation activities	16
6.3.5 Verification and validation activities	16
6.3.6 Installation and acceptance testing activities	16
6.3.7 Operations and maintenance activities.....	16
6.3.8 Change management.....	16
6.3.9 Decommissioning activities.....	16
6.4 Selected technical aspects of I&C systems constrained by safety and cybersecurity	17
6.4.1 General	17
6.4.2 Logical access control for HMIs of I&C programmable digital systems in control rooms.....	17
6.4.3 Software modification	17
6.4.4 Logging and audit capability	18
6.4.5 Use of cryptography by I&C systems	18
6.4.6 System availability and function continuity.....	19
7 Organizational and operational issues	19
7.1 Governance and responsibilities	19
7.2 Coordination between safety and cybersecurity staff during operations.....	19
7.3 Safety and cybersecurity culture	19
7.4 Emergency response management	20
Annex A (informative) Rationale for, and notes related to, the scope of this document.....	21
A.1 General.....	21
A.2 Inclusion of I&C programmable digital system not important to safety	21
A.3 Exclusion of physical security, room access control and site security surveillance systems.....	21

A.4	Exclusion of non-malevolent actions and events	21
A.5	Exclusion of development tools and platforms	22
	Bibliography	23

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 62859:2016](#)

<https://standards.iteh.ai/catalog/standards/iec/a5d57f99-15c1-40bd-9ea6-98f107f7adda/iec-62859-2016>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**NUCLEAR POWER PLANTS –
INSTRUMENTATION AND CONTROL SYSTEMS –
REQUIREMENTS FOR COORDINATING SAFETY AND CYBERSECURITY****FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 62859 edition 1.1 contains the first edition (2016-10) [documents 45A/1104/FDIS and 45A/1118/RVD] and its amendment 1 (2019-10) [documents 45A/1279/FDIS and 45A/1286/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 62859 has been prepared by subcommittee 45A: Instrumentation, control and electrical systems of nuclear facilities, of IEC technical committee 45: Nuclear instrumentation.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[IEC 62859:2016](#)

<https://standards.itih.ai/catalog/standards/iec/a5d57f99-15c1-40bd-9ea6-98f107f7adda/iec-62859-2016>

INTRODUCTION

a) Technical background, main issues and organisation of this standard

I&C systems have evolved during the last decades from non-digital equipment and stand-alone environments to digital technologies and interconnected systems. Such an evolution exposes them to risks related to cyberattacks. In addition to well-established safety-oriented provisions, more recent cybersecurity requirements and controls now apply to the same systems. A normative framework is needed to master the interactions and potential side-effects when safety and cybersecurity provisions converge on the same I&C systems and architectures, taking into account the nuclear I&C specifics and the SC 45A related standards.

This standard specifically focuses on the issue of requirements for coordinating safety and cybersecurity provisions for I&C programmable digital systems and architectures. It defines both generic principles and guidance for practical situations to integrate cybersecurity requirements in nuclear I&C architectures and systems, fundamentally tailored for safety. Technical but also conceptual, organizational and procedural aspects are covered.

It is intended that this standard be used by designers and operators of nuclear power plants (NPPs) (utilities), systems evaluators, vendors and subcontractors, and by licensors.

b) Situation of the current standard in the structure of the IEC SC 45A standard series

IEC 62859 is at the second level of the IEC SC 45A standard series. It is to be considered as bridging IEC 62645 (also at the second level of the IEC SC 45A standard series) and IEC 61513, the top level document of the IEC SC 45A standard series. Regarding the specific theme of cybersecurity, IEC 62645 is the top-level in the SC 45A standard series. Both IEC 62645 and IEC 62859 are considered formally as second level documents with respect to IEC 61513, although IEC 61513:2011 does not actually ensure proper reference to and consistency with them (this will be done in a future revision of IEC 61513).

For a generic description of the structure of the IEC SC 45A standard series, see item d) of this introduction.

c) Recommendations and limitations regarding the application of this standard

It is important to note that this standard establishes additional requirements for I&C programmable digital systems and architectures, with regard to the coordination between safety and cybersecurity, and clarifies the processes by which I&C programmable digital systems are designed, implemented and operated in nuclear power plants. Aspects for which special requirements and recommendations have been produced are:

- IAEA guidance on I&C;
- IAEA guidance on computer security at nuclear facilities;
- regulatory interpretations for country specific requirements.

d) Description of the structure of the IEC SC 45A standard series and relationships with other IEC documents and other bodies documents (IAEA, ISO)

The top-level documents of the IEC SC 45A standard series are IEC 61513 and IEC 63046¹. IEC 61513 provides general requirements for I&C systems and equipment that are used to perform functions important to safety in NPPs. IEC 63046 provides general requirements for electrical power systems of NPPs; it covers power supply systems including the supply

¹ In preparation. Stage at the time of publication: IEC ANW 63046:2016.

systems of the I&C systems. IEC 61513 and IEC 63046 are to be considered in conjunction and at the same level. IEC 61513 and IEC 63046 structure the IEC SC 45A standard series and shape a complete framework establishing general requirements for instrumentation, control and electrical systems for nuclear power plants.

IEC 61513 and IEC 63046 refer directly to other IEC SC 45A standards for general topics related to categorization of functions and classification of systems, qualification, separation, defence against common cause failure, control room design, electromagnetic compatibility, cybersecurity, software and hardware aspects for programmable digital systems, coordination of safety and security requirements and management of ageing. The standards referenced directly at this second level should be considered together with IEC 61513 and IEC 63046 as a consistent document set.

At a third level, IEC SC 45A standards not directly referenced by IEC 61513 or by IEC 63046 are standards related to specific equipment, technical methods, or specific activities. Usually these documents, which make reference to second-level documents for general topics, can be used on their own.

A fourth level extending the IEC SC 45 standard series, corresponds to the Technical Reports which are not normative.

The IEC SC 45A standards series consistently implements and details the safety and security principles and basic aspects provided in the relevant IAEA safety standards and in the relevant documents of the IAEA nuclear security series (NSS). In particular this includes the IAEA requirements SSR-2/1, establishing safety requirements related to the design of nuclear power plants (NPP), the IAEA safety guide SSG-30 dealing with the safety classification of structures, systems and components in NPP, the IAEA safety guide SSG-39 dealing with the design of instrumentation and control systems for NPP, the IAEA safety guide SSG-34 dealing with the design of electrical power systems for NPP and the implementing guide NSS17 for computer security at nuclear facilities. The safety and security terminology and definitions used by SC 45A standards are consistent with those used by the IAEA.

IEC 61513 and IEC 63046 have adopted a presentation format similar to the basic safety publication IEC 61508 with an overall life-cycle framework and a system life-cycle framework. Regarding nuclear safety, IEC 61513 and IEC 63046 provide the interpretation of the general requirements of IEC 61508-1, IEC 61508-2 and IEC 61508-4, for the nuclear application sector. In this framework IEC 60880, IEC 62138 and IEC 62566 correspond to IEC 61508-3 for the nuclear application sector. IEC 61513 and IEC 63046 refer to ISO as well as to IAEA GS-R-3 and IAEA GS-G-3.1 and IAEA GS-G-3.5 for topics related to quality assurance (QA). At level 2, regarding nuclear security, IEC 62645 is the entry document for the IEC SC 45A security standards. It builds upon the valid high level principles and main concepts of the generic security standards, in particular ISO/IEC 27001 and ISO/IEC 27002; it adapts them and completes them to fit the nuclear context and coordinates with the IEC 62443 series. At level 2, regarding control rooms, IEC 60964 is the entry document for the IEC SC 45A control rooms standards and IEC 62342 is the entry document for the IEC SC 45A ageing management standards.

NOTE 1 It is assumed that for the design of I&C systems in NPPs that implement conventional safety functions (e.g. to address worker safety, asset protection, chemical hazards, process energy hazards) international or national standards would be applied.

NOTE 2 IEC SC 45A domain was extended in 2013 to cover electrical systems. In 2014 and 2015 discussions were held in IEC SC 45A to decide how and where general requirements for the design of electrical systems were to be considered. IEC SC 45A experts recommended that an independent standard be developed at the same level as IEC 61513 to establish general requirements for electrical systems. Project IEC 63046 is now launched to cover this objective. When IEC 63046 will be published this NOTE 2 of the introduction of IEC SC 45A standards will be suppressed.

NUCLEAR POWER PLANTS – INSTRUMENTATION AND CONTROL SYSTEMS – REQUIREMENTS FOR COORDINATING SAFETY AND CYBERSECURITY

1 Scope

This document provides a framework to manage the interactions between safety and cybersecurity for nuclear power plant (NPP) systems, taking into account the current SC 45A standards addressing these issues and the specifics of nuclear I&C programmable digital systems.

NOTE In this document (as in IEC 62645), cybersecurity relates to prevention of, detection of, and reaction to malicious acts perpetrated by digital means (cyberattacks). In this context, it does not cover considerations related to non-malevolent actions and events such as accidental failures, natural events or human errors (except those degrading cybersecurity). Those aspects are of course of prime importance but they are covered by other SC 45A documents and standards, and are not considered as cybersecurity related in this document.

This document establishes requirements and guidance to:

- integrate cybersecurity provisions in nuclear I&C architectures and systems, which are fundamentally tailored for safety;
- avoid potential conflicts between safety and cybersecurity provisions;
- aid the identification and the leveraging of the potential synergies between safety and cybersecurity.

This document is intended to be used for designing new NPPs, or modernizing existing NPPs, throughout I&C programmable digital systems lifecycle. It is also applicable for assessing the coordination between safety and cybersecurity of existing plants. It may also be applicable to other types of nuclear facilities.

This document addresses I&C programmable digital systems important to safety and I&C programmable digital systems not important to safety. It does not address programmable digital systems dedicated to site physical security, room access control and site security surveillance.

This document is limited to I&C programmable digital systems of NPPs, including their on-site maintenance and configuration tools.

Annex A provides a rationale for and comments about the scope definition and the document application, in particular about the exclusions and limitations previously mentioned.

This document comprises three normative clauses:

- Clause 5 deals with the overall I&C architecture;
- Clause 6 focuses on the system level;
- Clause 7 deals with organizational and operational issues.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60709:2004, *Nuclear power plants – Instrumentation and control systems important to safety – Separation*

IEC 60880:2006, *Nuclear power plants – Instrumentation and control systems important to safety – Software aspects for computer-based systems performing category A functions*

IEC 61500:2009, *Nuclear power plants – Instrumentation and control systems important to safety – Data communication in systems performing category A functions*

IEC 61513:2011, *Nuclear power plants – Instrumentation and control important to safety – General requirements for systems*

IEC 62138:2004, *Nuclear power plants – Instrumentation and control important for safety – Software aspects for computer-based systems performing category B or C functions*

IEC 62340, *Nuclear power plants – Instrumentation and control systems important to safety – Requirements for coping with common cause failure (CCF)*

IEC 62566:2012, *Nuclear power plants – Instrumentation and control important to safety – Development of HDL-programmed integrated circuits for systems performing category A functions*

IEC 62645:2014, *Nuclear power plants – Instrumentation and control systems – Requirements for security programmes for computer-based systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62645, in IEC 61513 and the following apply.

NOTE If for a given term, different definitions are provided in these three sources, the definition of the present document applies.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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

3.1

computer-based item

item that relies on software instructions running on microprocessors or microcontrollers

Note 1 to entry: The term item can be replaced by the terms system, or equipment, or device.

Note 2 to entry: A computer-based item is a kind of programmable digital item.

Note 3 to entry: This term is equivalent to software-based item.

3.2

cyberattack

attempt by digital means to destroy, expose, alter, disable, steal or gain unauthorized access to or make unauthorized use of an asset

Note 1 to entry: Cyberattacks include targeted and non-targeted (e.g. malwares) attacks by digital means. Cyberattack is synonymous with digital attack.

3.3 cybersecurity

set of activities and measures the objective of which is to prevent, detect, and react to:

- malicious disclosures of information (confidentiality) that could be used to perform malicious acts which could lead to an accident, an unsafe situation or plant performance degradation;
- malicious modifications (integrity) of functions that may compromise the delivery or integrity of the required service by I&C programmable digital systems (incl. loss of control) which could lead to an accident, an unsafe situation or plant performance degradation;
- malicious withholding or prevention of access to or communication of information, data or resources (incl. loss of view) that could compromise the delivery of the required service by I&C systems (availability) which could lead to an accident, an unsafe situation or plant performance degradation

Note 1 to entry: This definition is tailored with respect to this standard scope and overall SC 45A document structure. It is recognized that the term “cybersecurity” has a broader meaning in other standards and guidance, often including non-malevolent threats, human errors and protection against natural disasters. Those aspects – except human errors degrading cybersecurity – are not included in the concept of cybersecurity used in the SC 45A standard series. See Annex A.4 for more detail about such exclusions.

Note 2 to entry: Computer security, security and cybersecurity are considered synonymous in this document.

3.4 cybersecurity event

identified occurrence of a system, service or network state indicating a possible breach of cybersecurity policy or failure of controls, or a previously unknown situation that may be cybersecurity relevant

3.5 cybersecurity-driven software modification

software modification of which the main reason is to implement one or more cybersecurity features, or remediate one or several security vulnerabilities in a I&C programmable digital component, or to prevent successful exploitation of these vulnerabilities or to mitigate attackers' capabilities to exploit these vulnerabilities

3.6 cybersecurity feature

provision, control or function specifically designed for cybersecurity purposes

Note 1 to entry: Non-cybersecurity features implementation can have negative, neutral, but also positive impact on cybersecurity. This is particularly the case of some safety features, as discussed in this document.

Note 2 to entry: The terms “feature” and “provision” are considered synonymous in this document.

3.7 HDL-Programmed Device

integrated circuit configured (for NPP I&C systems), with Hardware Description Languages and related software tools

Note 1 to entry: HDLs and related tools (e.g. simulator, synthesizer) are used to implement the requirements in a proper assembly of pre-developed micro-electronic resources.

Note 2 to entry: The development of HPDs can use pre-developed blocks.

Note 3 to entry: HPDs are typically based on blank FPGAs (Field Programmable gate Arrays) or similar programmable integrated circuits.

[SOURCE: IEC 62566:2012, 3.7]