

GUIDE YVL E.7

ELECTRICAL AND I&C EQUIPMENT OF A NUCLEAR FACILITY

1	Introduction	4
2	Scope of application	8
3	Requirement specification, selection, and procurement of electrical and I&C equipment and cables	9
3.1	General requirements for the requirement specification, selection and procurement of electrical and I&C equipment	9
3.2	Requirement specification	10
3.3	Configuration management	11
3.4	Suitability analysis	12
3.4.1	Preliminary suitability analysis	13
3.4.2	Final suitability analysis	15
4	Quality management of electrical and I&C equipment and cables	17
4.1	General quality management requirements	17
4.2	Quality management system	17
5	Qualification of electrical and I&C systems, equipment and cables	19
5.1	General qualification requirements	19
5.2	Qualification plan	19
5.3	Tests included in qualification	20
5.4	Assessment of the design and manufacturing process of electrical and I&C equipment	21
5.5	Compatibility with the electrical network	22
5.6	Qualification to environmental conditions	23
5.7	Electromagnetic compatibility	25
5.8	Qualification by means of analyses	25
5.9	Operating experience feedback	25
5.10	Type approval	26
5.11	Mechanical qualification of electrical and I&C equipment	28
6	Qualification of safety-classified software	29
6.1	General software requirements	29
6.2	Qualification of the system platform software and the application software	30
6.3	Software design procedures and processes	31
6.4	Software tools	31

6.5 Existing software	32
6.6 Software testing	32
7 Receiving, installation and commissioning	34
7.1 General requirements for receiving, installation and commissioning	34
7.2 Receiving inspection	34
7.3 Installation	34
7.4 Commissioning	35
8 Removed. (Ageing management, see Guide YVL A.8)	37
9 Documents to be submitted to STUK	38
9.1 Suitability analyses	38
9.2 Control of manufacturing and factory tests	39
9.3 Installation phase	40
9.4 Commissioning phase	40
9.5 Operation phase	41
9.6 Modifications during operation	41
10 Regulatory oversight by the Radiation and Nuclear Safety Authority	42
10.1 Oversight of quality management	42
10.2 Oversight of manufacturing and factory tests	42
10.3 Oversight of installation	42
10.4 Oversight of commissioning	42
10.5 Oversight during operation	43
10.6 Modifications during operation	43
11 References	44

Definitions

Authorisation

According to Section 7 r of the Nuclear Energy Act (990/1987), the Radiation and Nuclear Safety Authority (STUK) shall specify detailed safety requirements for the implementation of the safety level in accordance with the Nuclear Energy Act.

Rules for application

The publication of a YVL Guide shall not, as such, alter any previous decisions made by STUK. After having heard the parties concerned STUK will issue a separate decision as to how a new or revised YVL Guide is to be applied to operating nuclear facilities or those under construction, and to licensees' operational activities. The Guide shall apply as it stands to new nuclear facilities.

When considering how the new safety requirements presented in the YVL Guides shall be applied to the operating nuclear facilities, or to those under construction, STUK will take due account of the principles laid down in Section 7 a of the Nuclear Energy Act (990/1987): The safety of nuclear energy use shall be maintained at as high a level as practically possible. For the further development of safety, measures shall be implemented that can be considered justified considering operating experience, safety research and advances in science and technology.

According to Section 7 r(3) of the Nuclear Energy Act, the safety requirements of the Radiation and Nuclear Safety Authority (STUK) are binding on the licensee, while preserving the licensee's right to propose an alternative procedure or solution to that provided for in the regulations. If the licensee can convincingly demonstrate that the proposed procedure or solution will implement safety standards in accordance with this Act, the Radiation and Nuclear Safety Authority (STUK) may approve a procedure or solution by which the safety level set forth is achieved.

With regard to new nuclear facilities, this Guide shall apply as of 1 April 2019 until further notice. With regard to operating nuclear facilities and those under construction, this Guide shall be enforced through a separate decision to be taken by STUK. This Guide replaces Guide YVL E.7 (15.11.2013).

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STUK • SÄTEILYTURVAKESKUS
STRÅLSÄKERHETSCENTRALEN
RADIATION AND NUCLEAR SAFETY AUTHORITY

Osoite / Address • Laippatie 4, 00880 Helsinki

Postiosoite / Postal address • PL / P.O.Box 14, FI-00811 Helsinki, FINLAND

Puh. / Tel. (09) 759 881, +358 9 759 881 • Fax (09) 759 88 500, +358 9 759 88 500 • www.stuk.fi

1 Introduction

101. This Guide sets forth detailed safety requirements concerning the electrical and I&C equipment and cables of nuclear facilities, and it describes STUK's supervision and inspection related procedures. [2019-03-15]

102. According to Section 63(1)(3) of the Nuclear Energy Act (990/1987) [1], *the Radiation and Nuclear Safety Authority (STUK) is authorised to require that the nuclear fuel or the structures and components intended as parts of the nuclear facility be manufactured in a manner approved of by the Radiation and Nuclear Safety Authority. STUK is authorised to oblige the licensee or licence applicant to arrange for STUK an opportunity sufficiently to control manufacture of the fuel or such structures and components.* [2013-11-15]

103. According to Section 4(2) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *Requirements set for and the actions taken to ascertain the compliance with the requirements of the systems, structures and components implementing safety functions and connecting systems, structures and components shall be commensurate with the safety class of the item in question.* [2019-03-15]

104. According to Section 5(1) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *The design, construction, operation, condition monitoring and maintenance of a nuclear facility shall provide for the ageing of systems, structures and components important to safety in order to ensure that they meet the design-basis requirements with necessary safety margins throughout the service life and decommissioning of the facility.* [2019-03-15]

104a. According to Section 5(2) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *Systematic procedures shall be in place for preventing such ageing of systems, structures and components which may deteriorate their availability, and for the early detection of the need for their repair, modification and replacement. Safety requirements and applicability of new technology shall be periodically assessed in order to ensure that the technology applied is up to date, and the availability of the spare parts and the system support shall be monitored.* [2019-03-15]

105. According to Section 6(1) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *Human factors relating to safety shall be controlled with systematic procedures throughout the entire life cycle of the nuclear facility. Human factors shall be taken into account in the design of the nuclear facility and in the*

planning of its operations, maintenance and decommissioning in a manner that supports the high-quality implementation of the work and ensures that human activities do not endanger plant safety. Attention shall be paid to the avoidance, detection and correction of human errors and the limiting of their effects. [2019-03-15]

106. According to Section 9(4) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *High quality proven technology is to be used for the different defence levels. [2019-03-15]*

106a. According to Section 9(5) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *The necessary measures to bring a situation under control or to prevent harmful effects of radiation must be planned in advance. When organising licensee's operations, it must be ensured that operational occurrences and accidents are reliably prevented. There shall be effective technical and administrative provisions to ensure staff's ability to operate in these situations. [2019-03-15]*

106b. According to Section 11(5) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *Common cause failures shall only have minor impacts on nuclear power plant safety. [2019-03-15]*

107. According to Section 14(1) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *The design of a nuclear facility shall take account of external hazards that may endanger safety. Systems, structures, components and access shall be designed, located and protected so that the impacts of external hazards deemed possible on nuclear facility safety remain minor. The operability of systems, structures and components shall be demonstrated in their design basis external environmental conditions. [2019-03-15]*

108. According to Section 15(1) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *The design of a nuclear facility shall take account of any internal hazards that may endanger safety. Systems, structures and components shall be designed, located and protected so that the probability of internal hazards remains low and impacts on nuclear facility safety minor. The operability of systems, structures and components shall be demonstrated in the room specific environmental conditions used as their design bases. [2019-03-15]*

109. According to Section 18(1) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *The holder of the nuclear facility's construction license shall ensure during construction that the nuclear facility is constructed and*

implemented in conformity with the safety requirements and using approved plans and procedures. [2019-03-15]

110. Removed. [2019-03-15]

111. According to Section 19(1) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *In connection with the commissioning of a nuclear facility or its modifications, the licensee shall ensure that the systems, structures and components and the nuclear facility as a whole operate as designed. The procedures of the commissioning of the nuclear facility or its modifications shall be planned, and instructions shall be provided.* [2019-03-15]

112. According to Section 19(2) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *At the commissioning stage, the licensee shall ensure that appropriate procedures are in place for the future operation of the nuclear facility.* [2019-03-15]

112a. According to Section 20(3) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *For operational occurrences and accidents, appropriate procedures for the identification and control of circumstances shall be available.* [2019-03-15]

112b. According to Section 20(4) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *Operational measures concerning the nuclear facility, as well as events having an impact on safety, shall be documented so that they can be verified and assessed afterwards.* [2019-03-15]

112c. According to Section 22(2) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *The plant shall be operated in compliance with the requirements and restrictions set in the Operational Limits and Conditions, and compliance with them shall be monitored and deviations reported.* [2019-03-15]

113. According to Section 23(1) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *Systems, structures and components important to the safety of a nuclear facility shall be available as detailed in the design basis requirements.* [2019-03-15]

114. According to Section 25(2) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *Organisations participating in the design, construction, operation and decommissioning of a nuclear facility shall employ a management*

system for ensuring safety and the management of quality. The objective of such a management system shall be to ensure that safety is prioritised without exception, and that quality management requirements correspond to the safety significance of the activity and function. The management system shall be systematically assessed and further developed.
[2019-03-15]

115. According to Section 25(5) of the Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018): *The licensee shall commit and oblige its employees and the suppliers and subcontractors whose involvement affects the safety of the nuclear facility to adhere to the systematic management of safety and quality.* [2019-03-15]

116. The design, manufacture and installation of electrical and I&C equipment and cables of nuclear facilities shall take into account the regulations issued by authorities other than STUK that are in force in Finland. These include safety standards concerning the safety of electrical equipment and occupational safety for electrical work, and the instructions provided by authorities supervising electrical safety (such as standard series SFS 6000: Low-voltage electrical installations, standard SFS 6001: High-voltage electrical installations, and standard SFS 6002: Safety at electrical work), and the regulations and guidelines concerning machine safety. Compliance with the electrical safety and machine safety legislation is monitored by competent authorities. [2013-11-15]

117. Unless otherwise specified in the list of definitions, this Guide shall adhere to the quality management glossary in accordance with the standard [3]. [2013-11-15]

2 Scope of application

201. This Guide applies to the electrical and I&C equipment and cables of a nuclear facility throughout its life cycle. [2013-11-15]

202. The requirements set forth in the Guide apply to licence applicants, licensees and the plant suppliers and manufacturers in the supply chain of electrical and I&C equipment and cables. [2013-11-15]

203. Since qualification and maintenance, among other things, require that the electrical and I&C systems be handled at the component level, this Guide also presents certain system-level requirements, even though it mainly focuses on the component level. [2019-03-15]

204. The general requirements, design and configuration management of electrical and I&C equipment at architecture and system level are discussed in Guide YVL B.1 "Safety design of a nuclear power plant". [2019-03-15]

205. The general requirements regarding the management system are discussed in Guide YVL A.3 "Leadership and management for safety". [2019-03-15]

206. The general requirements for a construction and commissioning of a nuclear facility and modifications of operating plants are presented in Guide YVL A.5 "Construction and commissioning of a nuclear facility". [2019-03-15]

207. The ageing management requirements are provided in Guide YVL A.8 "Ageing management of a nuclear facility". [2019-03-15]

208. Removed. [2019-03-15]

209. The requirements for the security arrangements of a nuclear facility are presented in Guide YVL A.11 "Security of a nuclear facility". These may case-specifically have an impact on the requirements of electrical and I&C equipment, such as those concerning an aircraft crash. [2019-03-15]

210. The requirements for the information security of a nuclear facility are presented in Guide YVL A.12 "Information security management of a nuclear facility". [2019-03-15]

3 Requirement specification, selection, and procurement of electrical and I&C equipment and cables

3.1 General requirements for the requirement specification, selection and procurement of electrical and I&C equipment

301. The licensee's supplier evaluation procedures shall cover the assessment of the suppliers of electrical and I&C equipment and cables. [2013-11-15]

302. The licensee's design procedures shall include the procedures for determining location requirements for the use of electrical and I&C equipment and cables. [2013-11-15]

303. The licensee shall have in place procedures for communicating the requirements concerning the electrical and I&C equipment and cables to the organisations and their subcontractors that are involved in the component life cycle. [2013-11-15]

304. The licensee's design procedures shall present procedures for assessing the requirement specification of electrical and I&C equipment and cables in safety class 2 (para. 324). [2013-11-15]

305. The licensee's design procedures shall include the procedures for preparing the preliminary and final suitability analyses of the electrical and I&C equipment and cables. [2013-11-15]

306. The licensee's design procedures shall include the procedures for preparing a qualification plan of the electrical and I&C equipment and cables. [2013-11-15]

307. The licensee's design and procurement process for a safety class 2 or 3 electrical or I&C equipment and cable shall define the documentation to be produced at the various stages of the process. The documentation can be described in the quality plan. [2013-11-15]

308. Moved to Guide YVL B.1. [2019-03-15]

309. The design, manufacture and testing of electrical equipment and cables in safety class 2 and those electrical equipment and cables in safety class 3 that are to be qualified to accident conditions shall be based on Finnish or international electrical equipment standards and, where applicable, on nuclear industry standards and guidelines. [2019-03-15]

310. The design, manufacture and testing of electrical equipment and cables in safety class 3 other than those listed in para. 309 shall employ applicable Finnish or international electrical equipment standards. [2013-11-15]

311. The design, manufacture and testing of I&C equipment in safety class 2 and equipment mentioned in Guide YVL B.1 requirement 5214 or in Guide YVL C.6 requirement 402a shall be primarily based on nuclear industry standards and guidelines or, in the absence of applicable nuclear industry standards, on international I&C equipment standards. [2019-03-15]

312. The design, manufacture and testing of I&C equipment in safety class 3 shall employ applicable international I&C equipment standards. [2013-11-15]

313. The electrical and I&C equipment and cables of a nuclear facility shall be labelled with an easily readable marking that is manufactured from a material capable of withstanding the ambient conditions and stresses at the location of use. [2013-11-15]

3.2 Requirement specification

314. A requirement specification shall be prepared when selecting or procuring electrical and I&C equipment and cables in safety classes 2 and 3. The requirement does not apply to the procurement of an original spare part (see para. 335). [2019-03-15]

315. The requirement specification of electrical or I&C equipment or cable in safety classes 2 and 3 shall indicate the properties required from the equipment or cable at the intended location of use (such as the functional requirements, performance and reliability requirements, requirements set by environmental conditions and operation conditions, and requirements concerning connections, periodic tests, maintenance, information security, qualification, and service life). [2013-11-15]

316. The requirement specification of electrical and I&C equipment and cables in safety classes 2 and 3 shall indicate the safety classification of the component or cable. [2013-11-15]

317. The requirement specification of electrical and I&C equipment and cables in safety classes 2 and 3 shall indicate the seismic classification of the component or cable. [2019-03-15]

318. The requirement specification of electrical and I&C equipment and cables in safety classes 2 and 3 shall indicate the essential safety standards applied to the component or cable and the deviations to their requirements. [2013-11-15]

319. The requirement specification of electrical or I&C equipment or cable in safety classes 2 and 3 shall indicate any quality requirements presented for equipment in the system quality plan as well as other quality requirements. [2019-03-15]

320. The requirement specification of electrical or I&C equipment or cable in safety classes 2 and 3 shall indicate any requirements presented for equipment in the system qualification plan.

[2019-03-15]

321. The requirement specification of electrical or I&C equipment or cable in safety classes 2 and 3 shall be updated in connection with any changes during the system's design, manufacture and operation period. [2019-03-15]

322. The final requirement specification of electrical or I&C equipment or cable in safety class 2 or 3 shall be detailed enough in order to allow for the traceable verification of the compliance to the requirements in question of the final product. [2013-11-15]

323. The requirements of electrical and I&C equipment and cables in safety classes 2 and 3 shall be unambiguous and shall not contain conflicting information. [2019-03-15]

323a. The requirements of electrical or I&C equipment or cable in safety class 2 or 3 shall be traceable to their higher-level requirements (such as system level requirements, facility level concept requirements...). [2019-03-15]

324. The requirement specification of electrical or I&C equipment or cable in safety class 2 shall be assessed by an expert that has not been involved in the design of the item in question. The assessment shall demonstrate that the requirements set for the product are consistent with higher-level requirements. [2019-03-15]

325. Removed. [2019-03-15]

326. Removed. [2019-03-15]

3.3 Configuration management

327. The requirements of configuration management are described in Guide YVL B.1. [2019-03-15]

328. Removed. [2019-03-15]

329. Removed. [2019-03-15]

330. Removed. [2019-03-15]

331. Procedures shall be in place for the implementation of parameter changes in electrical and I&C systems and the associated components, describing the approval procedures for parameter changes and the procedures for implementing the changes. [2019-03-15]

332. Removed. [2019-03-15]

333. Removed. [2019-03-15]

3.4 Suitability analysis

334. A preliminary and final suitability analysis concerning the suitability of electrical and I&C equipment and cables in safety classes 2 and 3 for their intended location of use shall be prepared as part of the selection of components for a system or the procurement of a replacement spare part. Para. 906 specifies the cases where the preliminary and final suitability analyses may be combined into a single document. [2019-03-15]

335. A spare part is not considered an original part, but a replacement spare part in the meaning of para. 334 if:

- a. the performance values of the spare part related its safety function are inferior compared to the original
- b. the spare part deviates in terms of the way of function, any software part or structural characteristics from the original
- c. the spare part does not match the original part in terms of environmental condition endurance
- d. the quality management level of the spare part does not fulfil the original level
- e. the manufacturer of the spare part has changed. [2019-03-15]

336. A suitability analysis is not required for serially manufactured installation supplies used under normal operating conditions, such as cable clamps, cable joints and cable lugs. [2013-11-15]

337. Suitability analyses concerning electrical and I&C equipment and cables in safety classes 2 and 3 may only be prepared by an expert with knowledge of the requirements at the intended location of use.

- a. Selecting a component and assessing its suitability to a system that is being built is ordinary work for a system designer and a work phase during which, in an optimal case, the designer personally creates the main portion of the documentation for the preliminary suitability analysis in order to document the work and to ensure its traceability.
- b. A licensee's conclusion, part of the preliminary suitability analysis (see para. 340), may be created by the author of the preliminary suitability analysis if he or she belongs to the licensee's organisation, or other person belonging to the licensee's organisation and having good knowledge of the requirements at the intended location of use.
- c. The final suitability analysis may be created by the same author who created the preliminary suitability analysis, or some other person with good knowledge of the requirements at the

intended location of use.

d. Assessments of the licensee belonging to the final suitability analysis (see paras 348 and 349) may be created by the author of the final suitability analysis if he belongs to licensee's organisation, or a person belonging to licensee's organisation and having good knowledge of the requirements at the intended location of use. [2019-03-15]

338. A suitability analysis performed on an electrical or I&C equipment implemented by means of software-based technology shall cover the assessment of software and hardware.

[2013-11-15]

339. The equipment description presented in connection with the suitability analyses shall include the descriptions of any software tools used. [2019-03-15]

3.4.1 Preliminary suitability analysis

340. In connection with the preliminary suitability analysis, the licensee shall present a verification-based conclusion on the suitability of the component for its location of use.

[2019-03-15]

341. In the preliminary suitability analysis, the suitability of the component or cable shall be verified by comparing the rated values with the requirement specification (see subsection 3.2). In the necessary scope, the following characteristics of the component shall be examined:

- functional features and performance
- reliability
- endurance of environmental conditions
- electrotechnical dimensioning and protection
- operation of the component in case of disturbances or transients in the electrical network
- the applicability of the standards used in the design and manufacture of the component
- testability and maintainability
- service life.

[2019-03-15]

341a. The component requirement specification (see section 3.2) shall be presented in connection with the preliminary suitability analysis. [2019-03-15]

342. A description of the component and its operation shall be presented together with the preliminary suitability analysis. [2013-11-15]

343. A report of the manufacturer and the manufacturer's prerequisites for manufacturing the product in question as described in Chapter 4 (Quality management) shall be presented in connection with the preliminary suitability analysis. Special attention shall be paid to the following:

- the manufacturer's organisation
- the manufacturer's competence for manufacturing the product
- the manufacturer's management system, its assessment method and assessment results

[2019-03-15]

344. A delivery-specific quality plan (see para. 403) shall be presented in connection with the preliminary suitability analysis. [2019-03-15]

345. The component qualification plan (see paras 505–513) shall be presented in connection with the preliminary suitability analysis or, if the system-level qualification plan also includes the qualification plan of the component, a reference shall be made to the system-level qualification plan submitted to STUK. Justifications for omitting the qualification plan shall be presented if the component or cable is considered not to require a qualification plan (see para. 505).

[2019-03-15]

346. Removed. [2019-03-15]

347. The information concerning the accreditation and qualifications of any type approval organisations shall be presented together with the preliminary suitability analysis (for type approval, see section 5.10). [2019-03-15]

347a. A demonstration of the acceptability of the dimensioning strength of power transferring or load-bearing parts and structures of non-serial electromechanical components in safety class 2, as well as the coverage of the inspections and testing (see para. 579) during manufacturing, shall be presented in connection with the preliminary suitability analysis. [2019-03-15]

3.4.2 Final suitability analysis

348. In connection with the final suitability analysis, the licensee shall present a justified conclusion regarding the validation of the component for its location of use according to the requirement specification. [2019-03-15]

349. The licensee shall present in an appendix to the final suitability analysis a licensee's assessment pursuant to para. 519 on the component's or cable's conformity to requirements. [2019-03-15]

350. In connection with the final suitability analysis, the component or cable shall be demonstrated to fulfil its rated values on the basis of the validation. Special attention shall be paid to the following:

- qualification test results (subsection 5.3)
- compatibility with the electrical network (subsection 5.5)
- qualification to environmental conditions (subsection 5.6)
- EMC properties (subsection 5.7)
- analyses related to qualification (subsection 5.8)
- operating experience feedback (subsection 5.9)
- type approval (subsection 5.10)
- software qualification (Chapter 6)

[2019-03-15]

351. In connection with the final suitability analysis of electrical or I&C equipment in safety class 2, an independent assessment of the acceptability of the qualification procedure shall be presented. [2013-11-15]

352. The independent assessment (para. 351) of the acceptability of the qualification procedure of electrical or I&C equipment in safety class 2 may be performed by an expert or organisational unit employed by the licensee but independent of the design of the system in question.

[2013-11-15]

353. The use of an expert from an independent external organisation shall be considered for the assessment of the qualification procedures (para. 351) of electrical and I&C systems and components and cables that have a significant impact on nuclear safety. [2013-11-15]

354. The necessary actions taken concerning storage life, service life and ageing monitoring of the components and materials shall be presented in connection with the final suitability analysis.

[2019-03-15]

355. If the component in question is not serially manufactured, a summary of the quality management results obtained during manufacture shall be presented together with the final suitability analysis. [2013-11-15]

356. If the component in question is not serially manufactured, a summary of the factory test results shall be presented together with the final suitability analysis. [2013-11-15]

357. The final suitability analysis shall present any deviations from the information presented in the preliminary suitability analysis of the component or cable, and provide justifications for their acceptability. [2013-11-15]

358. Removed. [2019-03-15]

359. The result documentation of the mechanical inspections and testing (see para. 579) of power transferring or load-bearing parts and structures of non-serial electromechanical components in safety class 2 during manufacturing shall be presented in connection with the final suitability analysis. [2019-03-15]

4 Quality management of electrical and I&C equipment and cables

4.1 General quality management requirements

401. Guide YVL A.3 sets forth general requirements for the management system and quality management of a nuclear facility. Guide YVL B.1 sets forth requirements concerning the procedures relating to the management systems that are followed at the system level. Guide YVL A.5 set forth requirements for the construction and commissioning of a nuclear facility. The requirements laid down in these Guides shall be observed when arranging quality management for electrical and I&C equipment and cables. [2013-11-15]

402. The licensee shall prepare general procedures for arranging the quality management in the procurement, design, manufacture, testing, receiving, installation, commissioning, and operation phases of safety-classified electrical and I&C equipment and cables. [2019-03-15]

4.2 Quality management system

403. In addition to the general quality management procedures determined for electrical and I&C equipment and cables, a delivery-specific quality plan pursuant to paras 637, 638 and 639 of Guide YVL A.3 shall be in place for a safety-classified component or cable by the procurement phase. A quality plan is not required when procuring serially manufactured components. [2019-03-15]

404. Removed. [2019-03-15]

404a. The delivery-specific quality plan shall consider procedures required by safety-classified pressure equipment or pressure boundary (see para. 578) which belongs to the component. [2019-03-15]

405. Removed. [2019-03-15]

406. Removed. [2019-03-15]

407. Removed. [2019-03-15]

408. The in-service quality management procedures of electrical and I&C equipment and cables shall include the procedures for ensuring and maintaining the quality of periodic maintenance, periodic testing, test results, repairs and modifications, configuration management, spare part replacement, and instrument precision. [2019-03-15]

409. The quality management procedures of electrical and I&C equipment and cables shall ensure that the structure and features of the production batches procured to the facility are in

accordance with those of the qualified products. [2013-11-15]

410. The suppliers of electrical and I&C equipment and cables in safety classes 2 and 3 shall have in place a successfully certified management system or a management system independently assessed by a third party. [2019-03-15]

411. The management system of the suppliers of electrical and I&C equipment and cables in safety class 2 shall meet the requirements set on suppliers' management systems as presented in Guide YVL A.3. Where necessary, the management system may be supplemented in the delivery-specific quality plan pursuant to para. 403 if the management system requirements set forth in the aforementioned Guide YVL A.3 are not met. [2019-03-15]

5 Qualification of electrical and I&C systems, equipment and cables

5.1 General qualification requirements

501. The electrical and I&C systems of a nuclear facility and their components and cables shall be suitable for their intended purpose and location of use. [2013-11-15]

502. Safety-classified electrical and I&C equipment and cables shall be qualified for their intended purpose and location of use. [2013-11-15]

503. The qualification of safety-classified electrical and I&C equipment and cables shall be performed by means of both a preliminary and final suitability analysis. The combining of preliminary and final suitability analysis has been discussed in para. 906. [2019-03-15]

504. During qualification, the component's or cable's maximum storage life and service life shall be identified, after which the qualification shall be performed again or the product replaced, if the operation of the product is required under accident conditions, or if rapidly ageing parts have been identified in the product (see para. 354). [2019-03-15]

5.2 Qualification plan

505. A system or component-specific qualification plan shall be drawn up for the qualification of electrical and I&C systems, components and cables in safety classes 2 and 3. For the components and cables, the plan is required only if it is necessary to carry out management process evaluations, software assessment, testing, analyses or type approvals. Component and cable qualification plans may be part of the system qualification plan. [2019-03-15]

506. Removed. [2019-03-15]

507. The contents of the qualification plan of electrical or I&C system, equipment and cables in safety class 2 or 3 are presented in para. 363 of Guide YVL B.1 and paras 508 and 510 of Guide YVL E.7. [2019-03-15]

508. The suitability analyses to be prepared shall be presented in the qualification plan of an electrical and I&C system in safety classes 2 or 3. [2019-03-15]

509. Removed. [2019-03-15]

510. The qualification plan of electrical and I&C systems, equipment and cables in safety class 2 shall present the procedure whereby the acceptability of the qualification procedure of electrical and I&C systems, equipment and cables in safety class 2 is independently assessed (para. 351). [2019-03-15]

511. Removed. [2019-03-15]

512. Removed. [2019-03-15]

513. The qualification plan of electrical and I&C systems, equipment or cables in safety classes 2 or 3 shall be updated, if changes are introduced into the requirement specification such that this affects the qualification, or if information is revealed that may be seen to affect the qualification process and, thus, the qualification plan. [2019-03-15]

5.3 Tests included in qualification

514. Test plans shall be drawn up for the qualification tests of electrical and I&C systems, equipment and cables in safety classes 2 and 3. [2019-03-15]

514a. The testing plan (para. 514) shall define the acceptance criteria for the tests.
[2019-03-15]

515. The testers conducting the tests pursuant to para. 514 shall be independent of the design and manufacture of the electrical or I&C system, equipment or cable in safety class 2 or 3 in question. [2019-03-15]

516. The test plan (para. 514), the test acceptance criteria and the test results shall be documented in a manner that allows them to be evaluated by a third party. [2019-03-15]

517. Testing and analyses shall be used to ensure that the electrical or I&C systems or equipment in safety class 2 contain no unnecessary functions that could be detrimental to safety. [2013-11-15]

517a. An electrical or I&C system in safety class 2 shall be tested extensively in the configuration to be installed. [2019-03-15]

517b. Software in safety class 2 shall be tested extensively in the hardware and configuration to be installed. [2019-03-15]

518. The sufficiency of the electrical and I&C system or component tests in safety class 2 shall be justified, and the coverage of the tests shall be analysed against the requirements and rated values. [2013-11-15]

518a. The factory tests of an I&C system in safety class 2 or 3 shall cover all system functions and timings, failure behaviour and, where possible, self-diagnostic functions. [2019-03-15]

519. After the factory tests, the licensee shall assess the conformity to requirements of an electrical or I&C system, component or cable in safety class 2 or 3 before the product may be

shipped to the facility. The assessment shall be documented at the time of performance. The requirement need not be applied to serially manufactured components or cables that do not undergo factory tests supervised by the licensee. [2019-03-15]

520. An assessment pursuant to para. 519 shall be appended to the final suitability analysis. [2019-03-15]

521. The schedule for the delivery and installation of an electrical and I&C system, component or cable in safety class 2 or 3 shall be planned in a manner that allows for implementing the modification planning and modifications that may be required after the factory tests in accordance with procedures that are in line with the safety significance of the system or component. [2013-11-15]

522. The final testing of the electrical or I&C systems or components in safety classes 2 and 3 shall be performed at the facility in the actual operating environment. [2013-11-15]

523. Whenever possible, the final testing at the facility (para. 522) shall demonstrate that the electrical or I&C systems, components or cables in safety classes 2 and 3 correspond to the functional and performance requirements set for them. [2019-03-15]

524. The final testing of the electrical or I&C systems or components in safety classes 2 and 3 (para. 522) may in part employ simulation. [2013-11-15]

5.4 Assessment of the design and manufacturing process of electrical and I&C equipment

525. A nuclear facility's electrical and I&C equipment and cables in safety classes 2 and 3 shall be designed and documented in a manner that allows for ensuring at the various phases of the design and manufacturing process the correct transfer of the set requirements to the final product that will be taken into use. [2013-11-15]

526. The design, manufacture and testing processes of a nuclear facility's electrical and I&C equipment and cables in safety classes 2 and 3 shall be managed in a manner that allows for ensuring the correct transfer of the set requirements to the final product that will be taken into use. [2013-11-15]

527. The design, manufacture and testing processes of a nuclear facility's electrical and I&C equipment and cables in safety class 3 shall be evaluated in a way that allows for ensuring the correct transfer of the set requirements to the final product that will be taken into use. [2013-11-15]

528. The results of the design, manufacture and testing processes of a nuclear facility's electrical and I&C equipment and cables in safety class 2 shall be independently verified in a manner that allows for ensuring the correct transfer of the set requirements to the final product that will be taken into use. [2013-11-15]

529. Removed. [2019-03-15]

5.5 Compatibility with the electrical network

530. Removed. [2019-03-15]

531. Any possible variations of voltage and frequency occurring in the external power transmission grid and the nuclear facility's internal electrical networks (see para. 5408 of Guide YVL B.1) shall be taken into account in the selection and dimensioning of components.

[2019-03-15]

532. Possible variations of voltage and frequency occurring in the external power transmission grid and the nuclear facility's internal electrical networks (see para. 5408 of Guide YVL B.1) shall be taken into account in the qualification of components. [2019-03-15]

533. The qualification of electrical or I&C equipment in safety classes 2 or 3 shall demonstrate the proper operation and rise in temperature of the equipment when its terminals are under the following conditions:

- rated current and voltage continuously
- undervoltages of varying duration, with a simultaneous frequency variation of the most unfavourable type in terms of the component (see para. 5408 of Guide YVL B.1)
- overvoltages of varying duration, with a simultaneous frequency variation of the most unfavourable type in terms of the component (see para. 5408 of Guide YVL B.1)
- any fast voltage transients considered possible at the facility (see para. 5408 of Guide YVL B.1)
- highest input voltage ripple with direct current feed components
- short-circuit currents or start-up inrush current peaks on the output side of a power source component (e.g. inverters or generators).

[2019-03-15]

534. The assessment conducted under para. 533 shall take into account any changes in the loading condition of the component as the supply voltage and frequency change. [2019-03-15]

535. The qualification conducted under para. 533 shall assess the startability of a component under voltage disturbance scenarios if the component is required to start during voltage disturbance. [2019-03-15]

536. The qualification for voltage and frequency variations conducted under para. 533 may usually be performed by means of tests or analyses. Paras 538, 539 and 540, however, set additional qualification procedure conditions. [2019-03-15]

537. Removed. [2019-03-15]

538. The parameters measured experimentally under nominal conditions of the component shall be available when using analyses to qualify electromechanical components for the voltage/frequency disturbance scenarios laid down in para. 533. [2019-03-15]

539. The qualification of components containing electronics for the voltage and frequency variations described in para. 533 shall be based on tests. [2013-11-15]

540. The rise in temperature of the electrical or I&C equipment in safety classes 2 and 3 shall be defined in the nominal state according to the rated values of the component and by using type tests defined in the standards, if the power loss of the component is high enough for the component to be considered to warm up substantially due to the internal power loss. [2013-11-15]

541. When determining the rise in temperature of electrical or I&C equipment feeded from a battery-backed direct current network, the trickle charge voltage of accumulators shall be used as the supply voltage. [2019-03-15]

542. The rise in temperature of the electrical and I&C equipment or cable in its nominal state shall be taken into account when qualifying the component or cable to the prevailing environmental conditions. [2019-03-15]

5.6 Qualification to environmental conditions

543. The environmental conditions and stresses of a nuclear facility's safety-classified electrical and I&C systems, components and cables shall be defined in all planned operational conditions and during storage and transport. [2013-11-15]

544. The electrical and I&C systems, components and cables shall be of such design that their operability is maintained within the set requirements during their entire planned service life. [2013-11-15]

545. The validation of safety-classified electrical and I&C equipment and cables to the planned environmental conditions and stresses shall be performed by means of tests and analyses pursuant to standards. [2013-11-15]

546. The tests and analyses laid down in para. 545 shall correspond to the combined effects of the most unfavourable operational and environmental conditions possible. [2013-11-15]

547. The selection of structures and materials for electrical and I&C equipment and cables of safety classes 2 and 3 needed during or after accidents shall be such that, for their entire planned service life, their required operating capability in accidents will be in compliance with the set requirements. [2013-11-15]

548. The performance of electrical and I&C equipment and cables qualified for accident conditions shall be demonstrated by means of type tests. [2019-03-15]

549. The type tests defined in para. 548 shall form a uniform series of tests during which the same test pieces are subjected to the design basis operating and environmental stresses of the planned location of use. [2013-11-15]

550. Prior to accident condition testing, the test pieces of electrical and I&C equipment and cables shall be artificially aged to correspond to their planned service life. [2013-11-15]

551. Artificial ageing laid down in para. 550 shall be carried out in a way that represents actual ageing with an adequate degree of confidence. [2019-03-15]

552. An accident condition test of electrical and I&C equipment and cable shall cover exposure to radiation and stresses caused by temperature, pressure and humidity equivalent to accident conditions as well as rapid changes in the conditions. [2019-03-15]

553. The composition of the water used in the accident condition test of electrical and I&C equipment and cable shall, as far as possible, be equivalent to water in real accident conditions. [2019-03-15]

554. If there is a possibility of the electrical and I&C equipment or cable submerging in water in an accident and if it is required to function under such conditions, its capability to function in such a situation shall also be demonstrated. [2013-11-15]

555. The accident condition tests of an electrical and I&C equipment and cable shall be designed to verify, with a sufficient degree of confidence, the operability of the component or cable under accident conditions during their entire planned service life. [2019-03-15]

556. If the electrical and I&C equipment or cable must function under severe reactor accidents, it shall be validated by a manner applicable to severe reactor accidents (high temperatures, radiation doses, and hydrogen fires shall be taken into account, for example). [2019-03-15]

557. The seismic tests or analyses related to the vibration tolerance validation of an electrical or I&C equipment or cable shall be performed in accordance with Guide YVL E.6. [2013-11-15]

5.7 Electromagnetic compatibility

558. The EMC conformity of electrical and I&C equipment and installations shall be demonstrated by means of EMC tests or analyses pursuant to standards. [2013-11-15]

559. The procedures and technical solutions chosen to protect the nuclear facility's electrical and I&C equipment and installations from electromagnetic disturbances shall be justified. [2019-03-15]

559. Protection against electromagnetic disturbance has been discussed in more detail in Guide YVL A.11 and its Appendix A. [2019-03-15]

5.8 Qualification by means of analyses

560. The qualification of safety classified electrical and I&C systems and equipment shall include the validation of functional and performance requirements by means of analyses, if the fulfilling of the requirements cannot be demonstrated by means of other qualification activities. [2019-03-15]

5.9 Operating experience feedback

561. An operating experience analysis shall be prepared for the electrical and I&C equipment and cables in safety class 2 and for I&C system platforms in safety classes 2 and 3. [2019-03-15]

562. The operating experience feedback used in the operating experience analysis shall be collected according a documented process. [2019-03-15]

563. The operating experience analysis shall also take into account any software used. [2019-03-15]

564. The operating experience analysis shall also take into account the change and version history of the software. [2019-03-15]

565. The comprehensiveness of the operating experience collection process, the length of the collection period and their significance in terms of the reliability of the data shall be evaluated in the operating experience analysis. [2013-11-15]

566. The operating experience feedback used in the analysis shall be representative of the safety function reviewed. [2013-11-15]

567. The use of operating experience feedback from hardware or software versions, set-ups and operational profiles other than those that are planned to be taken into use for the validation of a system or component shall be justified. [2013-11-15]

568. A safety classified component or cable cannot be qualified on the basis of operating experience feedback only. [2019-03-15]

5.10 Type approval

569. Type approval shall be acquired for the following equipment:

- I&C system platforms in safety class 2
- I&C priority units in safety class 2
- I&C equipment in safety class 2 to be qualified to accident conditions
- electrical equipment in safety class 2 to be qualified to accident conditions
- cables in safety class 2 to be qualified to accident conditions
- those equipment of Guide YVL B.1 requirement 5214 instrumentation that are qualified to accident conditions
- those equipment of Guide YVL C.6 requirements 402 and 402a radiation monitoring instrumentation that are qualified to accident conditions.

[2019-03-15]

570. A third party shall assess the acceptability of the design and implementation when type approving I&C system platforms or priority units in safety class 2. A third-party assessment of the production process quality management shall also be required. The third party shall prepare the type approval certificate based on the assessments. The contents of the aforementioned assessments shall be implemented in line with the tasks of the notified body laid down in Decision 768/2008/EY [5] of the European Parliament and of the Council using module B as a combination of product type and design type, and module D. An EC type inspection certificate is not required. [2019-03-15]

570a. A third party shall assess the component's tolerance of environmental conditions when type approving components or cables intended for accident conditions. The third party shall prepare the type approval certificate based on its assessments. The contents of the aforementioned assessments shall be implemented in line with the tasks of the notified body laid down in Decision 768/2008/EY of the European Parliament and of the Council using module B as a combination of product type and design type. An EC type inspection certificate is not required. [2019-03-15]

571. The third party performing type approvals of I&C system platforms or priority units in safety class 2 shall be a certification body that has been accredited for the conformity evaluation of the applied standards under standard SFS-EN ISO/IEC 17065 [6]. The party performing the tests shall have applicable qualifications under standard ISO/IEC 17025 [8]. [2019-03-15]

571a. The third party authorised to perform type approvals of components or cables intended for accident conditions shall be a certification body that has been accredited for the conformity evaluation of the applied standards under standard SFS-EN ISO/IEC 17065, or an inspection organisation accredited for a similar task under standard SFS-EN ISO/IEC 17020 [7]. The party performing the tests shall have applicable qualifications under standard SFS-EN ISO/IEC 17025. [2019-03-15]

572. The accreditation decision pertaining to the organisation performing type approvals shall be appended to the preliminary suitability analysis. If the same organisation is to submit multiple type approvals, the accreditation decision may be delivered only once, but a reference to the documentation submitted earlier shall be made in the preliminary suitability analysis. [2019-03-15]

573. Removed. [2019-03-15]

574. The type approval certificate or appendices thereto shall indicate any limitations on operation required to assess the acceptability of the component for its intended use. [2019-03-15]

575. A document prepared by a third party concerning the approval of the quality system pursuant to module D of the Decision [5] shall be appended to the type approval documentation. [2013-11-15]

576. Removed. [2019-03-15]

577. The type approval of a component containing software-based technology shall cover the assessment of both software and hardware. [2013-11-15]

5.11 Mechanical qualification of electrical and I&C equipment

578. The design, manufacturing, installation, commissioning, official documentation and regulatory oversight of safety-classified pressure equipment or pressure boundary installed stationary on electrical or I&C equipment shall be implemented according to Guide YVL E.3.

[2019-03-15]

579. The acceptability of the dimensioning strength of power transferring or load-bearing parts and structures of non-serial electromechanical components in safety class 2, as well as the coverage of the inspections and testing during manufacturing, shall be demonstrated.

[2019-03-15]

580. An operability analysis pursuant to Guide YVL E.8/E.9 shall be prepared of the mechanical interface of a rotating electric machine or an electromechanical valve actuator. **[2019-03-15]**

6 Qualification of safety-classified software

6.1 General software requirements

601. Requirements presented in publication [4] “Licensing of safety critical software for nuclear reactors, Common position of international nuclear regulators and authorised technical support organisations, Revision 2018” shall be taken into account, when applicable, in the design of I&C systems in safety class 2. [2019-03-15]

602. The design and implementation of software in safety class 2 shall adhere to applicable nuclear industry standards. [2019-03-15]

602a. The design and implementation of software in safety class 3 shall adhere to applicable nuclear industry standards firstly or, secondarily, standards intended for the design of safety-critical software. [2019-03-15]

602b. The design and implementation of programmable IC circuits (FPGA/PLD/CPLD) in safety class 2 shall adhere to applicable nuclear industry standards. [2019-03-15]

602c. The design and implementation of programmable IC circuits (FPGA/PLD/CPLD) in safety class 3 shall adhere to applicable nuclear industry standards or standards intended for the design and implementation of safety-critical IC circuit programming. [2019-03-15]

603. The design of software in safety class 2 systems and equipment shall aim at clarity and simplicity. [2013-11-15]

604. The structure of software in safety class 2 shall minimise the propagation of the effects of a single software error. [2013-11-15]

605. The structure of software in safety class 2 shall enable the verification of the requirements set for the system. [2013-11-15]

606. The program execution cycle of software in safety class 2 shall be defined. [2019-03-15]

607. Those software parts that are unnecessary for functional performance shall be identified and their safety significance shall be analysed and taken into account in the design of the system in safety class 2. [2013-11-15]

608. The failure mechanisms of software in safety classes 2 and 3 shall be identified and analysed to a sufficient extent. [2013-11-15]

609. The comprehensiveness of the self-diagnostics shall be considered when determining the periodic test interval for a software-based system or component in safety classes 2 and 3.

[2019-03-15]

610. The coverage of the self-diagnostics and periodic tests of the software-based I&C systems and components in safety class 2 shall be analysed. [2013-11-15]

611. The effects of failures in the self-diagnostics function of a software-based system or component in safety class 2 on the operation of the protection I&C systems shall be analysed.

[2013-11-15]

612. The requirements set for software in safety class 2 or 3 shall be derivable in a traceable manner from component or system level requirements. [2013-11-15]

613. Paras 601–612 shall also apply to data transfer and data buses between different software. [2013-11-15]

6.2 Qualification of the system platform software and the application software

614. The qualification plan of a software based system in safety class 2 or 3 (see section 5.2) shall cover the qualification of the system platform software and the application software.

[2019-03-15]

615. The type approval of a system platform or component (see section 5.10) shall also cover the system platform software. [2013-11-15]

616. For system platforms or components in safety class 3 for which a type approval pursuant to section 5.10 is not required, an assessment of the system platform software shall be performed under an applicable standard. [2019-03-15]

617. The evaluation report defined in para. 616 shall present the observations made in the inspection, the need for any corrective actions, and a justified decision on the acceptability of the software for the intended purpose of use. [2013-11-15]

618. An analysis of the conformity to standards of the design process of the system platform software and application software shall form a part of the qualification of a software-based system or component in safety class 2 or 3. [2019-03-15]

619. An analysis of the qualifications of the personnel participating in design and testing shall form a part of the qualification of a software-based system or component in safety class 2 or 3. [2019-03-15]

620. Removed. [2019-03-15]

6.3 Software design procedures and processes

621. A life cycle model under an applicable standard shall be defined for the manufacture of software in safety class 2 or 3. [2013-11-15]

622. The methods used in the design, testing and quality assurance of software in safety classes 2 and 3 shall be defined. [2013-11-15]

623. Any conditions and limitations presented in the type approval of the system platform (para. 615) or the assessment of the system platform (para. 616) shall be taken into account in the design and implementation of application software in safety class 2 or 3. [2019-03-15]

624. The design, manufacture and testing processes of a nuclear facility's software in safety class 2 shall be independently assessed after each phase in a manner that allows for ensuring the correct transfer of the set requirements to the final product that will be taken into use. [2013-11-15]

6.4 Software tools

625. Removed. [2019-03-15]

626. The software tools of systems and equipment in safety class 2 shall be covered by comprehensive configuration management. [2013-11-15]

627. The design and implementation of software of safety class 3 systems and equipment shall utilise software tools whose configuration management, maintenance and fault data collection are appropriately documented. [2013-11-15]

628. The configuration management, maintenance and modification design of tools used for configuration and object code generation in safety classes 2 and 3 shall be implemented using procedures which consider the safety significance of the system or component. [2013-11-15]

629. Removed. [2019-03-15]

630. The procedures to be followed to ensure the safe functioning of systems installed at the facility in case of any software tool error shall be documented. [2019-03-15]

631. Removed. [2019-03-15]

632. Removed. [2019-03-15]

633. Removed. [2019-03-15]

634. Moved to Guide YVL A.12. [2019-03-15]

635. Moved to Guide YVL A.12. [2019-03-15]

636. Moved to Guide YVL A.12. [2019-03-15]

637. Removed. [2019-03-15]

638. Removed. [2019-03-15]

6.5 Existing software

639. Existing software is subject to the same requirements as software to be developed.
[2013-11-15]

640. Any deficiencies in the documentation and implementation of the design process of existing software may be substituted for by means of analyses and testing, while taking into account the requirements set by the safety class and safety significance. [2019-03-15]

641. Software structure and functions shall be analysed, and the functions to be excluded from use documented, for the suitability analysis of existing software. [2013-11-15]

642. The documentation of the existing software and system shall enable the configuration management and modification planning of the system or software. [2013-11-15]

6.6 Software testing

643. A testing plan shall exist for all software. [2013-11-15]

644. The software testing plan shall be aligned with the testing plans of the component and system. [2013-11-15]

645. The test plan and procedures used for a system or component belonging to safety class 2 or 3 shall be sufficient, taking into account the safety significance of the system or component.
[2019-03-15]

646. The software shall also be tested in the equipment to be installed at the facility.
[2013-11-15]

647. The final testing of a system or component belonging to safety class 2 or 3 shall cover all functions with their timings, including, as far as practically possible, the self-diagnostic functions. [2013-11-15]

648. Removed. [2019-03-15]

649. The software test cases shall also include transient situations used in transient and accident analyses. [2013-11-15]

650. The coverage of the tests of safety class 2 software shall be analysed against the requirements at the different phases of testing. [2019-03-15]

651. Removed. [2019-03-15]

7 Receiving, installation and commissioning

7.1 General requirements for receiving, installation and commissioning

701. Procedures used during the receiving, installation and commissioning of electrical and I&C systems and equipment presented in the licensee's quality management system shall describe the duties of the organisations responsible for a specific function, the division of work, the areas of responsibility, and the procedures used for documentation, and the scope of inspections to be performed. [2013-11-15]

7.2 Receiving inspection

702. A licensee's receiving inspection shall be performed on the safety-classified electrical and I&C equipment, cables and, if any, their software. [2013-11-15]

703. During the receiving inspections defined in para. 702, the licensee shall ensure that the component, its assembly, software and configuration correspond to the design. [2013-11-15]

704. During the receiving inspections pursuant to para. 702, the licensee shall ensure that the quality assurance and quality control result documentation defined in the order has been provided with the delivery of the serially manufactured component or software and that the documentation results meet the acceptance criteria. [2019-03-15]

705. During the receiving inspections pursuant to para. 702, the licensee shall ascertain that the component has not suffered any damage during transport. [2019-03-15]

706. Inspections and tests relating to the receiving inspection pursuant to para. 702 shall be performed acceptably. [2019-03-15]

707. The receiving inspection pursuant to para. 702 shall be documented. [2019-03-15]

7.3 Installation

708. An installation schedule shall be defined for installations. [2019-03-15]

709. The scope, actions, responsibilities and records of the installation and coupling inspections and functional tests to be done after the installation shall be defined. [2013-11-15]

710. The licensee shall perform an installation inspection on the safety-classified electrical or I&C equipment and cables installed. [2013-11-15]

711. During the installation inspection, the licensee shall ensure that the installation is appropriate and that it has been performed according to approved plans and the guidelines and

principles concerning a nuclear facility. [2013-11-15]

7.4 Commissioning

712. The licensee shall successfully perform a commissioning inspection on the installed or modified safety-classified electrical or I&C systems, equipment or cables before they are commissioned. [2013-11-15]

713. If necessary, the commissioning inspection may be divided into two parts. The first part may review the documentation created before commissioning testing, and determine that the system, component or cable installed is ready for commissioning testing operation. The second part reviews the result documentation from commissioning testing. This way the inspection load in larger projects may be divided across several phases, which improves the manageability of the installation and commissioning testing phase. [2013-11-15]

714. During the commissioning inspections, the licensee shall verify that the component or system installed complies with the approved plans, and that this has been ascertained by means of sufficient inspections and tests. [2013-11-15]

715. The licensee's commissioning inspection shall verify that any defects and faults discovered during previous phases have been processed acceptably. [2019-03-15]

716. The licensee's commissioning inspection shall ensure that any changes made in the commissioning phase have been implemented according to the procedures specified for the system's configuration management. [2013-11-15]

717. The licensee's commissioning inspection shall ensure that the parameters of a software-based component or system have been set and recorded according to the configuration management system. [2013-11-15]

718. The licensee's commissioning inspection shall inspect the realisation of the licensee's quality management. [2013-11-15]

719. The licensee's commissioning inspection shall verify that the electrical or I&C system, components, cables and installations fulfil the environmental and operating condition requirements set by their location of use. [2013-11-15]

720. The licensee's commissioning inspection shall inspect that the installation inspections and functional tests have been performed acceptably. The commissioning testing result documentation and the protocols related to commissioning shall be reviewed, and they shall not contain shortcomings that prevent commissioning. [2013-11-15]

721. The licensee's commissioning inspection shall inspect the readiness of the instructions regarding the system. [2013-11-15]

722. The licensee's commissioning inspection shall ensure that any remarks made by STUK during earlier regulatory measures have been appropriately taken care of. [2013-11-15]

723. The licensee's commissioning inspection shall verify that no obstacles exist that would prevent commissioning. [2013-11-15]

724. If any minor non-conformances from a STUK-approved suitability analysis or pre-inspection documents are discovered during the licensee's commissioning inspection, they shall be brought to the attention of STUK's inspector. [2013-11-15]

725. A deviation report shall be prepared of any significant deviations observed during the licensee's commissioning inspection, and it shall be submitted to STUK for approval. [2013-11-15]

726. The commissioning inspections of safety-classified electrical and I&C systems and equipment may only be performed by a STUK-approved organisational unit and inspector that is independent of design and installation and belongs to licensee's organisation. [2013-11-15]

727. The following shall be appended to the licensee's application for the performers of commissioning inspections:

- an organisation description showing the organisational position of the unit and individuals performing the inspections and the independence of the inspections activities.
- a description of those performing the inspections, detailing their education, work experience and competence as well as for what inspections the approval is sought
- a description of the procedures used in and the essential instructions pertaining to the inspections
- further clarifications, if necessary.

[2019-03-15]

728. The inspectors shall have sufficient professional competence and experience as well as appropriately qualified equipment, tools and methods needed to perform the inspections.

[2013-11-15]

729. A STUK-granted authorisation to perform commissioning inspections is valid for a maximum of five years at a time. When needed, an application for a renewal of the authorisation shall be submitted to STUK no later than 3 months prior to the expiration of the previous authorisation. [2013-11-15]

8 Removed. (Ageing management, see Guide YVL A.8)

801. Removed. [2019-03-15]

802. Moved to Guide YVL A.8. [2019-03-15]

803. Removed. [2019-03-15]

804. Removed. [2019-03-15]

805. Removed. [2019-03-15]

9 Documents to be submitted to STUK

901. Removed. [2019-03-15]

902. Removed. [2019-03-15]

903. Removed. [2019-03-15]

904. Removed. [2019-03-15]

9.1 Suitability analyses

905. Preliminary suitability analyses pursuant to section 3.4.1 concerning electrical and I&C equipment and cables in safety class 2 shall be submitted to STUK. Parts according to paras 340 and 341 shall be submitted for approval and other parts for information. [2019-03-15]

905a. Preliminary suitability analyses pursuant to section 3.4.1 concerning electrical and I&C equipment and cables in safety class 3 shall be submitted to STUK for information.
[2019-03-15]

905b. Final suitability analyses pursuant to section 3.4.2 concerning electrical and I&C equipment and cables in safety class 2 shall be submitted to STUK. Parts according to paras 348, 350 and 357 shall be submitted for approval and other parts for information. [2019-03-15]

905c. Final suitability analyses pursuant to section 3.4.2 concerning electrical and I&C equipment and cables in safety class 3 shall be submitted to STUK for information.
[2019-03-15]

906. The preliminary and final suitability analyses may be combined into a single document provided that the component qualification procedure does not include type approval, software assessments, tests or factory tests and the suitability analysis can be prepared directly in connection with the component selection process. [2019-03-15]

907. Removed. [2019-03-15]

908. Removed. [2019-03-15]

909. The preliminary suitability analyses and combined preliminary and final suitability analyses shall be submitted to STUK well in advance before the component factory testing. The aforementioned suitability analyses shall be submitted to STUK before equipment installation if the components do not undergo any factory tests. [2019-03-15]

910. The preliminary suitability analyses submitted to STUK for approval shall have been approved by STUK before the factory tests are started. [2013-11-15]

911. Removed. [2019-03-15]

912. The final suitability analysis shall be submitted to STUK well in advance before the performance of the licensee's commissioning inspections or, in the case of spare part changes, before the installation of the component at the facility. [2019-03-15]

913. The licensee's commissioning inspection cannot be closed before STUK has made a decision concerning the final suitability analysis submitted for approval. [2013-11-15]

914. In case of a spare part change, the installation of the component at the facility may not be started before STUK has made a decision concerning the suitability analysis submitted for approval. [2019-03-15]

9.2 Control of manufacturing and factory tests

915. A factory test plan shall be submitted to STUK for information of those factory tests which STUK confirms it will follow. [2013-11-15]

916. For the purpose of potential inspections on the manufacturers' and suppliers' premises, the testing schedules of the safety-classified electrical and I&C systems, components and cables (performance and functional tests) shall be submitted to STUK for information in good time. [2013-11-15]

917. During factory inspection visits, STUK shall be provided with the opportunity to check, for example, the manufacturers' design and manufacturing processes, management systems, the documents on quality assurance and quality control produced during manufacturing and those referred to in the qualification plan. [2019-03-15]

917a. Before the installation of the system, the licensee shall submit to STUK for information a post-factory test licensee's assessment on the component's conformity to requirements (para. 519; in the case of equipment and cables, the assessment shall be submitted to STUK according to para. 349). [2019-03-15]

9.3 Installation phase

918. For the purposes of installation supervision, if STUK so requests, the installation schedule of safety class 2 and 3 electrical and I&C systems, components and cables subject to pre-inspection shall be sent to STUK for information prior to the commencement of the installation.

[2013-11-15]

919. During installation supervision, the licensee shall show STUK the plans and instructions used in the licensee's installation inspection as well as the inspections' result documentation.

[2013-11-15]

9.4 Commissioning phase

920. Removed. [2019-03-15]

921. Removed. [2019-03-15]

922. Removed. [2019-03-15]

923. The general requirements concerning commissioning testing are given in Guide YVL A.5.

[2019-03-15]

924. A report on the commissioning inspections performed by the licensee (see section 7.4) and their results shall be submitted to STUK for information annually. [2019-03-15]

925. The performance of a system commissioning inspection performed by STUK (see section 10.4) shall be requested in writing well before the inspection date. [2013-11-15]

926. The system commissioning inspection performed by STUK (see section 10.4) shall be conducted prior to plant unit start-up or prior to system commissioning in case commissioning takes place during operation. [2013-11-15]

927. During the commissioning inspections performed by STUK (see section 10.4), the licensee shall present to STUK the results from the licensee's commissioning inspection and their related result documentation. [2013-11-15]

9.5 Operation phase

928. Requirements concerning the periodic testing programmes of electrical and I&C systems, components and cables are presented in Guide YVL A.6. [2019-03-15]

929. The licensee shall record the test results for the electrical and I&C systems, equipment, and cables during the operation phase. [2013-11-15]

9.6 Modifications during operation

930. Electrical and I&C system modifications in safety classes 2 and 3 may be started only after STUK has approved the system's pre-inspection documentation and when any requirements pertaining to the starting and supervision of work stated in the approval have been fulfilled. [2019-03-15]

931. The installation of electrical or I&C equipment subject to the requirement of para. 334 shall not be started before the preliminary and final suitability analyses have been submitted to STUK and any documentation submitted for approval has been approved by STUK. [2019-03-15]

932. The commissioning testing programmes of modified system parts and components shall be prepared such that the impact of the modifications is tested to a sufficient extent by means of commissioning testing programmes corresponding to the original commissioning testing programmes. [2013-11-15]

933. Prior to a system's commissioning, the licensee shall obtain approval for any changes that need to be made to the Operational Limits and Conditions. [2013-11-15]

934. The emergency, transient and operating procedures of a nuclear facility shall be updated to correspond to the modified electrical or I&C system or equipment prior to the system commissioning. [2013-11-15]

935. The maintenance instructions of the electrical or I&C system and its components shall be updated without delay in connection with the modification. [2013-11-15]

936. Removed. [2019-03-15]

937. Removed. [2019-03-15]

10 Regulatory oversight by the Radiation and Nuclear Safety Authority

10.1 Oversight of quality management

1001. STUK assesses the quality management systems of the licensee and its subcontractors and how the licensee assesses the operation of its own and the subcontractors' quality management systems. [2013-11-15]

10.2 Oversight of manufacturing and factory tests

1002. STUK supervises, at its discretion, manufacture of the electrical and I&C systems, equipment and cables in safety classes 2 and 3 by means of inspection visits. [2013-11-15]

10.3 Oversight of installation

1003. At its discretion, STUK supervises the installation of safety class 2 and 3 electrical and I&C systems and equipment. [2019-03-15]

1004. During inspection visits, STUK oversees that the overall implementation corresponds to the approved pre-inspection documentation and that it meets the required quality level. [2013-11-15]

10.4 Oversight of commissioning

1005. During the inspections part of the inspection programme during operation and construction, STUK supervises the licensee's commissioning activities of electrical and I&C equipment and cables. [2019-03-15]

1006. STUK oversees commissioning testing and system tests at its discretion at the facility. [2013-11-15]

1007. At its discretion, STUK may perform its own commissioning inspection of electrical and I&C systems and equipment. [2013-11-15]

1008. During the pre-inspection of electrical and I&C systems, STUK specifies the systems whose commissioning inspections it will conduct. [2013-11-15]

10.5 Oversight during operation

1009. During the operation of a nuclear facility, STUK supervises the electrical and I&C systems, equipment and cables by evaluating the licensee's operations and the effectiveness of its procedures. The inspection focuses on the procedures whereby the licensee ensures the reliable and correct operation of systems and equipment. This supervision may be carried out, for example, by reviewing the licensee's guidelines, functional processes, reports, or the maintenance, repair and modification works of systems and individual components.

[2019-03-15]

1010. The licensee's operations are monitored in regularly repeated inspections of the operation inspection programme, during annual outages, and in connection with large modifications. [2013-11-15]

1011. The acceptability of the requirements pertaining to the operability of safety-classified electrical and I&C systems, equipment and cables, as well as the scope of periodic tests are assessed by STUK during the review of the Operational Limits and Conditions of the nuclear facility. [2013-11-15]

10.6 Modifications during operation

1012. STUK applies the same principles to the supervision of modifications made during operation to the electrical and I&C systems and equipment of nuclear facilities as to the control of the design, procurement, installation and commissioning of new systems and equipment.

[2013-11-15]

1013. Removed. [2019-03-15]

11 References

1. Nuclear Energy Act (990/1987). [2013-11-15]
2. Radiation and Nuclear Safety Authority Regulation on the Safety of Nuclear Power Plant (STUK Y/1/2018). [2019-03-15]
3. Quality management systems. Fundamentals and vocabulary. SFS-EN ISO 9000:2015. [2019-03-15]
4. Licensing of safety critical software for nuclear reactors, Common position of international nuclear regulators and authorised technical support organisations, Revision 2018. [2019-03-15]
5. Decision 768/2008/EC of the European Parliament and of the Council on a common framework for the marketing of products, and repealing Decision 93/465/EEC, 9 July 2008. [2013-11-15]
6. Conformity assessment. Requirements for bodies certifying products, processes and services. SFS-EN ISO/IEC 17065:2012. [2019-03-15]
7. Conformity assessment. Requirements for the operation of various types of bodies performing inspection. SFS-EN ISO/IEC 17020:2012. [2019-03-15]
8. Competence of testing and calibration laboratories. General requirements. SFS-EN ISO/IEC 17025:2017. [2019-03-15]

Definitions

Trickle charge voltage for a set of accumulators

The trickle charge voltage for a set of accumulators shall refer to a voltage generated by a battery charger in order to maintain a charge level on a set of accumulators that exceeds the nominal voltage of the set of accumulators.

Preliminary suitability analysis

Preliminary suitability analysis shall be used by the licensee to verify that a component is suitable for its intended location of use on the basis of its rated values. The qualification of the component is also inspected and designed. After the preliminary suitability analysis the requirement specification of the component is verified, and the procurement of the component may be started, if necessary.

Instrumentation and control (I&C) system

Instrumentation and control (I&C) system shall refer to a system that controls, adjusts or observes the operation of a nuclear facility or components thereof. Control may consist of automatic operation or relaying commands given by humans. The results of the observation may be processed by the I&C system or relayed to the operators of the facility.

Instrumentation and control (I&C) platform

Instrumentation and control (I&C) platform shall refer to a product that, by the use of pre-developed tools and software and electronic modules, enables the design, implementation and maintaining of an application-specific I&C system.

Instrumentation and control (I&C) equipment

Instrumentation and control (I&C) equipment shall refer to a piece of equipment such as a measuring device, display unit, electronic card or I&C relay that is part of an instrumentation and control system.

Software to be developed

Software to be developed during the present design work, such as software for a programmable logic application.

Qualification

Qualification is normally used as a synonym for “validation” in YVL-guides. Qualification shall refer to confirmation, through the provision of objective evidence, that the requirements for a

specific intended use or application have been fulfilled.

Validation

Validation shall refer to confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled.

Location requirements

Location requirements shall refer to the requirements set on a component by its location of use at a nuclear facility. The location of use at a facility and as part of the facility's other systems sets requirements on the device in terms of the tolerance of environmental conditions, functionality, performance, and tolerance of potential accident conditions.

Component life cycle

Component life cycle shall refer to the various stages of a component from design to production, operation, maintenance and decommissioning.

Final suitability analysis

Final suitability analysis shall refer to the licensee's assessment to demonstrate (validate) that a component meets its rated values. This can be achieved by means of type approval and testing, quality control procedures, and operating experience.

Rated value

Rated value shall refer to the information used by the component manufacturer as a starting point for the design of a component or an I&C system platform, such as the nominal current of a breaker or the duration of a processing sequence of programmable logic. The manufacturer usually indicates the rated values in the component's brochure or specification.

Software-based

Software-based shall refer to a function achieved by means of executing program code with a processor. The term should not be confused with the concept of programmable. For example, a software-based temperature transducer is in no way "programmable" after manufacture, but its operation is based on program code executed by a processor.

Existing software

Existing software shall refer to software that has been manufactured before the life cycle of the present project, such as the software for a serially manufactured pressure transducer or the system platform software of programmable logic.

System platform software

System platform software shall refer to component software that is not modified for different

locations of use, such as the real-time operating system, network communication routines, or function libraries. Generally, users cannot access the system platform software.

Serially manufactured component

Serially manufactured component shall refer to a component which has not been designed particularly based on the customer's specification but it is procured from an existing product line of the manufacturer. Typically one is manufactured in large quantities, and can be used for other applications, too. Functionality, structure, dimensions, materials, manufacturing process and quality of the component do not essentially differ within and between production lots.

Application software

Application software shall refer to component software created for each location of use in order to achieve the desired functionality at the location of use. User can usually view or modify application software.

Electrical equipment

Electrical equipment shall refer to equipment used in the production, transmission and transformation of electrical power and the protection of the grid. Electrical equipment includes accumulators, transformers, distribution centres, power distribution network protective relays, motors, frequency converters and electromechanical components. If a nuclear facility uses distributed instrumentation and control systems, with I&C functions distributed between various pieces of electrical equipment, such as protective relays and frequency converters, the requirements of I&C equipment shall also be taken into account in handling these electrical equipment.

Verification

Verification shall refer to confirmation, through the provision of objective evidence, that set requirements have been fulfilled.

System/structure/component important to safety

System/structure/component important to safety shall refer to systems, structures or components in safety classes 1, 2 and 3 and systems in class EYT/STUK.

Type approval

Type approval shall refer to a nationally or internationally recognised procedure whereby the accredited certification body granting the approval verifies that the product and its implementation meet the applicable technical requirements.