

Safety Standards

of the
Nuclear Safety Standards Commission (KTA)

KTA 3703 (2022-11)

**Emergency Power Facilities with Batteries
and AC/DC Converters in Nuclear Power Plants**

(Notstromerzeugungsanlagen mit Batterien
und Gleichrichtergeräten in Kernkraftwerken)

Previous versions of this safety standard
were issued in 1999-06 and 2012-11

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 Batteries and AC/DC Converters in Nuclear Power Plants

KTA 3703

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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 permissible. 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 safety standards KTA 3701 through KTA 3705 specify the requirements for the energy supply of the safety system.

(3) In the present safety standard, it is presumed that the conventional requirements and standards (e.g., the German Occupational Accident Prevention Regulations, DIN Standards and VDE Regulations) are met unless other safety-related requirements are specified on account of the specifics of nuclear power plants.

(4) The present safety standard contains the special requirements for emergency power generation facilities with batteries and rectifier units. Superordinate requirements for the electrical power supply in nuclear power plants are specified in KTA 3701. The latter also includes requirements for the electronic modules of rectifier units.

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

(6) The requirements for emergency power facilities with converters in nuclear power plants are specified in KTA 3704.

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

(8) The KTA safety standards consider the emergency power facilities 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 and KTA 3504.

(9) The basic requirements regarding quality assurance are specified in KTA 1401.

(10) The requirements regarding explosion protection in nuclear power plants with light water reactors are specified in KTA 2103.

(11) The requirements regarding the seismic design of mechanical and electrical components in nuclear power plants are specified in KTA 2201.4.

1 Scope

This safety standard applies to emergency power generation facilities with vented lead-acid batteries and rectifier units (referred to in the following as 'battery facilities') in stationary nuclear power plants.

Note :

Figure 1-1 is a graphic representation of the scope.

2 Definitions

(1) Stand-by parallel operation of battery facilities

The stand-by parallel operation of battery facilities is a parallel

operation where the battery delivers electrical current only when the supply from the rectifier unit is not available.

(2) Discharge time period

The discharge time period is the time period between the begin of discharge until the minimum permissible battery cell voltage, U_{Zmin} , is reached.

Note :

The minimum permissible battery cell voltage, U_{Zmin} , is specified in Section 4.5.2.2.

(3) Battery, vented

A vented battery consists of battery cells where the cover of each cell has one or more vent openings through which the produced gasses can escape.

(4) Parallel operation of battery facilities

The parallel operation of battery facilities is an operation mode where the power load, the rectifier unit, and the battery are continuously connected in parallel.

3 General Requirements

(1) The design of the battery facilities, the switch gear, the distribution facilities and the DC power loads shall be coordinated such that the static and dynamic supply voltage limits permissible for the power loads will not be exceeded.

(2) The effects of failure-inducing events inside the battery facilities on the nuclear power plant shall be analyzed with respect to their permissibility.

Note :

In the system design, one assumes, e.g., that a failure-inducing event (e.g., short circuit) can cause a failure of one train of the DC power supply and, thereby, a failure of the power loads (e.g., magnetic valves) that are supplied from a single power source.

4 Design

4.1 Circuit Design Concept and Supply of the Power Loads

(1) When specifying the circuit design concepts due consideration shall, in particular, be given to the redundancy of the supplied power loads and the effects of component failures in the battery facilities on the reliability of the supplied power loads.

(2) Battery facilities supplying train-oriented power loads shall be designed as consisting of functionally and spatially separated trains.

(3) Regarding the power supply of rectifier units and power loads one of the following circuit design concepts shall normally be chosen:

a) One rectifier unit for each train of the battery facility. The connection of the rectifier unit to the diesel emergency power facility of the same train. Supply of the power loads of one train from the associated train of the battery facility, or supply of the power loads of one train from the associated train and from a neighboring train of the battery facility (e.g., **Figure 4-1**).

b) Two rectifier units for each train of the battery facility. Connection of the first rectifier unit to the diesel emergency power facility of the same train, connection of the second rectifier unit to the diesel emergency power generator of a neighboring train. In this case, each one of the rectifier units shall be designed for 100 % of the electrical current requirements of the train. The power loads of the individual trains shall be supplied only from the associated train of the battery facility (e.g., **Figure 4-2**).

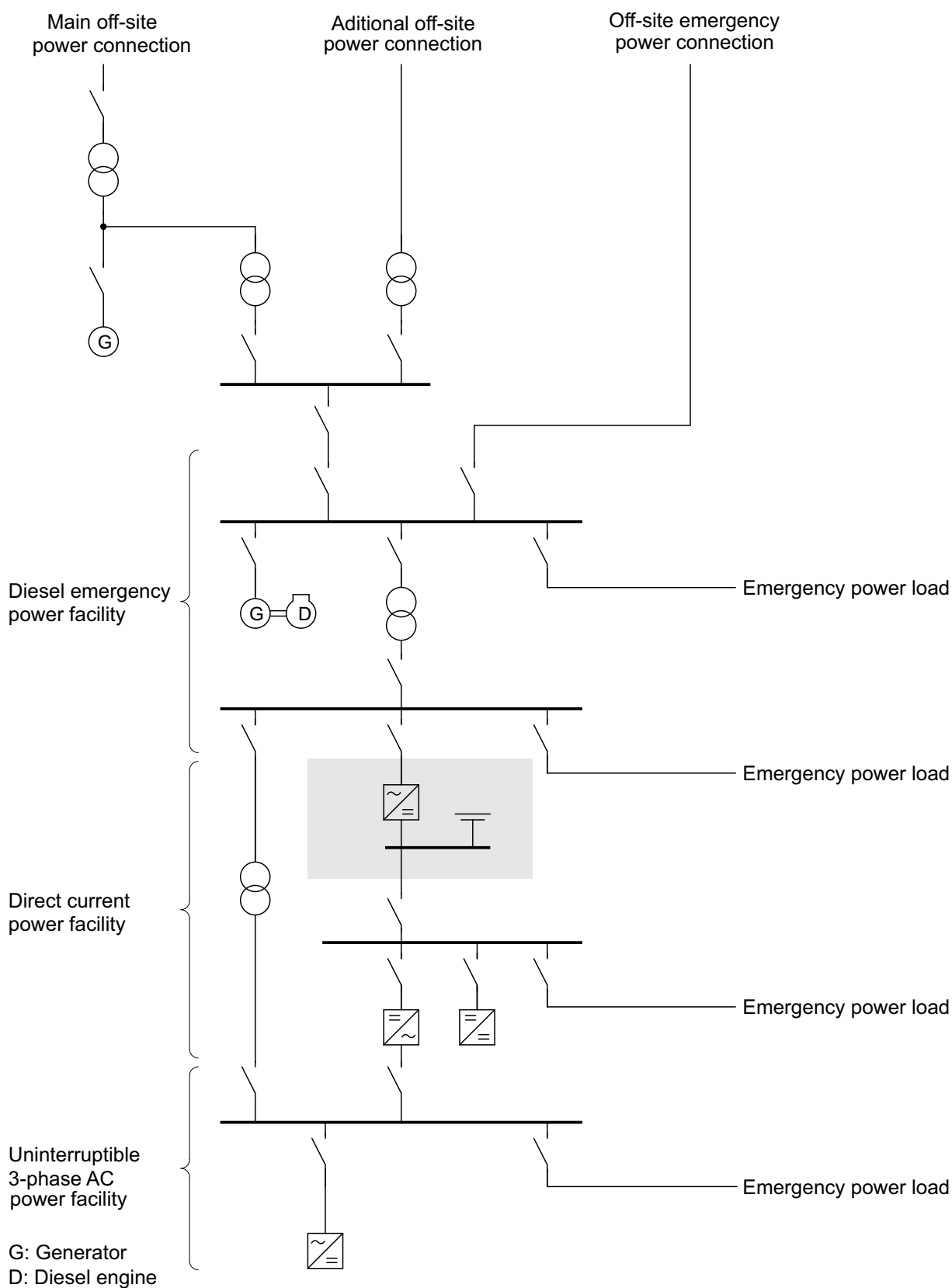


Figure 1-1: Scope of this safety standard (grayed area)