

Safety Standards

of the
Nuclear Safety Standards Commission (KTA)

KTA 3507 (2022-11)

**Factory Tests, Post-Repair Tests and the Certification of
Proven Performance of Modules and Devices of the Instru-
mentation and Control System Important to Safety**

(Werksprüfungen, Prüfungen nach Instandsetzung und Nachweis der
Betriebsbewährung der Baugruppen und Geräte der Sicherheitsleittechnik)

Previous versions of this safety standard
were issued in 1986-11, 2002-06 and 2014-11

If there is any doubt regarding the information contained in this translation, the German wording shall apply.

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Factory Tests, Post-Repair Tests and the Certification of Proven Performance of Modules and Devices of the Instrumentation and Control System Important to Safety

KTA 3507

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PLEASE NOTE: Only the original German version of this safety standard represents the joint resolution of the 35-member Nuclear Safety Standards Commission (Kerntechnischer Ausschuss, KTA). The German version was made public in the Federal Gazette (Bundesanzeiger) on July 25, 2023. Copies of the German versions of the KTA safety standards may be mail-ordered through the Wolters Kluwer Deutschland GmbH (info@wolterskluwer.de). Downloads of the English translations are available at the KTA website (<http://www.kta-gs.de>).

All questions regarding this English translation should please be directed to the KTA office:

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Comments by the Editor:

Taking into account the meaning and usage of auxiliary verbs in the German language, in this translation the following agreements are effective:

shall	indicates a mandatory requirement,
shall basically	is used in the case of mandatory requirements to which specific exceptions (and only those!) are permitted. It is a requirement of the KTA that these exceptions - other than those in the case of shall normally - are specified in the text of the safety standard,
shall normally	indicates a requirement to which exceptions are allowed. However, exceptions used shall be substantiated during the licensing procedure,
should	indicates a recommendation or an example of good practice,
may	indicates an acceptable or permissible method within the scope of the present safety standard.

Basic Principles

(1) The safety standards of the Nuclear Safety Standards Commission (KTA) have the task of specifying those safety-related requirements which shall be met with regard to precautions to be taken in accordance with the state of science and technology against damage arising from the construction and operation of the plant (Sec. 7, para. (2), subpara. (3) Atomic Energy Act - AtG) in order to attain the protective goals specified in the AtG, the Radiation Protection Act (StrlSchG) and the Radiation Protection Ordinance (StrlSchV) as well as further detailed in the Safety Requirements for Nuclear Power Plants (SiAnf) and the Interpretations of the SiAnf.

(2) In accordance with SiAnf and the SiAnf-Interpretations, this safety standard specifies the requirements regarding preparation, extent and execution of factory tests, of post-repair tests and of the certification of proven performance for the instrumentation and control equipment of the safety-related instrumentation and control (I&C) system.

(3) In the present safety standard, it is presumed that conventional requirements and technical standards (e.g., Accident Protection Requirements, DIN-Standards, VDE-Regulations) are adhered to under consideration of the safety-related requirements specific to nuclear power plants.

(4) Requirements for the radiological protection equipment are specified in safety standard series KTA 1500.

(5) Requirements for the seismic instrumentation are specified in safety standard KTA 2201.5.

(6) Requirements for the instrumentation and control (I&C) system important to safety, in particular, for the reactor protection system and monitoring equipment of the safety system are specified in safety standard KTA 3501.

(7) Requirements for the type testing of electrical modules of the instrumentation and control (I&C) system important to safety are specified in safety standard KTA 3503.

(8) Requirements for type testing the measuring sensors and transducers of the instrumentation and control (I&C) system important to safety are specified in safety standard KTA 3505.

(9) Requirements for the system test of the instrumentation and control equipment of the instrumentation and control (I&C) system important to safety are specified in safety standard KTA 3506.

(10) Requirements for testing the instrumentation and control equipment of the safety system are specified in Section 7 of the RSK Guidelines.

(11) General requirements regarding quality management are specified in DIN EN ISO 9000.

(12) A model regarding quality assurance in design, development, production, assembly and servicing is specified in DIN EN ISO 9001.

(13) General requirements for quality assurance are specified in safety standard KTA 1401.

(14) Requirements for the documentation during the construction and operation of nuclear power plants are specified in safety standard KTA 1404.

1 Scope

(1) This safety standard applies to factory tests, post-repair tests and the certification of proven performance of the modules and devices of the instrumentation and control (I&C) system important to safety in accordance with safety standard KTA 3501 (*In the present safety standard, modules and devices are often referred to as products*).

(2) This safety standard specifies the requirements regarding planning, executing and documenting factory tests, post-repair tests and regarding the certification of proven performance.

(3) Furthermore, Appendix A specifies requirements regarding the selection, processing and testing of materials for pressurized, medium-contacted or structural component parts.

Notes:

(1) Pressurized component parts are parts of measuring devices that are under internal or external overpressure. These include, e.g., pressure covers of measuring transmitters, bolted nozzle connections.

(2) Medium-contacted component parts are, e.g., parts of measuring devices that are in immediate contact with the measurement medium.

(3) Structural component parts are parts with which the measuring devices are connected to, e.g., the supporting structure.

(4) This safety standard does not specify any requirements for the tests and inspections during on-site assembly and commissioning.

2 Definitions

(1) Quality audit

The quality audit is the verification of the quality assurance system or of its parts.

(2) Factory test

Factory tests are quality tests and inspections performed and documented at specified hold points and at the completion of fabrication either by the module or equipment manufacturer or are performed during and after completion of a repair task by a repair division certified in accordance with safety standard KTA 1401.

Note:

Cf. Sec. 7.2 of safety standard KTA 1401.

(3) Authorized expert

An authorized expert is a qualified person or organization that, based on Sec. 20 AtG, is consulted by the nuclear licensing or supervisory authority.

3 Quality Audit

3.1 Superordinate Requirements

(1) The factory tests specified in this safety standard may be performed by the manufacturer or a repair division certified in accordance with safety standard KTA 1401 in own responsibility, provided, the structural and procedural organization for carrying out the quality assurance and the product- and procedure-related quality assurance measures are demonstrated to the licensee or her contractor in quality audits and, provided, these quality audits are accepted by the licensee or her contractor.

(2) The responsible persons specified in the quality assurance system (head of quality assurance, plant expert, chief inspector) shall supervise the factory tests with respect to their proper execution in accordance with the schedules for fabrication and testing, and they shall evaluate the operating experience gathered with the installed products. Their areas of responsibility and range of authority and their independence from fabrication shall be clearly documented in the quality assurance system. This shall be verified in the quality audit.

(3) Within the scope of testing the product-related quality assurance measures, the documents and activities specified under para. (2) and under Section 4 shall be checked.

(4) The quality audits shall be performed in regular intervals in accordance with a fixed schedule. The quality audits

shall normally be jointly carried out by at least two inspectors. The inspectors shall have qualified product-related knowledge and shall have been trained in the performance of quality audits.

(5) The quality audits shall normally be carried out in three-year intervals. In case of a repeated occurrence of deficiencies in delivered products, a quality audit in consultation with an authorized expert shall be performed.

(6) The focal points of the quality audit shall be specified in the form of checklists based on written specifications regarding the structural and procedural organization of the quality assurance of the division to be audited and based on the product-related requirements to be inspected. Also based on checklists, random inspections shall be performed of the divisions responsible for quality assurance. In this context, it shall be checked whether

- a) the described quality assurance measures are being applied,
- b) the corresponding and valid regulations, standards, guide lines and instructions are available and known at the level of work performance,
- c) the instructions are sufficient and appropriate.

(7) The licensee or her contractor may accept the quality audits of other licensees or their contractors, provided, the quality audits were carried out based on this safety standard.

3.2 Assessment of the Results

The results of the quality audits shall be documented in a report. Any detected inadmissible deviations from specified quality assurance measures shall be described. Based on the results, the quality assurance system and the product quality shall be assessed. The acceptance of the quality assurance system and of the product quality shall be documented by the issuance of a certificate.

3.3 Corrective Measures

If the quality audit reveals inadmissible deviations, the following shall be established in consultation with the manufacturer:

- a) the planned measures,
- b) the schedule for their realization,
- c) the dates for their completion and
- d) the responsible divisions.

The effectiveness of these corrective measures shall be verified.

3.4 Alternative Measures

In the exceptional case that a manufacturer cannot demonstrate a quality assurance system or its application during fabrication, the licensee or her contractor, neither of whom may be identical with the manufacturer, shall ensure and document the product quality by tests and inspections performed during fabrication or on the finished product.

4 Factory Tests during Fabrication

4.1 General Requirements

The factory test shall basically be performed in accordance with the requirements specified under Sections 4.2 through 4.7. Exceptions are admissible, provided, they are approved of by the persons specifically appointed for this task in the quality as

assurance system and these exceptions are recorded in non-conformance reports.

4.2 Quality Characteristics

The quality characteristics to be checked shall be specified by the manufacturer under his own responsibility, specifically, by evaluating

- a) the technical specifications,
- b) the fabrication schedules,
- c) the plant-internal tests and inspections, e.g., examinations regarding choice of materials,
- d) the results of the type tests,
- e) the results of certifying the proven performance,
- f) the stress calculations for pressurized parts,
- g) the plant-internal repair reports,
- h) the failure reports by the fabrication division,
- i) the available operating experience,
- j) the fabrication procedure and
- k) the configuration and version management.

The quality characteristics to be checked shall be specified in lists.

Note:

Quality characteristics are, e.g., transmission behavior, electromagnetic compatibility, self-diagnosis, functionality, temperature influence, influence of auxiliary power, high-voltage resistance, material properties, pressure resistance, leak tightness, packaging, traceability of the fabrication.

4.3 Test Instructions

(1) For each of the specified quality characteristics the test instructions shall contain specifications regarding

- a) test facilities,
- b) test procedure,
- c) test parameters, e.g., temperature of the testing chamber, voltage, frequency, testing pressure,
- d) extent of test,
- e) required values with permissible deviations and
- f) version and revision identification.

(2) Regarding tests under critical load conditions, the manufacturer shall specify in the test instruction at which worst-case combination of the two test parameters, ambient temperature and auxiliary power, the function of the product is still assured.

4.4 Schedules for Fabrication and Testing

(1) Within the framework of the factory test, schedules shall be established for each product regarding

- a) receiving inspection,
- b) fabrication test and
- c) final inspection.

(2) In these schedules, every fabrication and testing procedure shall be specified including the necessary fabrication and test instructions as well as their sequence. These shall include the necessary material and fabrication tests of pressurized, medium-contacted or structural component parts. These schedules shall normally assure that the quality characteristics to be demonstrated are tested at that point in time when an unrestricted testing is possible.

(3) In case parts with the same specification are installed in assorted products, only one schedule is required.