

Safety Standards

of the
Nuclear Safety Standards Commission (KTA)

KTA 3704 (2022-11)

**Emergency Power Facilities with Static and Rotary
Converters in Nuclear Power Plants**

(Notstromanlagen mit statischen und rotierenden Umformern in Kernkraftwerken)

Previous versions of this safety standard
were issued in 1984-06, 1999-06 and 2013-11.

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

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KTA SAFETY STANDARD

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Emergency Power Facilities with Static and Rotary AC/DC Converters in Nuclear Power Plants

KTA 3704

Previous versions of this safety standard:

1984-06 (BAnz No. 191a of October 9, 1984, Addendum 51/84)

1999-06 (BAnz No. 243b of December 23, 1999)

2013-11 (BAnz AT 17.01.2014 B3)

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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) Based on the Safety Requirements and their interpretations, the safety standards KTA 3701 through KTA 3705 specify requirements for the power supply of the safety 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) General requirements for the electrical power supply in nuclear power plants are specified in safety standard KTA 3701. These also pertain to electronic modules and converters.

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

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

(7) Requirements for switchgears, transformers and distribution networks for the electrical power supply of the safety system in nuclear power plants are specified in safety standard KTA 3705.

(8) In KTA safety standards the emergency power facilities are considered as ending at the connection terminals of the power loads. Requirements for the power loads are, therefore, specified in the equipment related safety standards KTA 3501 and KTA 3504.

(9) Basic requirements regarding quality assurance are specified in safety standard KTA 1401.

(10) Requirements regarding the design of nuclear power plants against seismic events are specified in KTA 2201.4.

1 Scope

This safety standard applies to emergency power facilities with static or rotary converters having alternating-current output ports, and it applies to switching power supply units and multi-unit switching power supplies having direct-current outputs used for providing the uninterruptible emergency power supply in stationary nuclear power plants. The scope of the present safety standard is exemplarily shown in **Figure 1-1**.

2 Definitions

(1) Switching power supply unit

A switching power supply unit is a type of converter that contains one or more transformers and one or more electronic

circuits and that uses switching semiconductor components to convert electrical energy into various voltages. The internal operating frequency and wave shape are different from the supplied frequency and wave shape; the internal operating frequency is higher than 500 Hz but no higher than 100 MHz. Switching power supply units have direct-current/direct-voltage output ports.

(2) Multi-unit switching power supply

A multi-unit switching power supply is comprised of multiple switching power supply units connected in parallel, and of the corresponding protective and monitoring equipment.

Note:

Multi-unit switching power supplies may be collectively placed in power supply cabinets.

(3) Converters

Converters are devices that convert electrical energy into different voltages and different frequencies.

Note:

A converter may be a rotary converter, a static inverter, a switching power supply unit (DC/DC converter, AC/DC converter).

(4) Converter facility

Converter facilities are rotary converters or static inverters together with the corresponding switch-over devices in a single or multi-train design.

3 General Requirements

(1) The design of converters, switchgear, distribution systems and power loads shall be coordinated with each other such that the static and dynamic limits of the admissible supply voltages for the power loads are not exceeded.

(2) The effects that failure inducing events within the converter facilities or within single converters may have on the nuclear power plant shall be analyzed.

(3) Failure of one converter may not inadmissibly affect any parallel connected converters.

4 Design

4.1 Circuit Design Concept

4.1.1 Circuit design concept for converter facilities

(1) When specifying the circuit design, special consideration shall be given to the redundancy of the supplied systems, and to the effects that component failure of the converter facility have on the reliability of the supplied systems.

(2) Converter facilities supplying train-correlated power loads shall themselves, including their auxiliary equipment, be designed in functionally and spatially separated trains.

(3) Regarding the spatial separation of the train-independent standby converter, the requirement of Section 4.6, para. (2), applies.

(4) Every converter within a specific train shall be supplied from the direct current switchgear of the same train to which the converter belongs (cf. **Figure 1-1**).

(5) Every converter shall feed into the same converter emergency power switchgear of the same train to which the converter belongs (cf. **Figure 1-1**).

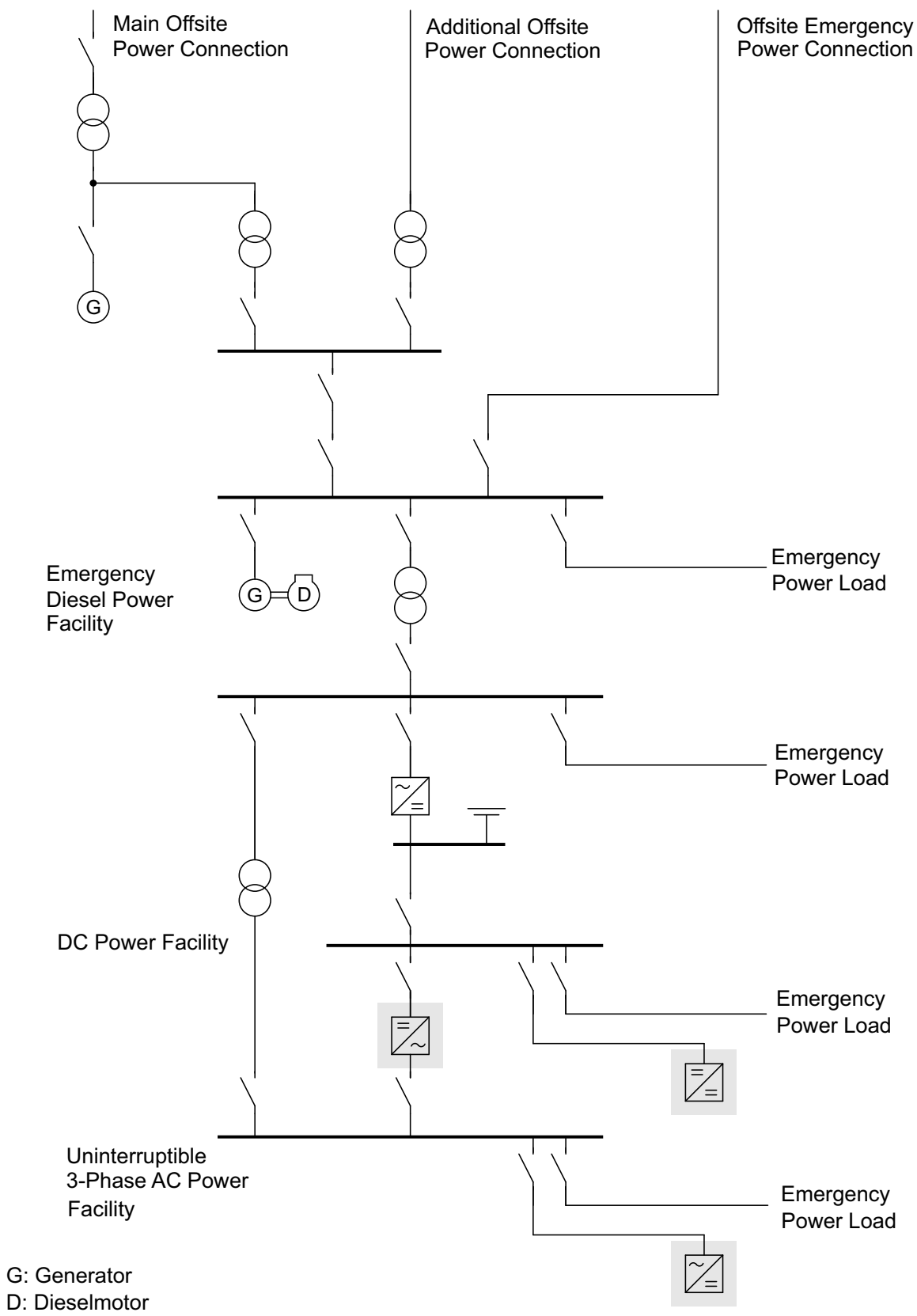


Figure 1-1: Diagram exemplarily showing the scope (greyed background) of the present safety standard