

Safety Standards

of the

Nuclear Safety Standards Commission (KTA)

KTA 3705 (2022-11)

**Switchgear, Transformers and Distribution Networks for
the Electrical Power Supply of the Safety System in
Nuclear Power Plants**

(Schaltanlagen, Transformatoren und Verteilungsnetze zur
elektrischen Energieversorgung des Sicherheitssystems in
Kernkraftwerken)

Previous versions of this safety standard
were issued in 1988-09, 1999-06, 2006-11 and 2013-11

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

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Switchgear, Transformers and Distribution Networks for the Electrical Power Supply of the Safety System in Nuclear Power Plants

KTA 3705

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1999-06 (BAnz. No. 243b of December 23, 1999)
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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 this 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) Based on the Safety Requirements and their interpretations, the present safety standard specifies the requirements that apply to switchgear, transformers and distribution networks for the electrical power supply of the safety system in nuclear power plants.

(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) The present safety standard specifies superordinate requirements for the design and analysis as well as for the design and testing of component-specific requirements for switchgear, transformers and distribution networks for the electrical power supply of the safety system in nuclear power plants.

(5) Superordinate requirements for the electrical power supply in nuclear power plants are specified in safety standard KTA 3701.

(6) The requirements for emergency power generating facilities with diesel generator units in nuclear power plants are specified in safety standard KTA 3702.

(7) The requirements for emergency power generating facilities with batteries and rectifier units in nuclear power plants are specified in safety standard KTA 3703.

(8) The requirements for emergency power facilities with static and rotating AC/DC converters in nuclear power plants are specified in safety standard KTA 3704.

(9) Within the framework of the KTA safety standards, the emergency power facilities are considered as ending at the connection terminals of the individual power loads. Requirements for the power loads are, therefore, specified in the component-specific safety standards

KTA 3501 Reactor Protection System and Monitoring Equipment of the Safety System

and

KTA 3504 Electrical Drives of the Safety System in Nuclear Power Plants.

(10) The requirements for fire protection of mechanical and electrical components in nuclear power plants are specified in safety standard KTA 2101.3.

(11) The requirements for the design of nuclear power plants against lightning are specified in safety standard KTA 2206.

(12) The requirements for the procedure for verifying the safety of mechanical and electrical plant components against earthquakes are specified in safety standard KTA 2201.4.

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

1 Scope

This safety standard applies to the switchgear, transformers and distribution networks for the power supply of the safety system in nuclear power plants. The scope of the superordinate

requirements specified in Section 3 ends with the circuit breakers of the offsite-power connections. The scope of the component-specific requirements for the design and testing of switchgear, transformers and distribution networks specified in Sections 4 and 5 ends at the high-voltage terminals of the offsite-power connection transformers.

Note:

Figure 1-1 shows the boundary line of the scope of safety standard KTA 3705.

2 Definitions

(1) Switchgear

A switchgear is an assembly of high-voltage or low-voltage components for switching, measuring, distributing and controlling as well as for the electrical protection within the framework of supplying power to power loads.

(2) Selectivity of electric protective features

Selectivity of electric protective features means the interaction of protective features such that, in the case of a short-circuit or an overcurrent, only that protective feature that is series-connected upstream and closest to the fault location will lead to an interruption of the fault current.

(3) Distribution network

A distribution network comprises the cables, lines, busbars as well as the terminal and connecting elements between the connecting terminals of the switchgear, the power generating facilities, the transformers and the power loads.

3 Superordinate Requirements for Design and Analysis

3.1 General Requirements

(1) The design of the switchgear, the distribution networks, the feeding generator units, the transformers and the power loads (e.g., motors for machines, actuators, solenoid valves, cabinets for control and instrumentation equipment) shall be coordinated such that the design loads which are presumed to act on the components will not be exceeded. In particular, the following requirements shall be met:

- The static and dynamic limit values specified with respect to the permissible supply voltages and frequencies of the power loads shall not be exceeded.
- The loads specified as permissible for the components shall not be exceeded in case of short-circuits currents and overcurrents.
- Protective features shall not be triggered as a result of voltage, frequency and current transients that may occur during operating procedures. Furthermore, the operating procedures shall not trigger any automatic switchover nor the emergency power operation of diesel generator units.

Tables 3-1 through **3-4** show examples for coordinating the voltage design and the adjustments of corresponding limit values and time delays between the switchgear, transformers, distribution networks and power loads of the emergency power system.

(2) The effects which failure-initiating events within switchgear, transformers and distribution networks for the power supply of the safety system may have on the nuclear power plant shall be investigated with regard to their permissibility.

(3) The selectivity in the auxiliary power system and the emergency power system shall normally be maintained. In the case of a diode-decoupled dual power supply of a direct-current power load from different trains, the selectivity within each of the supplying trains shall be maintained for any faults occurring within these power loads.

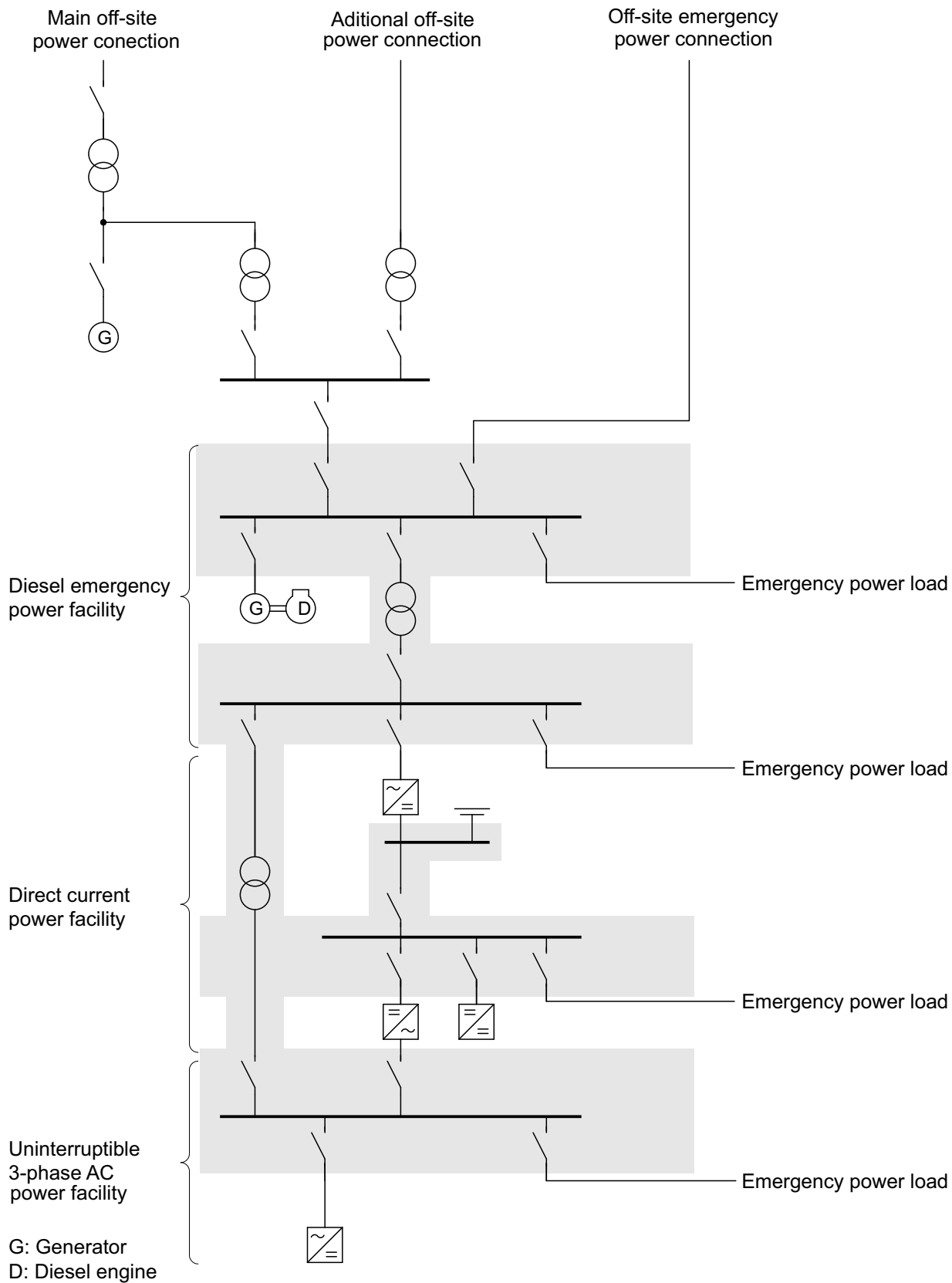


Figure 1-1: Boundary line of the scope of safety standard KTA 3705