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Interested committees:

Title: BS EN IEC 63147 Standard criteria for accident monitoring instrumentation for nuclear power generating stations

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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.

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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.	



45A/1571/CD

COMMITTEE DRAFT (CD)

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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:

TC 45, SC 45B

HORIZONTAL FUNCTION(S):

ASPECTS CONCERNED:

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:

Standard criteria for accident monitoring instrumentation for nuclear power generating stations

NOTE FROM TC/SC OFFICERS:

Circulation of CD in accordance with decision 45A/2023-29 made during IEC SC45A plenary meeting (see 45A/1509A/RM). This document is circulated in parallel with IEEE NPEC in accordance with the procedure defined in the "Guide to IEC/IEEE Cooperation".

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1	Contents	
2	1. Overview	9
3	1.1 Scope.....	9
4	1.2 Purpose	9
5	1.3 Word usage.....	9
6	1.4 Application	9
7	2. Normative references.....	10
8	2.1 Normative references for IEEE domain	10
9	2.2 Normative references for IEC domain	11
10	3. Terms and definitions	11
11	4. Symbols and abbreviations	14
12	5. Selection criteria	15
13	5.1 Type A variables	15
14	5.2 Type B variables	15
15	5.3 Type C variables	15
16	5.4 Type D variables	16
17	5.5 Type E variables	16
18	5.6 Type F variables.....	16
19	5.7 Documentation of selection criteria.....	16
20	6. Performance criteria	18
21	6.1 Range	18
22	6.2 Accuracy	18
23	6.3 Response time	18
24	6.4 Required operating time	19
25	6.5 Reliability	19
26	6.6 Documentation of performance criteria	19
27	7. Design criteria	19
28	7.1 Single failure	20
29	7.2 Common cause failure.....	20
30	7.3 Independence and physical separation	20
31	7.4 Isolation	21
32	7.5 Information ambiguity	21
33	7.6 Power supply.....	21
34	7.7 Calibration.....	22
35	7.8 Testability	22
36	7.9 Direct measurement	22
37	7.10 Control of access	23
38	7.11 Maintenance and repair	23
39	7.12 Multi-purpose instrumentation indications	23
40	7.13 Auxiliary supporting features	23
41	7.14 Portable instruments	23
42	7.15 Documentation of design criteria	23
43	7.16 Cyber security	24
44	8. Qualification criteria	24
45	8.1 Type A variables	24

46	8.2 Type B variables	24
47	8.3 Type C variables	24
48	8.4 Type D variables	25
49	8.5 Type E variables	25
50	8.6 Type F variables.....	25
51	8.7 Portable instruments	25
52	8.8 Operating time	25
53	8.9 Documentation of qualification criteria	26
54	9. Display criteria	26
55	9.1 Display characteristics	26
56	9.2 Trend or rate information	26
57	9.3 Display identification	26
58	9.4 Type of monitoring channel display	27
59	9.5 Display location	27
60	9.6 Information ambiguity	27
61	9.7 Recording.....	27
62	9.8 Digital display signal validation.....	27
63	9.9 Documentation of display criteria.....	28
64	10. Quality assurance	28
65	Annex A (informative) Accident monitoring instrument channel accuracy	29
66	A.1 Introduction.....	29
67	A.2 Accuracy requirement groupings according to usage.....	29
68	A.3 Typical accuracy requirements.....	29
69	Annex B (informative) Examples of monitoring channel displays	30
70	Annex C (informative) Operational state diagram	32
71	Annex D (informative) Variable Mapping to IEC 61226.....	33
72	Annex E (informative) Bibliography	34
73		

INTERNATIONAL ELECTROTECHNICAL COMMISSION

STANDARD CRITERIA FOR ACCIDENT MONITORING INSTRUMENTATION FOR
NUCLEAR POWER GENERATING STATIONS

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- IEC/IEEE63147-497 has been prepared by subcommittee 45A: Instrumentation, control and electrical power systems of nuclear facilities, of IEC technical committee 45: Nuclear instrumentation, in cooperation with Nuclear Power Engineering Committee of the IEEE, under the IEC/IEEE Dual Logo Agreement.

The text of this standard is based on the following IEC documents:

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

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

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, [and the ISO/IEC Directives, JTC 1 Supplement] available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The IEC Technical Committee and IEEE Technical Committee have 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,

- 128 • replaced by a revised edition, or
129 • amended.
130

Introduction

This introduction is not part of P497™/D1, IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations.

History

This standard evolved from IEEE Std 497™-2016 0¹. It represents a continued effort by IEEE to support the specification, design, and implementation of accident monitoring instrumentation of nuclear power generating stations.

IEEE Std 497-2016 0 was developed to provide criteria for advanced instrumentation system designs and design modifications based on modern digital technology. It marked a clear path forward for the application of new technology. Though still maintaining applicability to existing systems, this version of IEEE Std 497 provides more current guidance based on historically related standards and guidance.

It was the working group's intention that the criteria of this standard address the variety of possible accident monitoring channel configurations that current technology affords. It was also the working group's intention to address the display of information using computer generated displays and calculated values. The criteria presented in this standard provide guidance in this area without limiting the types of displays that can be made available to accident management personnel.

Although written primarily for new plant designs, existing plants may also use the guidance and applicable criteria in this standard. The use of applicable plant procedures to determine the requirements of the accident monitoring instrumentation provides the necessary flexibility for useful design criteria. This standard can be used to help address the necessary changes to the plant configuration that occur over the operating life of any plant.

Historically the standard addressed accident monitoring instrumentation used for monitoring events that a nuclear power generating station is designed to withstand. These events include accidents and incidents that may occur during anticipated operating occurrences (AOOs) and design basis events (DBEs). To address lessons learned from various industry events, the scope of this standard has evolved to now include design extension conditions (DEC) including severe accidents. This evolution was intended to provide a broader applicability to cover both preventative and mitigative phases of potential plant events. While limited information on severe accident management has been provided within the standard, it is recommended to consult other relevant standards and guidelines for more specific guidance in this area.

A broader applicability of the standard was also achieved by moving to a more international, technology neutral approach to the standard. This approach was achieved by changing to International Atomic Energy Agency (IAEA) definitions of terms, where applicable; the removal, where appropriate, of U.S. specific references; and involvement in the working group of members of other standards organizations. Furthermore, the corresponding International Electrotechnical Commission (IEC) counterparts to the IEEE standards referenced were investigated and introduced as a second set of normative references. This opens the possibility to apply this standard in the IEC domain. The individual IEEE and IEC reference sets in whole are individually appropriate for use in the application of the standard, but inclusion of the IEEE and IEC references does not imply equivalency between the individual references of the two sets.

¹ The numbers in brackets correspond to those of the bibliography in 0.

The working group has evaluated the IEC 61226 safety classification map and has concluded that additional details on safety classifications should not be added to future revisions of IEEE Std 497. This decision stems from a fundamental difference in the scopes and purposes of the two standards. IEEE 497 primarily focuses on monitoring and confirmation of function completion within nuclear power generating stations. Its objective is to provide guidelines and requirements for ensuring the safety and reliability of monitoring systems during accidents and events to provide verification of the effectiveness of existing safety functions. On the other hand, IEC 61226 is specifically designed to classify the safety functions themselves within nuclear power plants. It aims to provide a systematic approach for categorizing functions based on their importance and impact on safety. The working group encourages the application of IEC 61226 during the early stages of safety system design, where safety functions are defined and the systems are classified. By ensuring appropriate safety function classification at the system design stage, the subsequent monitoring and verification activities, as guided by IEEE 497, can be optimized. This approach leverages the strengths of both standards, recognizing their distinct yet complementary roles in achieving robust safety within plant system monitoring. (See Annex D).

Intended use

The standard applies to instrumentation intended for use during AOOs, DBEs, and DECAs including severe accidents. Accident monitoring is not defined as a specific system, but rather as a set of requirements that can be implemented by individual instruments, subsystems, or an entire system. These requirements aim to ensure effective monitoring of various parameters and conditions following an accident or incident in a nuclear power generating station. The standard provides guidelines for establishing the necessary instrumentation and monitoring capabilities to assess potential accident conditions, allowing for appropriate response and mitigation measures to be implemented promptly.

This standard defines severe accidents as a subset of design extension conditions during which fuel damage has occurred. Operationally, severe accidents and design extension conditions without fuel damage are distinguished by the procedures and guidelines used to manage the event, with emergency operating procedures (EOP) used for design extension conditions without fuel damage and severe accident management guidelines (SAMG) used for severe accidents (see 0).

The standard is to be applied to instruments designated for severe accidents (Type F variables); however, use of non-designated instruments during a severe accident is not precluded if these instruments are available and can aid in the accident mitigation. Design extension conditions that are not severe accidents are not covered by this standard.

This standard is intended to be used for both new plant designs and major modifications or upgrades of existing nuclear power generating stations. The standard can be applied to various reactor types used for power generation; however, development of the standard focused on light water reactors and application of the standard to reactor technologies beyond light water reactors should be evaluated prior to initial use.

Revision summary

Since IEEE Std 497 was approved in 2016, the working group has considered and incorporated appropriate changes related to the following items:

- 221 — Reactor technology neutral approach including consideration of advanced reactor
- 222 applications
- 223 — International usability including direct input from IEC SC45A WGA9 and IAEA Nuclear
- 224 Safety and Security Glossary, 2022 Edition
- 225 — User feedback, including application of Type F variables
- 226 — Risk informed techniques
- 227 — NRC RG 1.97 Rev.5 Position Statements

228 Other minor editorial improvements throughout the standard were also incorporated.

229 **Future work**

230 As the use of digital technology in the nuclear plant is a dynamic area of design, the working
231 group intends to keep this area as an ongoing future task.

232

233

IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations

1. Overview

1.1 Scope

This standard contains the functional and design criteria for accident monitoring instrumentation for new nuclear power plant designs and design modifications for nuclear power generating stations.

1.2 Purpose

The purpose of this standard is to establish selection, design, performance, qualification, and display criteria for accident monitoring instrumentation for anticipated operational occurrences, design basis events, and design extension conditions (including severe accident conditions).

1.3 Word usage

<This subclause is mandatory and shall appear after the Scope and Purpose (if included).>

The word *shall* indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals *is required to*).^{1,2}

The word *should* indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (*should* equals *is recommended that*).

The word *may* is used to indicate a course of action permissible within the limits of the standard (*may* equals *is permitted to*).

The word *can* is used for statements of possibility and capability, whether material, physical, or causal (*can* equals *is able to*).

1.4 Application

This standard applies to accident monitoring instrumentation intended for use during the following operations:

- As required for planned operator action related to accident mitigation
- For assessing plant conditions, safety system performance, and making decisions related to plant response to abnormal events
- For assessing plant conditions in support of achieving and maintaining safe shutdown following an accident

This standard does not apply to the following:

¹ The use of the word *must* is deprecated and cannot be used when stating mandatory requirements; *must* is used only to describe unavoidable situations.

² The use of *will* is deprecated and cannot be used when stating mandatory requirements; *will* is only used in statements of fact.

- 267 — Accident monitoring instrumentation that is intended solely for historical recording or
268 solely for maintenance purposes
- 269 — Other instrumentation that may be available during accident conditions

270 2. Normative references

271 The following referenced documents are indispensable for the application of this document (i.e.,
272 they must be understood and used, so each referenced document is cited in text and its
273 relationship to this document is explained).

274 This Standard can be used with either the IEEE or the IEC normative references but one set of
275 references shall be used in whole as the basis for the design (additional use of references from
276 the other set is acceptable).

277 For dated references, only the edition cited applies. For undated references, the latest edition
278 of the referenced document (including any amendments or corrigenda) applies.

279 2.1 Normative references for IEEE domain

280 ASME NQA-1, Quality Assurance Requirements for Nuclear Facility Applications.³

281 IEEE Std 7-4.3.2™, IEEE Standard Criteria for Programmable Digital Devices in Safety
282 Systems of Nuclear Power Generating Stations.^{4,5}

283 IEEE Std 308™, IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power
284 Generating Stations.

285 IEC/IEEE 60780-323, IEC/IEEE International Standard – Nuclear Facilities - Electrical
286 Equipment Important To Safety - Qualification.

287 IEC/IEEE 60980-344 IEC/IEEE International Standard – Nuclear Facilities – Equipment
288 Important To Safety – Seismic Qualification.

289 IEEE Std 352™-2016, IEEE Guide for General Principles of Reliability Analysis of Nuclear
290 Power Generating Station Systems and Other Nuclear Facilities.

291 IEEE Std 379.1, IEEE Guide for Application of the Single-Failure Criterion to Nuclear Power
292 Generating Station Safety Systems.

293 IEEE Std 384™, IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits.

294 IEEE Std 577™, IEEE Standard Requirements for Reliability Analysis in the Design and
295 Operation of Safety Systems for Nuclear Power Generating Stations and Other Nuclear
296 Facilities.

297 IEEE Std 603™, IEEE Standard Criteria for Safety Systems for Nuclear Power Generating
298 Stations.

299 IEEE Std 1819™, IEEE Standard for Risk-Informed Categorization and Treatment of Electrical
300 and Electronic Equipment at Nuclear Power Generating Stations and Other Nuclear Facilities.

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