
International Standard



6527

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Nuclear power plants — Reliability data exchange — General guidelines

Centrales nucléaires — Échange de données de fiabilité — Critères généraux

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6527 was developed by Technical Committee ISO/TC 85, *Nuclear energy*, and was circulated to the member bodies in October 1980.

It has been approved by the member bodies of the following countries :

Austria	Hungary	South Africa, Rep. of
Belgium	Italy	Sweden
Brazil	Japan	Switzerland
Canada	Netherlands	Turkey
Czechoslovakia	New Zealand	United Kingdom
Finland	Poland	USSR
Germany, F. R.	Romania	

The member body of the following country expressed disapproval of the document on technical grounds :

France

Nuclear power plants — Reliability data exchange — General guidelines

1 Scope and field of application

This International Standard identifies the typical parameters of a component that permit it to be characterized unequivocally and to allow the corresponding reliability data to be associated with those of other components having equivalent typical parameters. This International Standard deals in particular with exchange of reliability data collected on field. Laboratory reliability test data exchange may require additional information.

For the determination of the equivalence of components, the components shall be characterized as a function of the following parameters :

- technical characteristics including, the physical principle of operation and quality level;
- actual operating conditions and maintenance and test intervals.

In particular, the operating conditions shall have been taken into consideration when selecting the components and, it is considered useful to refer to them as they may affect the performance of the components.

The reliability data may be presented both in a historical and in a statistical form. In order to facilitate their utilization together with the data from other sources, it seems convenient to have them in historical form. However, presentation of reliability data in a processed form is also discussed.

If reliability information is required on a detailed basis, it is necessary to define the failure mode.

2 Definitions¹⁾

For the purpose of this International Standard the following definitions apply.

2.1 nuclear power unit : Nuclear steam-supply system, its associated turbine generator(s) and auxiliaries.

2.2 system : Integral part of a nuclear power unit comprising electrical, electronic, or mechanical components (or combinations of them) that may be operated as a separate entity to perform a particular process function.

2.3 line/train : Part of a system which by itself can perform the type of process function.

NOTE — One line on its own may or may not meet full system capacity.

2.4 sub-system : Part of a system which participates in the operation of the latter (for example, electric power supply, controls, mechanical devices, etc.).

2.5 component : Element of a sub-system, having its own defined performance characteristics and forming a whole that can be removed from the process and replaced with a spare.

2.6 failure (of a component) : Termination of the ability of a component to perform any one of its designed functions.

2.7 failure (of a system) : Termination of the ability of a system to perform any one of its designed functions. Failure of a line within a system may occur in such a way that the system retains its ability to perform all its required functions; in this case the system has not failed.

2.8 failure mode : Effect by which the failure is observed.

2.9 failure rate : Number of failures per unit time in a given time interval. The failure rate may be specified for different failure modes.

2.10 failure probability on demand : Failure probability expressed as a number of failures per number of type of actions requested (i.e. start, stop, open, close etc.).

2.11 reliability : Ability of a component or a system expressed as the probability to perform a required function under stated conditions for a stated period of time.

1) Definitions in IEC Publication 271 have been used as a basis for these definitions.

2.12 operating time : Total time during which components or systems are performing their designed functions.

2.13 availability time : Total time during which components or systems are capable of performing their designed functions.

2.14 unavailability time : Total time during which components or systems are incapable of performing their designed functions.

2.15 mean time between failure (MTBF) : Arithmetic average of calendar times between failures of components or a system.

NOTE — MTBF is the reciprocal of failure rate when an exponential failure distribution can be assumed.

2.16 mean time to failure (MTTF) : Average time to failure of a new item or a repaired item assumed as new.

2.17 mean time to repair (MTTR) : Arithmetic average of times required to perform a repair activity on the actual item.

2.18 preventive maintenance : Activity performed on a system or component in order to reduce the probability of failures due to known wear-out failure modes.

2.19 corrective maintenance : Activity performed on a system or component in order to eliminate the causes of failures that happened or were revealed by scheduled tests.

3 Component characteristics

This clause identifies the main characteristics of components so as to establish a comparative basis. The characteristics are separated into technical characteristics and quality characteristics.

3.1 Technical characteristics

The following characteristics shall be given wherever applicable.

- a) Technical generic description

The technical term designating the component in question shall be specified; as far as possible reference shall be made to existing pertinent regulations, codes, manuals, etc.

- b) Definition of the component in question

The definition of the component in question described under a) shall be specified including the interface points with adjacent components.

- c) Physical principle of operation

For the individual functions that may be associated with the component in question, the principle of operation by which the function is achieved shall be stated.

- d) Component design characteristics

The key design characteristics shall be specified, for example, nominal (connection) dimensions, rated pressure and temperature, materials, design class, rated voltage, etc.

Table 5 (see the annex) gives detailed examples of the design characteristics deemed important for a group of components. Similar tables may be drawn for other components, on the basis of their manufacturing data. Other data may be added to those listed in table 5 according to particular needs.

In addition the following information shall be given, if possible.

- e) Manufacturer

- f) Manufacturer type designation and fabrication date

The manufacturer's reference is requested in particular cases to allow the user to find another source of data if necessary. Of course, components of the same type made by different manufacturers very seldom have the same characteristics. As a consequence engineering judgement will very often be required to decide whether the component may be considered to have equivalent characteristics or not. In general, it will be necessary for the values of the major parameters to fall within certain ranges.

3.2 Quality characteristics

The quality of a component is an essential characteristic for establishing its equivalence with others. Components having the same technical characteristics may be designed and manufactured, tested and controlled at different quality levels and thus they might not be equivalent. As an example of such a difference in quality, circuit breakers for safety-related systems and for normal loads may be mentioned. The former are subjected to a series of type qualifications, aging, and seismic tests that are not required for the latter. Furthermore, the quality of the safety-related equipment is verified with a quality assurance programme having well-defined characteristics.

For the equivalence of components, it should be adequate to refer to their quality level and, if applicable, to their safety classification.

4 Operation characteristics

While the preceding clause gives guidance to determining the technical equivalence of components, this clause gives guidance to determining whether the operating conditions are comparable or not. A different operating mode and the exposure to different environmental conditions are factors which may affect the behaviour of a single component and thus the reliability data. As a consequence, an engineering judgement