BRITISH STANDARD

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IEC 1225 : 1993

Nuclear power plants — Instrumentation and control systems important for safety — Requirements for electrical supplies

BSi STANDARDS

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Nuclear Engineering Standards Policy Committee (NCE/-) to Technical Committee NCE/8, upon which the following bodies were represented:

AEA Technology
British Aerospace plc
British Nuclear Forum
British Nuclear Fuels plc
Electricity Association
GAMBICA (BEAMA Ltd.)
Health and Safety Executive
Institution of Nuclear Engineers

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Contents

National foreword

This British Standard has been prepared under the direction of the Nuclear Engineering Standards Policy Committee and is identical with IEC 1225 : 1993, *Nuclear power plants — Instrumentation and control systems important for safety — Requirements for electrical supplies*, published by the International Electrotechnical Commission (IEC).

IEC 1225 was produced as a result of international discussions in which the United Kingdom took an active part.

Cross-references

International standard	Corresponding British Standard
	BS 5654: *Stabilized power supplies, d.c. output*
IEC 478-1:	Part 1 : 1979 *Terms and definitions* (Identical)
IEC 478-2:	Part 2 : 1979 *Method of specifying rating and performance* (Identical)
IEC 478-4:	Part 4 : 1979 *Tests other than radio frequency interference* (Identical)
	BS 6667: *Electromagnetic compatibility for industrial-process measurement and control equipment*
IEC 801-1:	Part 1 : 1985 *General introduction* (Identical)
IEC 801-2:	Part 2 : 1985 *Method of evaluating susceptibility to electrostatic discharge* (Identical)
IEC 801-3:	Part 3 : 1985 *Method of evaluating susceptibility to radiated electromagnetic energy* (Identical)

The Technical Committee has reviewed the provisions of the following IEC Standards and IAEA Safety Guides to which normative reference is made in the text and has decided that they are acceptable for use in conjunction with this standard.

IEC 38 : 1983

IEC 146-2 : 1974

IEC 146-4 : 1986

IEC 293 : 1968

IEC 557 : 1982

IEC 639 : 1979

IEC 686 : 1980

IEC 709 : 1981

IEC 780 : 1984

IEC 896

IEC 980 : 1989

IAEA Safety Guide 50-SG-D3 : 1980

IAEA Safety Guide 50-SG-D7 Rev. 1 : 1991

IAEA Safety Guide 50-SG-D8 : 1984

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Nuclear power plants - Instrumentation and control systems important for safety - Requirements for electrical supplies

1 Scope

This International Standard specifies the performance and the functional characteristics of the electrical supply systems required for the instrumentation and control (I&C) systems important to safety of a nuclear power plant. Guidance is also given on the possible use of these supplies for other I&C systems.

These supplies are required to be fed from primary sources of suitable redundancy and reliability, such that the safety and functional objective of the I&C system can be adequately achieved.

This standard defines the methods of application of IAEA Safety Guides 50-SG-D3, 50-SG-D7 and 50-SG-D8.

The specific design requirements for the components of the I&C power supply system are outside the scope of this standard.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 38:1983, *IEC standard voltages*
IEC 146-2:1974, *Semiconductor convertors - Part 2: Semiconductor self-commutated convertors*
IEC 146-4:1986, *Semiconductor convertors - Part 4: Method of specifying the performance and test requirements of uninterruptible power systems*
IEC 293:1968, *Supply voltages for transistorized nuclear instruments*
IEC 478, *Stabilized power supplies, d.c. output*
IEC 557:1982, *IEC terminology in the nuclear reactor field*
IEC 639:1979, *Nuclear reactors - Use of the protection system for non-safety purposes*
IEC 686:1980, *Stabilized power supplies, a.c. output*
IEC 709:1981, *Separation within the reactor protection system*
IEC 780:1984, *Qualification of electrical items of the safety system for nuclear power generating stations*
IEC 801, *Electromagnetic compatibility for industrial-process measurement and control equipment*
IEC 896, *Stationary lead acid batteries - General requirements and methods of test*
IEC 980:1989, *Recommended practices for seismic qualification of electrical equipment of the safety system for nuclear generating stations*
IAEA Safety guide 50-SG-D3: 1980, *Protection system and related featuring in nuclear power plants*
IAEA Safety guide 50-SG-D7 Rev. 1: 1991, *Emergency power system of nuclear power plants*
IAEA Safety guide 50-SG-D8: 1984, *Safety related instrumentation and control system for nuclear power plants*

3 Definitions

For the purpose of this International Standard, the following definitions apply:

I&C systems important to safety: See Guide of IAEA 50-SG-D8.
safety systems: See IEC 557.
I&C safety related systems: See Guide of IAEA 50-SG-D8
separation within the reactor protection system: See IEC 709
safety system support features (power supplies): See IEC 557
I&C non-interruptible electrical power supply systems: Systems which will not be lost solely as a result of loss of off-site and on-site power sources (see figures 1 and 3).
stationary lead acid batteries: See IEC 896.

Other terms not defined above are defined in IAEA Safety Guide 50-SG-D7.

4 System requirements

4.1 *Function and description*

I&C electrical supplies generally consist of the following non-interruptible systems (see figure 1):

- a d.c. power system with batteries, supplying d.c. loads;
- an a.c. power system with internal batteries, supplying a.c. loads.

The d.c. power system shall supply the d.c. loads, including control, monitoring, protection, switching and auxiliary power, during normal operation, anticipated operational occurrences and accident conditions.

If loads important for safety require continuous a.c. power, a non-interruptible a.c. power system shall be provided to supply such loads.

4.2 *System divisions*

The d.c. power system and the non-interruptible a.c. power system shall be divided into redundant and independent divisions in accordance with clause 5 of this standard.

Each division of the d.c. power system shall consist of at least a battery supply, a battery charger and a distribution system (figure 2).

Each division of the non-interruptible a.c. power system shall consist of at least a supply from a d.c. power system, a d.c.-a.c. inverter and a distribution system. Another a.c. back-up power supply and an automatic switch-over device should also be provided (figures 3 and 4).

4.3 *System boundaries*

The boundaries of the electrical supply system covered by this standard are from the incoming terminals of the breakers fed by the a.c. low-voltage power busbar of the Electrical Emergency Power Supplies (Electrical EPS) up to the feeders dedicated to provide power to each individual load system, equipment and/or component (see figure 1).

For safety reasons, the loads will be divided into several separate divisions; each of these divisions shall be supplied from separate redundant supplies.

Within the limits specified above, each system may include equipment such as transformers, converters, motor generator sets, inverters, cables, isolation devices, distribution boards, change-over devices, central and local batteries, switching, monitoring and protection equipment.

Any equipment within an I&C system needed to provide specific power supplies is not within the scope of the I&C power supply system covered by this standard.

5 Requirements for independence, physical separation and redundancy

5.1 *General*

The I&C power supply systems covered by this standard support the operation of the I&C systems that are in general designed in accordance with the single failure criterion. The following design criteria shall be followed as a minimum.

5.2 *Redundancy*

The redundancy of an I&C power supply system covered by this standard shall be determined by the plant design criteria which apply to the I&C systems which are fed from it.

5.3 *Independence*

In general, the I&C power systems consist of redundant divisions without interconnection (see IEC 709). Each division shall have its own feeds and supplies, batteries and chargers, switchboards, raceways and auxiliary facilities so as to be functionally independent and physically separate from the other divisions (see example figure 3).

Should double-feeding be necessary, either for the load side (e.g. via diode-decoupling) or for the charger side, the connections between the redundant supplies shall be designed such that any fault which might occur consistent with the single failure criterion as applied in IEC 709 does not adversely affect more than one redundant supply system (see example figure 5).

Where diodes are used, a means for checking that they can perform their function shall be provided.

5.4 *Physical separation*

The redundant parts of the I&C power supply systems shall be separated according to IEC 709.

A single postulated initiating event shall not lead to the failure of more than one redundant system.

In the case of a design using large centralized batteries, the batteries of each redundant supply system should be installed in a separate room with adequate ventilation, particularly where Planté cells are used. Any ventilation system shall be supplied from the same division of the power supply system as the battery concerned.

5.5 *Reliability*

The availability of the supply shall be commensurate with the requirements of the I&C system to be fed.

To increase the reliability of each redundant supply system, attention should be paid to the redundant or diverse design of its components, to component reliability, to maintenance and to test procedures.

6 Functional requirements for I&C power supplies

6.1 *Power source*

I&C systems are supplied from busbars, whose normal power source originates from the main generator, grid connections and alternative supplies. In the event of loss of normal power, these busbars shall be fed by emergency on-site power supplies.

The I&C supplies may be subject to transients when loads such as large motors are started or under fault conditions and thus care should be taken to prevent transients outside acceptable limits (see examples in annex A), from affecting the I&C load busbar voltage.

The supplies to each busbar shall have a break time that will not exceed the break time tolerated by the loads connected to the busbars.

I&C system loads will consist of d.c. and a.c. loads. The output voltages to the loads (whether a.c. or d.c.) shall be maintained within specified limits following loss of primary power for the break duration specified.

The distribution system should be normally earthed to prevent dangerous faults that could occur on a normally non-earthed system when multiple earth faults occur. Where an unearthed system is used, particular attention should be paid to the monitoring and subsequent clearance of earth faults to prevent the possible introduction of fail to danger conditions when two or more earth faults are present on a supply system.

6.2 *Batteries and chargers*

Except in specified modes of operation such as maintenance, a battery shall always be connected to its associated busbar to maintain the uninterruptible supplies.

The battery and charger design capability shall take into account such factors as the availability of off-site power supplies, number and reliability of stand-by generator sets and the particular requirements of the plant. In any case, it shall be adequate to supply the system loads (including transient loads) and maintain the supply for the specified minimum time.

Consideration shall also be given to the method of operation and equipment capacity in the case of batteries or chargers being out of service because of a single failure.

The battery chargers shall have sufficient capacity to restore the battery from a discharged condition to a float charged state within an acceptable time, e.g. 8 h, while at the same time supplying the largest combined demands of the various steady-state loads following an initiating loss of normal power. The charger should be protected from overload during this time. If the battery charger is permitted to supply the system with the battery disconnected, the charger shall have the capability of supplying the largest combined demands, including transients. Each battery charger shall have appropriate disconnecting devices in the a.c. and d.c. circuits to enable the charger to be isolated.

Taking into account factors such as design margins, temperature effects and deterioration with age, the capability of the float charged batteries shall be such as to meet all required load demands and conditions (including duty cycles, electrical transients during operational states and accident conditions) until such time as the standby generator can meet the load demands.

Batteries and chargers shall be operated in parallel so that the battery is maintained in the charged condition and supplies current to the loads only when a supply via the charger is not available.

Local batteries, e.g. batteries supplying a single instrument or cubicle, shall meet the applicable clauses of this standard.

6.3 *Inverters and converters*

The inverter design shall consider the following conditions in addition to summation of the total load capacity:

- the commutation failure limit shall be greater than the summation of peak currents generated under overload conditions by the power conversion units installed as part of the loads;
- the voltage control during loss of primary power supply shall maintain the output voltage within specified limits;
- the inverter shall be suitable for non-linear loads such as switched mode power supplies (SMPS) (see example 1 of annex A);
- the frequency regulation; to facilitate rapid change-over, inverters should run synchronously with the dedicated back-up system when the system frequency is normal;
- the permissible output voltage and waveform quality (see clause 9).

To supply electronic devices, intermediate circuit d.c./d.c. converters may be used. These d.c./d.c. converters will be connected on the input side at the voltage of the battery equipment and will feed, on the output side, loads or groups of loads with a **controlled** voltage which may have a nominal value different from the battery voltage.

7 Requirements for distribution system design

The following requirements shall be considered in relation to each system.

7.1 *System aspects*

The supply system shall operate to maintain supplies important for safety under normal and relevant accident conditions.

The system design of the whole system shall accept redundant supplies and provide a continuous supply to each I&C load within the specified tolerances of voltage, waveform and frequency for all input conditions. Typical values are given in annex A, but different system voltage levels may be used, depending on the requirements of the I&C system and other loads to be supplied.

When main and back-up systems are provided, they should be connected to separate sources that will not fail simultaneously, allowing for repair time (see IEC 709, clause 6).

The completed design shall be validated and tested to demonstrate that it meets the specified functional requirements.

The d.c. system busbar shall be fed from the battery and the charger. The non-interruptible a.c. busbar shall be fed from the inverter and an a.c. back-up power supply (see figure 3). The busbar may be split into two or more sections to limit the size of the inverters.

7.2 *Load allocation*

The I&C system loads should be allocated to the most appropriate a.c. or d.c. source in accordance with their specific requirements.

Loads may be grouped according to the duration of transient supply interruption that they can accept. The grouping of loads should also be optimized by taking into account load characteristics such as transient current, non-linearity, etc.

Alternative types of distribution systems covered by this standard are shown in figures 4, 5 and 6.

Where very high availability, non-interruptible a.c. supplies are required, fast automatic change-over between the inverter and an alternative supply[1], e.g. a transformer or regulated transformer, shall be provided using a static switch or a change-over contactor.

The capability and logic of such a transfer system, including restoration to the normal source, shall be clearly stated.

High-reliability non-safety loads may be supplied subject to 8.4.

7.3 *Electrical aspects*

Standard distribution voltages should be chosen to enable a wide range of equipment to be used, but the number of levels should be minimized to avoid system complexity. Individual loads may be provided with their own converter, if necessary, to adapt them to the standard voltages. Recommended voltages are given in IEC 38 and IEC 293.

The design of the electrical protection system can have an important effect on the availability of the supply to individual loads in the event of a fault in the system. The design required to take this into account is specified in 10.2.

Consideration shall be given to the type of connection between safety earth ground, and neutral connections of power supplies, and the signal reference of I&C equipment (see IAEA SG-D-7).

8 Effects of influence conditions

8.1 *Electromagnetic interference*

Individual loads can generate interference and radiate to other equipment directly or via power supply connections. This shall be minimized by purchasing equipment that meets the interference levels specified in IEC 801 and by physical separation and screening of the cables according to IEC 709 and IEC 639.

Many loads (e.g. switched mode power supply units) generate current pulses that cause harmonics of current and such loads shall be specified to meet acceptable levels of current waveform and interference to ensure that acceptable voltage waveforms can be maintained.

Sensitive loads shall be protected against interference of the levels specified in IEC 801.

8.2 *Transients*

Many types of loads (e.g. computers and programmable devices) are susceptible to malfunction caused by supply voltage transients (such as those caused by the blowing of fuses or switching on of large loads), which reduce the voltage on equipment fed from the same supply to unacceptable low levels or those causing damage to items of equipment by overvoltage. Appropriate action shall be taken to overcome such problems.

The maximum current supplied by an inverter under such conditions may reach only a low value, and the characteristics of the loads and the protection in the distribution system (e.g. fuses or automatic switches) shall be matched to the characteristics of the power source (see annex A, example 1).

Inrush currents should be limited to an acceptable value by the design of the loads or by load sequencing.

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[1] The alternative supply may be required to provide a high prospective current to blow fuses.

8.3 *Load current*

An a.c. load current is seldom sinusoidal because of the characteristics of inductive loads such as transformers and the charging of capacitors.

The peak voltage has a major effect on the load performance and the current and voltage waveforms may have to be specified to be within certain limits. Annex A, example 1, shows typical values for an a.c. power supply. Other values depending on the nominal distribution voltage level are also acceptable if in accordance with IEC 38, IEC 293 and IEC 686.

8.4 *Loads important to safety and loads not important to safety*

The following design criteria should be followed to enhance the reliability of the I&C power supply systems:

- loads not important to safety shall be fed from the safety busbars only when connected through devices that prevent faults on these non-safety loads from adversely influencing the safety supplies (e.g. isolation devices);
- the capacity of the supply system shall be adequate to support both the safety and the relevant non-safety loads for the time required by the safety criteria.

9 Characteristics of supplies given to individual loads

9.1 *DC supplies*

The characteristics of the d.c. supplies required by individual loads shall have a margin on the values specified for the output of the power supply system to allow for deterioration in service, and for the impedance of connections between the load and the supply. Where d.c./a.c. inverters or d.c./d.c. converters are provided, the variation of the voltage at the equipment can be designed to be less than at the battery (see annex A, example 3).

Reference should be made to IEC 478.

9.2 *AC supplies*

The characteristics of a.c. supplies required by individual loads shall have a margin on the values specified for the output of the power supply system to allow for deterioration in service and for the impedance of the connections between the load and the supply.

Close control of the mean frequency may be required when the frequency is used as a measure of time (e.g. on synchronous recorder charts).

Examples of limits are given in annex A.

In case of three-phase supplies, the loads should be appropriately balanced across the three phases. Reference should be made to IEC 686.

10 Monitoring and protection

Highly reliable and continuously available power supplies for the I&C equipment are dependent on proper protection and monitoring of all important power supply characteristics.

Monitoring and protection devices shall be installed in each redundant supply system. They shall be physically separated and operated independently from each other.

10.1 *Monitoring*

All important functions of I&C power supplies shall be monitored to give appropriate information and/or alarm signals or to initiate appropriate protective action. Alarms shall be classified in a similar way to other alarms in the station in accordance with their significance and the operator action required.

The following items may require monitoring for each redundant supply system:

- voltages or frequency outside permissible limits;
- interruption in the supply;
- circuit breaker position;
- battery voltage;
- battery open circuit (e.g. by monitoring ripple in battery circuit current);
- battery charger or inverter failure;
- earth faults, etc.

Alarms should be initiated in the event of protective action, the loss of one supply in a redundant system or the loss of supply to a load.

10.2 *Protection*

Protection shall be provided on the I&C supply system to minimize the effect on the system and the number of loads affected by a fault. The effect of spurious operation shall be minimized. The main source of faults will be in the loads and their connections to the supply, and so adequate individual instantaneous overload protection shall be provided, e.g. by fuses. The connection of supplies in parallel should be avoided and where permitted adequate protection shall be provided, e.g. by fuses.

Paralleling of two batteries of different divisions is not permitted except through diodes and isolating devices, isolating the systems from each other. Provision should be made for testing these diodes (see clause 12).

11 Qualification of equipment

All equipment used in the supply system shall be qualified according to the specific rules and standards applicable to the equipment for normal, abnormal and accident conditions to assure its safety functions and reliable operation throughout its life.

Where required by the station design, the equipment shall be qualified for conditions that may arise during plant operation, that is, natural events (seismic, etc.), internal events (plant failures) and special external events such as those caused by human activities.

The qualification programme shall meet the requirements of IEC 780, IEC 146-2, IEC 146-4 and IEC 980.

12 Testing

Electrical supply systems shall be regularly tested at the intervals prescribed in the specific station maintenance rules and standards for each type of equipment.

The system design shall enable checks to be made that the systems still have their designed redundancy, fast change-over facilities and that batteries are fully charged and have adequate capacity.

The system shall therefore be designed so that sections of it can be disconnected without the loss of an unacceptable number of loads and without jeopardizing the operation of the plant relying on the remaining I&C supplies.

The designer shall review the merits of on-line and off-line tests for each part of the system, and the need to minimize manual reconfiguration of the system to carry out the tests.

Provision should be made to enable battery discharge testing to be carried out at design emergency-load current.

For test purposes the chargers may be operated in a test mode with an output voltage (e.g. 2,05 V per cell) less than the float charging voltage of the battery. In this mode, the diodes of decoupled loads can be tested for the specified function.

13 Maintenance

A maintenance programme shall be provided for the equipment covered by this standard.

The design and arrangements of all components of the I&C power supply system shall provide a good layout for easy identification of components, easy maintenance and short repair times (e.g. by accessibility and exchangeability). Particular attention shall be paid to testing and maintenance requirements for local batteries. The ageing of all batteries should be monitored.

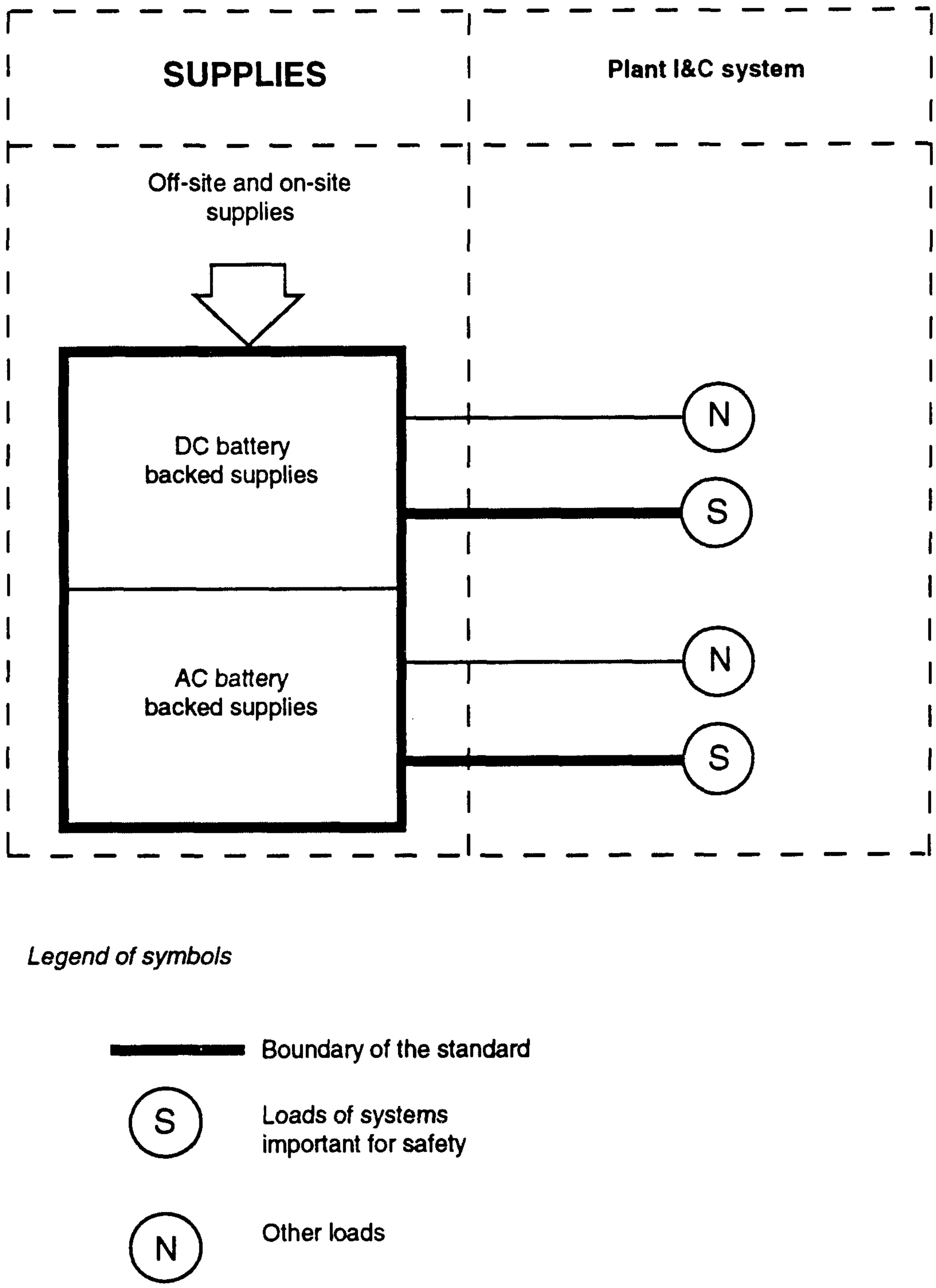


Figure 1 - System boundary

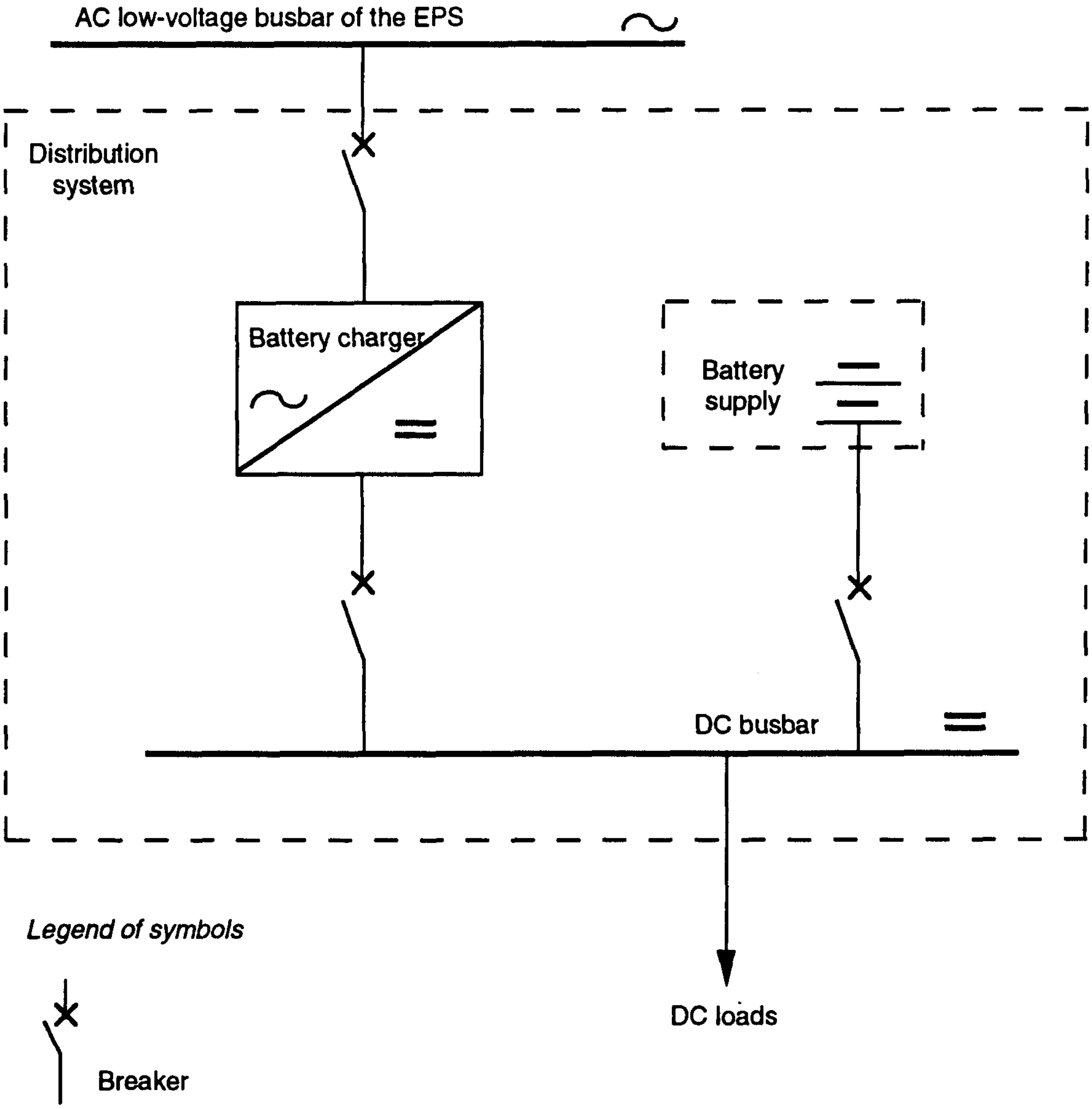
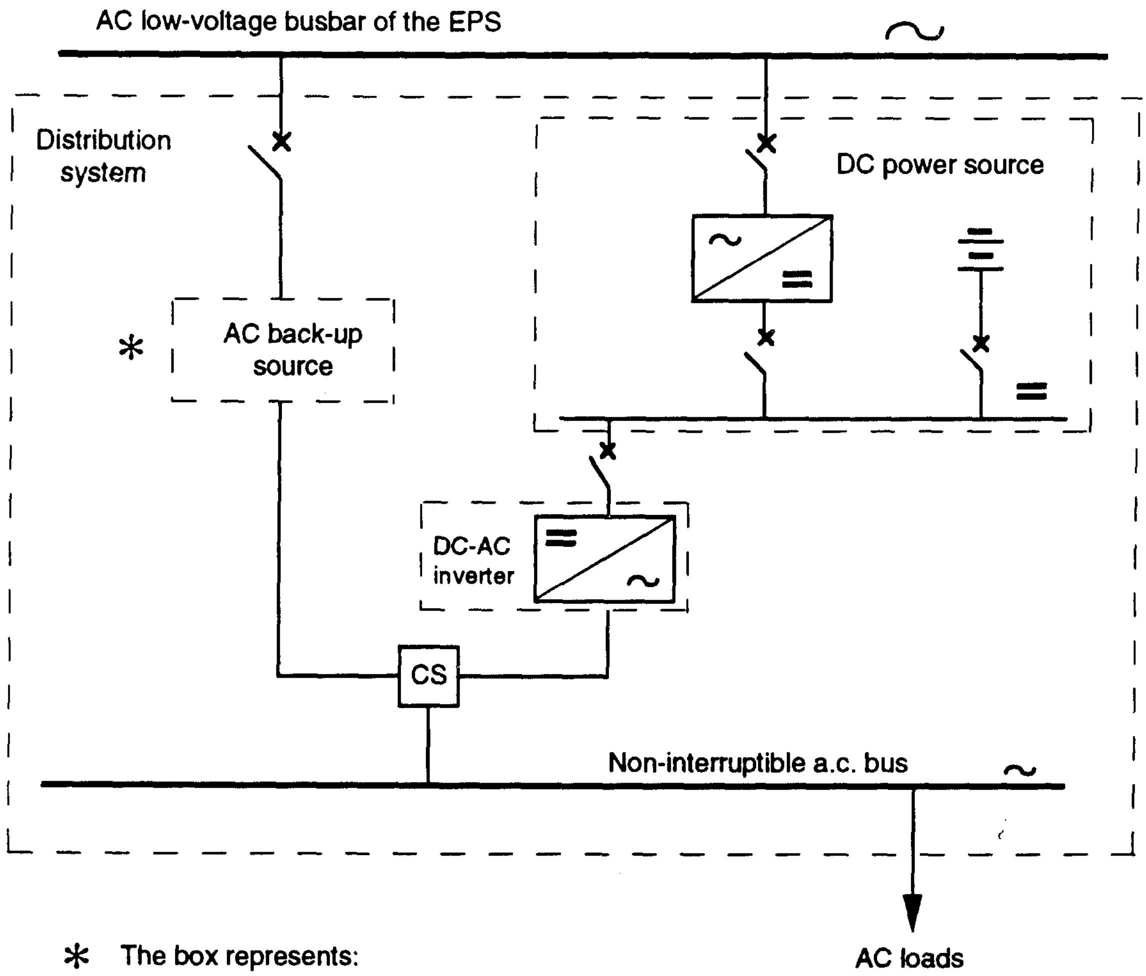


Figure 2 - DC power system



* The box represents:
- a direct connection,
- a transformer, or
- a regulated transformer.

Legend of symbols

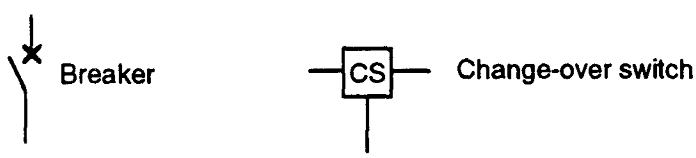
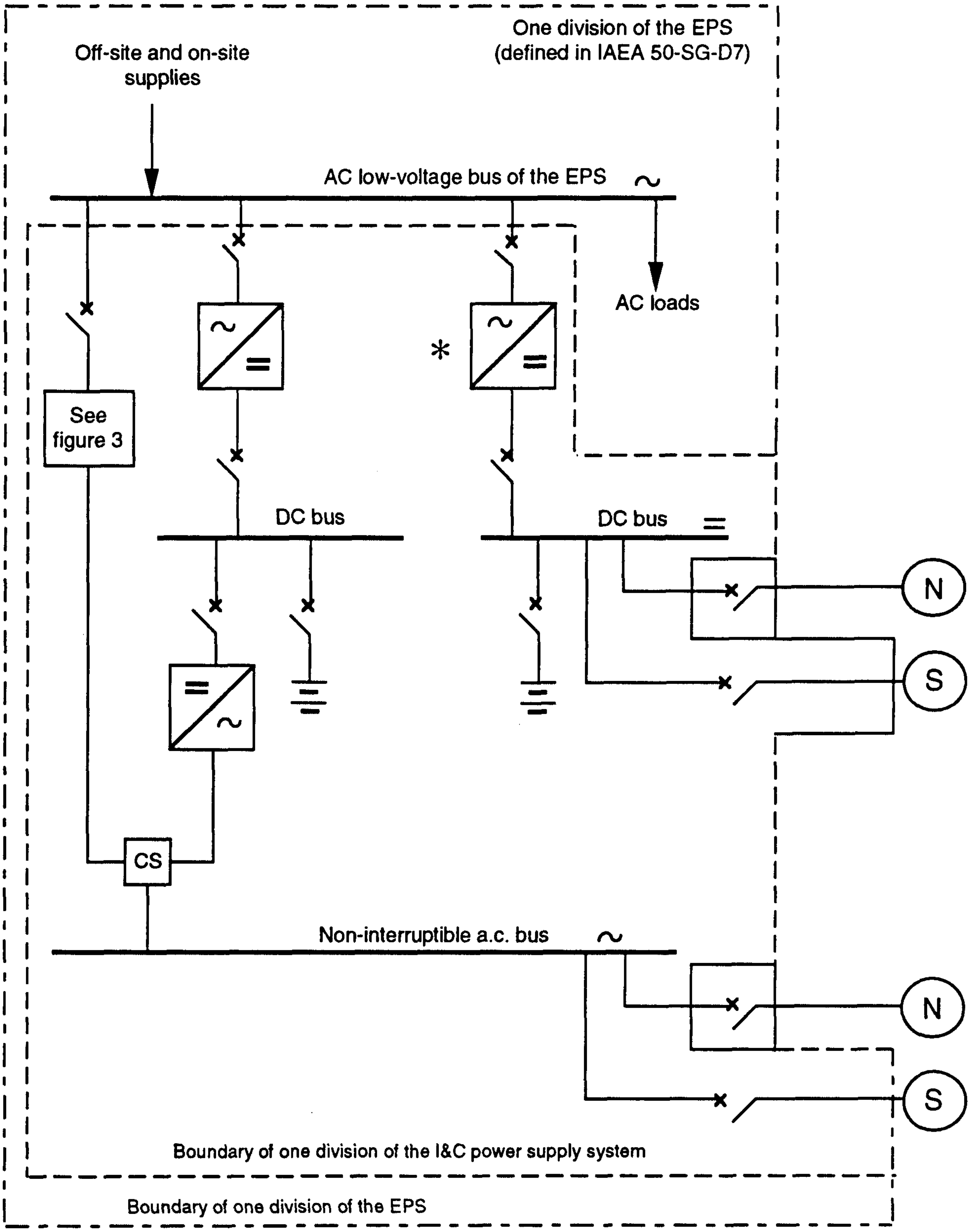


Figure 3 - Non-interruptible a.c. power system



* DC power system and non-interruptible a.c. power system may share the same battery and charger if the performance conditions can be satisfied.

Legend of symbols

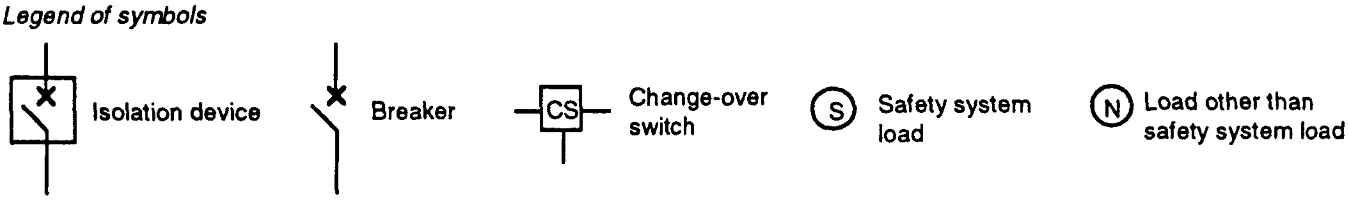


Figure 4 - One division of the I&C power supply system

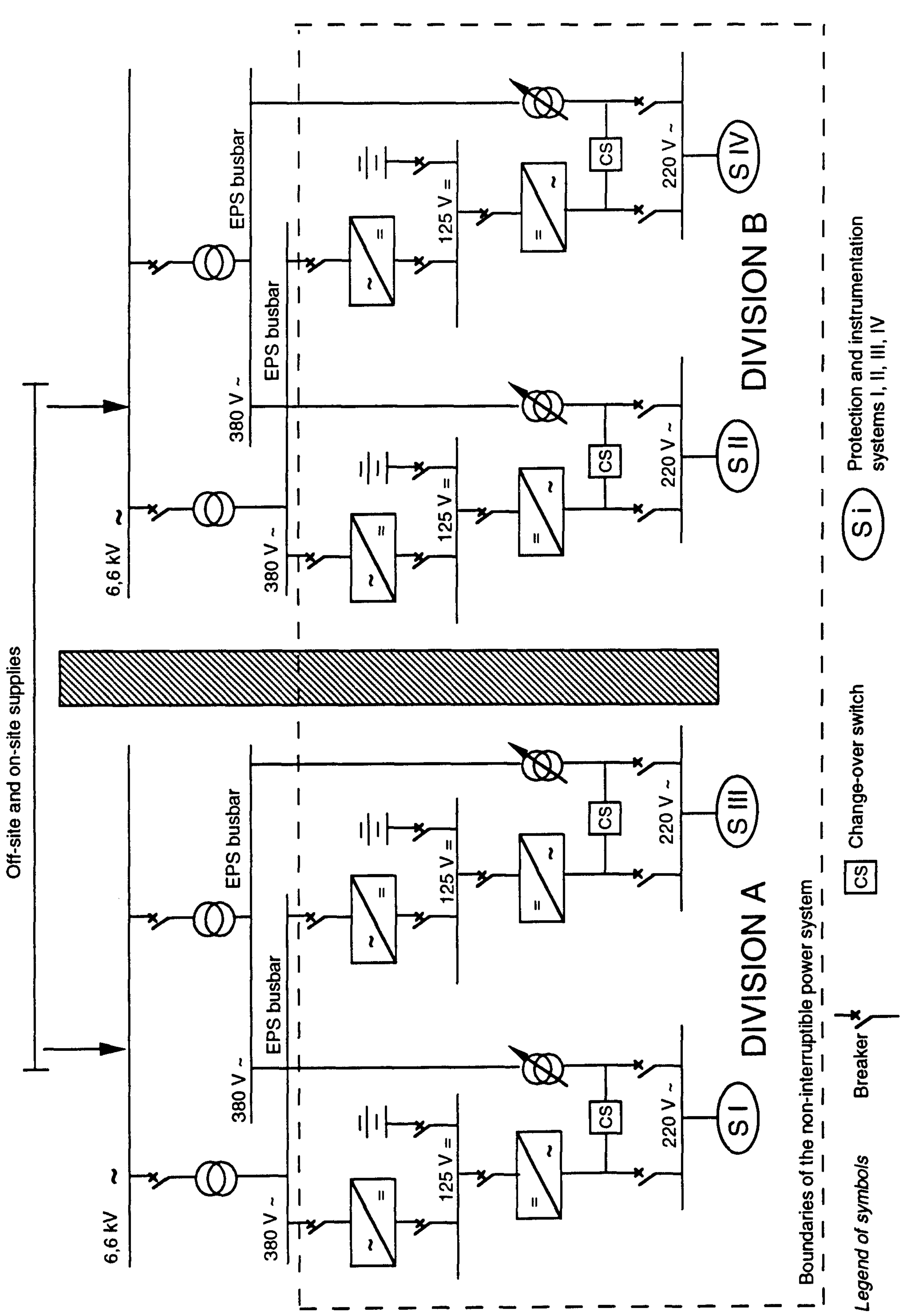
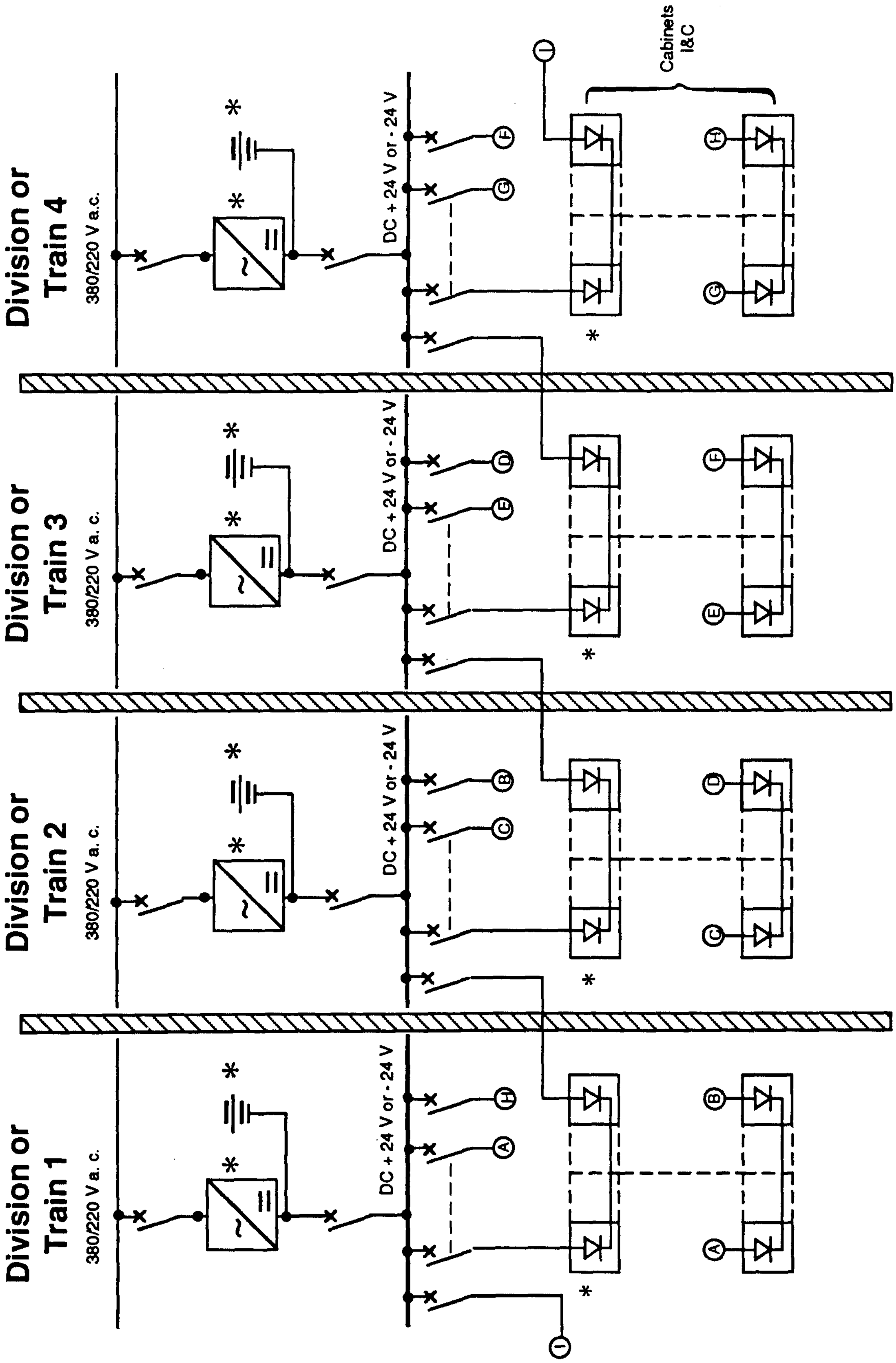


Figure 5 - Example of I&C non-interruptible a.c. power system



* The example is drawn from a power station which has two systems corresponding to that shown, one operating at + 24 V and one at - 24 V.

Figure 6 - Example of d.c. system

ANNEX A
(informative)

Examples of specifications

Example 1: Specification for an a.c. power supply for I&C equipment requiring a non-interruptible supply

To provide a non-interruptible supply of a.c., the system includes a battery charger and battery feeding an invertor.

The battery voltage shall be chosen to give an optimal design of battery chargers/battery/invertor system. The battery capacity shall maintain the invertor output for a time longer than the longest duration of loss of a.c. input that is to be considered. As the battery feeds no external supply, it may be earthed or non-earthed.

Invertor output:

Nominal output voltage	115 V or 230 V single-phase.
Nominal output frequency	50 Hz (or 60 Hz if this is the national standard).

- The output waveform shall be synchronized with that of the back-up supply over the nominal frequency range ± 1 %. When the back-up supply is outside the range, the invertor shall run autonomously and maintain the frequency within 1 % of nominal.

- The total harmonic content of the output voltage waveform shall not exceed 5 % over the anticipated range of load currents (which may not be sinusoidal with I&C equipment).

- The invertor efficiency at rated load shall not be less than 75 % at any power factor in the range 0,7 lag to 1,0.

- Under steady-load conditions, the peak amplitude[1] of voltage shall be maintained in the nominal range + 6 % to - 10%.

- The drop in busbar peak-amplitude voltage when the load is suddenly increased by 50 % (to less than 100 %) shall not exceed:

  - 25 % in the first half-cycle,
  - 20 % in the second half-cycle, and
  - 15 % in the tenth half-cycle.

- Where fuses are used, the prospective current shall be not less than 10 times the fuse rating (to give fault clearance times not exceeding 0,5 s).

- The amplitude of supply pulse transients shall not exceed 500 V.
- The energy content shall be less than 0,1 J.

[1] Peak amplitude is used in the examples as I&C equipment is generally more affected by deviations in peak amplitude than r.m.s.

Example 2: Specification for d.c. power supply for I&C equipment requiring a non-interruptible supply

To provide a non-interruptible supply, the system includes a battery and battery charger.

Nominal voltage	220 V with 108 cells or 110 V with 54 cells, etc.
Nominal voltage per cell (float or trickle charge voltage)	2,23 V
Final discharge voltage per cell (chargers not in service)	1,8 V
Maximum battery voltage after boost charging	2,7 V/cell
Operating voltage when testing diodes of duplex supply	2,05 V/cell
Static variation of voltage over load range when on float charge	± 1 %

Battery charger

Input voltage	400 V a.c. nominal ± 10 % (static) three-phase (or other appropriate voltage)
Dynamic variation	+ 15 % - 20 %
Frequency	50 Hz (or 60 Hz) nominal ± 5 %
Dynamic variation	+ 15 % - 10 %

Output voltage variation to match battery voltages above.

If required for operation feeding loads without the battery connected:

Dynamic control of output voltage within range	- 20 % + 15 %
for step changes of load between	50 % and 100 % rated current
Correction time for voltage control	500 ms
Voltage ripple (battery disconnected)	2 %
Output current limitation system to limit at	102 %

Battery

To be of Planté type designed for float/standby operation.

Electrolyte density fully charged 1,22 ± 0,01 kg/l at 20 °C.

Example 3: Specification for d.c. power supply with d.c./d.c. converters for I&C equipment

24 V distribution or d.c./d.c. converter output

Nominal voltage	26 V
Set-point range of the output voltage	26 V to 29 V
Variation	26 V ± 1 %
Voltage ripple	≤ 5 %
Load characteristics	IV (according to DIN 41773)
Rated output current of each converter	65 A
Current limiter	102 %
Dynamic control of the output voltage	≤ 5 %

Voltage deviation, either caused by step-type load changes from 10 % up to 90 % and down to 10 % rated current or by dynamic input voltage deviations, shall not lead to tripping of the invertor by monitoring unit.

Response time for voltage control	≤ 5 ms
Short-circuit proof	Required
Parallel operation of several d.c./d.c. converters	Required

Input data of the d.c./d.c. converters

Nominal voltage	220 V
Input voltage range	176 V to 275 V
Voltage ripple	≤ 10 %
Inrush current	≤ 2,5 times rated current

List of references

See national foreword.

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Contract requirements

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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