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Interested committees:

Title: BS EN IEC 63413 Nuclear Power Plants - Instrumentation and control systems important to safety - Platform qualification

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

PROJECT NUMBER: IEC 63413 ED1	
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IEC SC 45A : INSTRUMENTATION, CONTROL AND ELECTRICAL POWER SYSTEMS OF NUCLEAR FACILITIES	
SECRETARIAT: France	SECRETARY: Mr Alexander WIGG
OF INTEREST TO THE FOLLOWING COMMITTEES: SC 65A	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☒ SAFETY	

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Recipients of this document are invited to submit, with their comments, notification of any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "In Some Countries" clauses. (See [AC/22/2007](#) or [NEW GUIDANCE DOC](#)).

TITLE: Nuclear Power Plants – Instrumentation and control systems important to safety – Platform qualification
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NOTE FROM TC/SC OFFICERS: Committee Draft prepared based on discussions at WGA3 meeting in September 2023 and circulated to IEC National Committees in accordance with decision 45A/2023-10 from IEC SC 45A plenary meeting in October 2023 (see 45A/1509/RM).

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**NUCLEAR POWER PLANTS – INSTRUMENTATION AND CONTROL
SYSTEMS IMPORTANT TO SAFETY – PLATFORM QUALIFICATION**

FOREWORD

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International Standard IEC 63413 has been prepared by subcommittee 45A: Instrumentation, control and electrical power systems of nuclear facilities, of IEC technical committee 45: Nuclear instrumentation. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
45A/XX/FDIS	45A/XX/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at <http://www.iec.ch/standardsdev/publications>.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

INTRODUCTION

a) Technical background, main issues and organization of the standard

This International Standard provides requirements on the qualification of instrumentation and control (I&C) platforms for use in I&C systems important to safety within the framework of the IEC SC 45A standards. The standard gives guidance in how IEC SC 45A standards are to be applied for I&C platforms considering all possible constituents of an I&C platform (i.e., hardware, software, programmable logic, its architecture including internal and external interfaces and engineering tools). The standard covers both product and life cycle process aspects according to IEC 61513.

In general, I&C platforms are developed for a defined set of applications and are pre-existing with regards to their application in I&C systems of a specific nuclear power plant. Therefore, the standard is organised in two parts:

The first part deals with requirements for performing a generic qualification of an I&C platform for use in I&C systems important to safety of nuclear power plants. A generic (i.e., plant independent) qualification considers known or anticipated requirements for the applications the I&C platform will be used for.

The second part covers the plant specific aspects related to the I&C platform qualification and its relation to the qualification of I&C systems important to safety in nuclear power plants.

The approach is based on and consistent with the framework and requirements provided by IEC SC 45A standards and refers to corresponding standards that are required in the context of an I&C qualification: According to IEC 61513: 2011 clause 6.2.3.2, the suitability of pre-existing I&C components (forming the I&C platform) shall be evaluated to demonstrate that their characteristics comply with the plant specific system requirements specification. A generic platform qualification would facilitate the verification of the feasibility of the qualification in accordance with IEC 61513 clause 6.5.2 and the identification of additional work and constraints necessary for the plant specific qualification.

IEC 61513: 2011 chapter 6.5 deals with requirements related to the I&C system qualification, which concerns the qualification of the I&C platform and the plant specific I&C system. The requirements on qualification herein are given for different quality management activities and for each I&C platform and module development life cycle phase including verification and validation. However, up to the issuance of this standard it was not clear how IEC SC 45A standards can be applied consistently for generic qualification of I&C platforms and its use in I&C systems. By establishing a consistent approach this standard also aims at facilitating qualification of I&C systems important to safety of nuclear power plants based on a qualified I&C platform.

It is intended that this International Standard be used by designers and operators of nuclear power plants (utilities), licensees, systems evaluators, vendors and subcontractors, and by regulators.

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

The first-level IEC SC 45A standard for I&C systems important to safety in nuclear power plants (NPPs) is IEC 61513. IEC 63413 is a second-level IEC SC 45A standard which addresses the generic issue of requirements on the qualification of I&C platforms for use in I&C systems important to safety.

IEC 60987 is a second-level standards which covers the hardware aspects of I&C systems used to perform functions important to safety in NPPs. This standard makes direct reference to IEC 60987 for I&C platform hardware requirements.

IEC 60880 and IEC 62138 are second-level standards which together cover the software aspects of computer-based systems used to perform functions important to safety in NPPs. This standard makes direct reference to IEC 60880 and IEC 62138 for I&C platform software requirements.

IEC 62566 and IEC 62566-2 are second-level standards which together cover the development of HPDs used to perform functions important to safety in NPPs. This standard makes direct reference to IEC 62566 and IEC 62566-2 for requirements on HPDs for use in I&C platforms.

The requirements of IEC/IEEE 60780-323 for equipment qualification are referenced within IEC 63413.

For more details on the structure of the IEC SC 45A standard series, see item d) of this introduction.

c) Recommendations and limitations regarding the application of the standard

It is important to note that this standard establishes no additional functional requirements for classified systems (see IEC 61226 for system classification requirements).

The standard does not directly prescribe what is necessary for the successful licensing of I&C systems based on a qualified I&C platform. Rather, it provides assistance for licensing and creates a framework by formulating requirements on I&C platform qualification and making specific reference to the relevant IEC SC 45A standards.

It is recognized that I&C technology is continuing to evolve and that it is not possible for a standard such as this to include references to all modern design technologies and techniques. To ensure that the standard will continue to be relevant in future years the emphasis has been placed on issues of principle, rather than specific hardware or software design technologies. If new design techniques are developed then it is possible to assess the suitability of such techniques by adapting and applying the design principles contained within this standard.

This document refers to IEC 62645 to address how to protect I&C systems against those threats arising from malicious attacks, i.e., cybersecurity, for programmable digital items from the perspective of an I&C platform. IEC 62645 provides requirements for security programmes for programmable digital items for all their development phases and on-site operation.

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 IEC SC 45A standard series comprises a consistent set of documents organised in a hierarchy of four levels. The top-level documents of the IEC SC 45A standard series are IEC 61513 and IEC 63046, covering respectively general requirements for instrumentation and control (I&C) systems and general requirements for electrical power systems of NPPs. IEC 61513 and IEC 63046 adopt an overall system life-cycle framework and constitute, along with the relevant second-level standards, the nuclear implementation of the basic safety series IEC 61508.

IEC 61513 and IEC 63046 refer directly to other IEC SC 45A standards for general requirements for specific topics, such as categorization of functions and classification of systems, qualification, separation, defence against common cause failure, control room design, electromagnetic compatibility, human factors engineering, cybersecurity, software and hardware aspects for programmable digital systems, coordination of safety and security requirements and management of ageing.

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

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

96 The IEC SC 45A standards series consistently implements and details the safety and security
97 principles and basic aspects provided in the relevant IAEA safety standards and in the relevant
98 documents of the IAEA nuclear security series (NSS). In particular this includes the IAEA
99 requirements SSR-2/1 , establishing safety requirements related to the design of nuclear power
100 plants (NPPs), the IAEA safety guide SSG-30 dealing with the safety classification of structures,
101 systems and components in NPPs, the IAEA safety guide SSG-39 dealing with the design of
102 instrumentation and control systems for NPPs, the IAEA safety guide SSG-34 dealing with the
103 design of electrical power systems for NPPs, the IAEA safety guide SSG-51 dealing with human
104 factors engineering in the design of NPPs and the implementing guide NSS42-G for computer
105 security at nuclear facilities. The safety and security terminology and definitions used by the
106 SC 45A standards are consistent with those used by the IAEA.

107 IEC 61513 and IEC 63046 refer to ISO 9001 as well as to IAEA GSR part 2 and IAEA GS-G-
108 3.1 and IAEA GS-G-3.5 for topics related to quality assurance (QA).

109 At level 2, regarding nuclear security, IEC 62645 is the entry document for the IEC/SC 45A
110 security standards. It builds upon the valid high-level principles and main concepts of the
111 generic security standards, in particular ISO/IEC 27001 and ISO/IEC 27002; it adapts them and
112 completes them to fit the nuclear context and coordinates with the IEC 62443 series. At level
113 2, IEC 60964 is the entry document for the IEC/SC 45A control rooms standards, IEC 63351 is
114 the entry document for the human factors engineering standards and IEC 62342 is the entry
115 document for the ageing management standards.

116 NOTE 1 IEC TR 63400 provides a more comprehensive description of the overall structure of the IEC SC 45A
117 standards series and of its relationship with other standards bodies and standards.

118

NUCLEAR POWER PLANTS – INSTRUMENTATION AND CONTROL IMPORTANT TO SAFETY – PLATFORM QUALIFICATION

1 Scope

1.1 General

This document provides guidance and establishes requirements for qualification of I&C platforms, according to IEC nuclear standards, aimed to be used in nuclear applications important to safety. Qualification of an I&C platform (also called pre-qualification or generic qualification) is performed as a generic activity outside the framework of a plant specific application project. Platform qualification aims to fulfill in an anticipated manner all requirements leading to an I&C platform fully suitable for the implementation of a plant specific application project. It enables a licensing process to concentrate on two separate steps; one dedicated to the suitability of the I&C platform, considering safety features and development processes, and one dedicated to the plant specific implementation, considering safety functions.

The platform qualification covers consequently all I&C platform specific aspects including hardware aspects, software aspects, HDP aspects, engineering tools, environmental qualification, quality aspects and the applied safety life cycle supporting these activities. Platform qualification has to consider also interaction of platform assemblies. This standard applies to I&C platforms under development as well as to pre-existing I&C platforms.

I&C platforms and their qualification are in principle mentioned within IEC 61513, but in many cases it is not clear which requirements on I&C systems are already relevant for an I&C platform and are therefore required for their qualification. This standard provides guidance on what is relevant to I&C platform qualification and what is relevant to the implementation of an I&C system design based on a qualified I&C platform.

According to IEC 61513:2011 clause 6.5.2 it is convenient to take credit from evidence of qualification of hardware and software modules, established outside the framework of a plant specific application (i.e., pre-qualification or generic qualification of COTS products or of an equipment family). The objective of this standard is to identify those requirements that relate closely to an I&C platform qualification and aims to support a two-step approach for the licensing of I&C systems based on this I&C platform.

In any case, requirements specified by IEC SC 45A standards (e.g., hardware and software requirements) apply for the qualification of an I&C platform. Therefore this standard refers to existing requirements within the IEC SC 45A series of standards that are necessary for qualifying an I&C platform and for its use in the NPP. Basic means of equipment qualification, as prescribed by IEC/IEEE 60780-323, are through analysis, type testing and documented operational experience. Other documents applicable for qualification for nuclear use include IEC 61513, IEC 63046, IEC 60880, IEC 62138, IEC 62566, IEC 62566-2, IEC 60987, IEC 62671, and IEC 61226.

1.2 Framework

This document is organized as follows:

- Clause 5 addresses the requirements for performing a qualification of an I&C platform for use in I&C systems important to safety of nuclear power plants. This includes differentiation of requirements according to the safety category of the I&C functions which are to be implemented by the I&C platform. The given structure of the qualification is based on the system life cycle specified by IEC 61513 and all applicable standards related to the specific aspects including requirements on hardware, software and programmable logic.

- Clause 6 addresses the requirements for the use of a qualified I&C platform in I&C systems important to safety of nuclear power plants. This includes suitability of the I&C platform and consideration of context and dependencies between I&C platform and I&C system qualification.
- Additionally, the standard provides an informative annex A giving examples of cooperation between parties involved in the process of I&C platform qualification. The informative annex B provides an overview for allocation of requirements by qualification aspects.

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

IEC 61226:2020, *Nuclear power plants – Instrumentation, control and electrical power systems important for safety – Categorization of functions and classification systems*

IEC/IEEE 60780-323:2016, *Nuclear facilities – Electrical equipment important to safety – Qualification*

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

IEC 60987: 2021, *Nuclear power plants – Instrumentation and control systems important to safety – Hardware requirements*

IEC 62138:2018, *Nuclear power plants – Instrumentation and control systems important to safety – Software aspects for computer-based systems performing category B or C functions*

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 62566-2:2020, *Nuclear power plants – Instrumentation and control systems important to safety – Development of HDL-programmed integrated circuits – Part 2: HDL-programmed integrated circuits for systems performing category B or C functions*

IEC 62645:2019, *Nuclear power plants - Instrumentation, control and electrical power systems - Cybersecurity requirements*

IEC 62671:2013 - *Nuclear Power Plants - Instrumentation And Control Important To Safety - Selection And Use Of Industrial Digital Devices Of Limited Functionality*

IEC 62859:2016, *Nuclear power plants - Instrumentation and control systems - Requirements for coordinating safety and cybersecurity*

IEC 63096:2020, *Nuclear power plants – Instrumentation, control and electrical power systems – Security controls*

IEC 60709:2018, *Instrumentation, control and electrical power systems important to safety - Separation*

208 *IEC 61500:2018, Nuclear power plants – Instrumentation and control systems important to*
209 *safety - Data communication in systems performing category A functions*

210 *ISO 9001:2016, Quality management systems – Requirements*

211 *ISO 19443:2018, Quality management systems - Specific requirements for the application of*
212 *ISO 9001:2015 by organizations in the supply chain of the nuclear energy sector supplying*
213 *products and services important to nuclear safety (ITNS)*

214 **3 Terms and definitions**

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

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

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

220 **3.1**

221 **application software library**

222 collection of software modules implementing typical application functions

223 NOTE: When using pre-existing equipment (here I&C platform), such a library is considered to be part of the system
224 software and qualified as such.

225 [SOURCE: IEC 61513: 2011, 3.3]

226 **3.2**

227 **assessment**

228 systematic process that is carried out throughout the design process to ensure that all the
229 relevant safety requirements are met by the proposed (or actual) design

230 [SOURCE: IAEA Safety Glossary, 2022 edition, Modified]

231 **3.3**

232 **audit**

233 planned and documented activity performed by qualified personnel to determine by
234 investigation, examination, or evaluation of objective evidence, the adequacy and compliance
235 with established procedures, or applicable documents, and the effectiveness of implementation

236 NOTE 1: The term refers here to internal or external control of organisations on quality management, project
237 management, and all other issues concerning safety requirements on nuclear processes.

239 NOTE 2: It is further assumed that the audited organisation provides "auditable data", i.e. technical information which
240 is documented and organized in a readily understandable and traceable manner that permits independent review of
241 the inferences or conclusions based on the information (see IEC/IEEE 60780-323).

242 [SOURCE: IAEA Safety Glossary, 2022 edition, Modified]

243 **3.4**

244 **automated code generation**

245 function of automated tools allowing transformation of the application-oriented language into a
246 form suitable for compilation or execution

247 [SOURCE: IEC 60880/ 2006, 3.5]

3.5**commissioning**

process by means of which systems and components of facilities and activities, having been constructed, are made operational and verified to be in accordance with the design and to have met the required performance criteria

NOTE: Commissioning may include both non-nuclear/non-radioactive and nuclear/radioactive testing.

[SOURCE: IAEA Safety Glossary, 2022 edition]

3.6**Hardware Description Language, HDL**

language used to formally describe the functions and/or the structure of an electronic component for documentation, simulation or synthesis

NOTE: The most widely used HDLs are VHDL (IEEE 1076) and Verilog (IEEE 1364).

[SOURCE: IEC 62566: 2012, 3.6]

3.7**HDL-Programmed Device, HPD**

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

NOTE: HPDs are typically represented by ASICs, FPGAs, PLDs or similar micro-electronic technologies.

[SOURCE: IEC 62566: 2012, 3.7]

3.8**I&C system**

system, based on electrical and/or electronic and/or programmable electronic technology, performing I&C functions as well as service and monitoring functions related to the operation of the system itself

NOTE 1: The term is used as a general term which encompasses all elements of the system such as internal power supplies, sensors and other input devices, data highways and other communication paths, interfaces to actuators and other output devices (see note 2). The different functions within a system may use dedicated or shared resources.

NOTE 2: The elements included in a specific I&C system are defined in the specification of the boundaries of the system.

NOTE 3: An I&C system can be engineered based on an existing I&C platform or be developed directly for a specific application in a NPP.

NOTE 4: According to their typical functionality, IAEA distinguishes between automation / control systems, HMI systems, interlock systems and protection systems.

[SOURCE: IEC 61513: 2011, 3.29, Note 3 added]

3.9**independent assessment**

assessments such as audits or surveillances carried out to determine the extent to which the requirements for the management system are fulfilled, to evaluate the effectiveness of the management system and to identify opportunities for improvement. They can be conducted by or on behalf of the organization itself for internal purposes, by interested parties such as customers and regulators (or by other persons on their behalf), or by external independent organizations

NOTE 1: This definition applies in management systems and related fields.

NOTE 2: Persons conducting independent assessments do not participate directly in the work being assessed.

NOTE 3: Independent assessment activities include internal and external audit, surveillance, peer evaluation and technical review, which are focused on safety aspects and areas where problems have been found.

296 [SOURCE: IAEA Safety Glossary, 2022 edition]

297 **3.10**

298 **I&C platform**

299 set of hardware and software components that may work co-operatively in one or more defined
300 architectures (configurations). The development of plant specific configurations and of the
301 related application software may be supported by software tools. An I&C platform usually
302 provides a number of standard functionalities (e.g. application functions library) that may be
303 combined to generate specific application software

304 NOTE: An I&C platform may be a product of a defined manufacturer or a set of products interconnected and adapted
305 by a supplier.

306 [SOURCE: IEC 61513:2011, 3.17, “equipment family”]

307 **3.11**

308 **qualification**

309 process of determining whether a system or component is suitable for operational use. The
310 qualification is performed in the context of a specific class of the I&C system and a specific set
311 of qualification requirements

312 NOTE: Qualification of I&C systems is always a plant specific activity while platform qualification relies to a large
313 degree on qualification activities performed outside the framework of a specific plant design (these are called “generic
314 qualification” or “pre-qualification”).

315 [SOURCE: IEC 61513: 2011, 3.38, notes modified]

316 **3.12**

317 **redundancy**

318 provision of alternative (identical or diverse) structures, systems or components, so that any
319 one can perform the required function regardless of the state of operation or failure of any other

320 [SOURCE: IEC 60880: 2006, 3.31]

321 **3.13**

322 **regulatory body**

323 authority or a system of authorities designated by the government of a State as having legal
324 authority for conducting the regulatory process, including issuing authorizations, and thereby
325 regulating nuclear, radiation, radioactive waste and transport safety

326 NOTE: For each Contracting Party any body or bodies given the legal authority by that Contracting Party to grant
327 licences and to regulate the siting, design, construction, commissioning, operation or decommissioning of nuclear
328 installations.

329 [SOURCE: IAEA Safety Glossary, 2022 edition]

330 **3.14 representative platform configuration**

331 exemplary configuration of an I&C platform to demonstrate its suitability for an intended plant
332 specific use

333 NOTE: The representative configuration is used to demonstrate the specified functional requirements and interface
334 specifications are met and to demonstrate the platform properties and characteristics important to safety.

335 [SOURCE: IEC 61513: 2011, 3.56, adapted to IAEA Safety Glossary, 2022 edition]

336 **3.15**

337 **type test**

338 conformity test made on one or more items representative of the production

339 [SOURCE: IEC 61226: 2020, 3.30]