

Australian/New Zealand Standard®

**Electrical installations—Emergency
power supplies in hospitals**

AS/NZS 3009:1998

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Gas and Fuel, Australia
Health Department of Western Australia
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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee HT/25, Emergency Power Supplies in Hospitals, to supersede AS 3009—1985.

Major alterations to the previous edition are as follows:

- (a) Allowance of the use of mains supply as an emergency supply, if the normal supply is an on-site generator.
- (b) Allowance of the use of natural gas as a fuel for engine-driven sets.
- (c) Requirements for fire-rated cables where emergency lighting and power supply systems pass through areas that are not fire-rated have been removed, because the Committee believes that the maintenance of emergency services after fire has destroyed normal cabling is not needed in all circumstances. However, advice has been added (in Clause 8.5) that fire-rated cables should be used in some circumstances.

Interruption of normal electrical service in hospitals may be caused by catastrophes such as storms, floods, fires, earthquakes, or explosions or by failures of the systems supplying electrical power (including those resulting from system damage from traffic accidents), or by incidents within the hospital itself. Outages may be corrected in seconds or may require hours. For all such situations, electrical systems need to be planned so as to limit internal disruption and to provide for continuity of vital services at all times.

Medical and nursing sciences are becoming progressively more dependent upon electrical apparatus for the preservation of life of hospitalized patients. For example, year by year, more cardiac operations are performed, in some of which the patient's life depends upon artificial circulation of the blood; in other patients, life is sustained by means of electrical impulses that stimulate and regulate heart action; in others, suction developed by electrical means is routinely relied upon to remove body fluids and mucous that might otherwise cause suffocation. Lighting is needed in strategic areas in order that precise procedures may be carried out, and power is needed to safeguard such vital services as refrigerated stores held in tissue, bone and blood banks. The maximum acceptable delays prior to restoration of supply varies as a function of the area in question and the nature of the procedures undertaken.

Selecting vital areas and functions considered to be essential, designing safeguards to ensure continuity in these circuits, and maintaining the electrical and mechanical components of such essential services so that they will work when called on are complex problems that warrant standardized guidance for regulatory authorities, governing boards and administrators of hospitals, and architects and engineers concerned with their construction. Such guidance is offered in this Standard.

This Standard is only concerned with ensuring that, in the event of interruption of the normal electrical supply, emergency lighting and power will be restored to those circuits deemed to be essential (vital or delayed vital) to ensure that effective and safe care of patients can be maintained.

The Standard provides for a variety of forms of emergency power plant (e.g. batteries, static inverters and engine-driven generating sets) and for their automatic or manual operation.

Requirements for emergency evacuation lighting are primarily covered by reference to AS/NZS 2293.1, *Emergency evacuation lighting for buildings*, Part 1: *System design, installation and operation*, and in building regulations. However, this Standard includes some recommendations for location of emergency evacuation luminaires and exit signs for guidance of regulatory authorities and for those situations where the relevant building regulations are not specified.

In the preparation of this Standard, the Committee was especially requested to review closely what equipment necessitated 'no break' supply. In this regard, investigations and comments from hospital staff revealed that very few circuits genuinely necessitate instantaneous re-energization through 'no break' systems. As a result, most 'essential' circuits within hospitals have been allocated 'vital' (30 s) or 'delayed vital' (2 min) classifications by this Standard. These classifications provide for the use of more economical and practicable emergency power plant.

Investigations also revealed that specialist uninterruptible power supplies for sophisticated equipment, e.g. computers, are nearly always required to be 'tailored' to the specialist equipment they serve and are therefore usually 'extras' specified or provided by the equipment manufacturer. Accordingly, this Standard does not include requirements for such special power supplies, the details of which need to be negotiated with the equipment supplier.

The term 'informative' has been used in this Standard to define the application of the appendix to which it applies. An 'informative' appendix is only for information and guidance.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Electrical installations—Emergency power supplies in hospitals**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE This Standard sets out requirements for the design, installation and operation of emergency power supplies for power and lighting for hospitals. The Standard applies to the design, installation, operation and maintenance of those portions of the hospital electrical system in which the failure of the supply from the normal supply authority would jeopardize the effective and safe care of its patients.

Requirements for the wiring of the electrical installation for the normal supply to hospitals are specified in AS 3000 in Australia and the Electricity Regulations in New Zealand.

The Standard does not cover the special requirements for uninterruptible power supplies for computer equipment. These special power supplies should be the subject of separate specification and negotiation with the equipment supplier.

NOTE: This Standard does not apply to essential services (fire and smoke control equipment, emergency evacuation equipment and lifts) covered by AS 3000 in Australia and the Electricity Regulations in New Zealand.

1.2 PURPOSE The purpose of this Standard is to reduce the hazards which may arise from interruption of the normal power supply to a hospital or portion thereof.

This Standard—

- (a) specifies emergency lighting and power requirements for those portions of hospitals where restoration of such supply is considered necessary to patient care; and
- (b) specifies that minimum emergency evacuation lighting is to be installed in accordance with AS/NZS 2293.1 in locations designated by the relevant building regulations.

The Standard does not prescribe the type or size of hospital or patient-care area that requires emergency power supplies. Instead it identifies those medical treatment areas or functions of which regular usage necessitates restoration of lighting and power considered necessary to the continuing safe care of patients. This identification provides a basis for hospital administrators and designers to evaluate the need and type of emergency power and lighting to be provided in a patient-care area.

1.3 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS

1170	Minimum design loads on structures (known as the SAA Loading Code)
1170.4	Part 4: Earthquake loads
1359	Rotating electrical machines—General requirements
1939	Degrees of protection provided by enclosures for electrical equipment (IP Code)
2625	Rotating and reciprocating machinery—Mechanical vibration (all Parts)
2789	Internal combustion engines—Performance

AS	
2789.1	Part 1: Engines for land, rail-traction and marine use—Standard reference conditions and declarations of power, fuel consumption and lubricating oil consumption
2790	Electricity generating sets—Transportable (up to 25 kW)
3000	Electrical installations—Buildings, structures and premises (known as the SAA Wiring Rules)
3010	Electrical installations—Supply by generating set
3010.1	Part 1: Internal combustion engine driven sets
3200	Approval and test specification—Medical electrical equipment
(NZS 6150)	
3200.1.0	Part 1.0: General requirements for safety—Parent Standard
3731	Stationary batteries—Nickel-cadmium
3731.1	Part 1: Vented type
3731.2	Part 2: Valve regulated type
4029	Stationary batteries—Lead-acid
4029.1	Part 1: Vented type
4029.2	Part 2: Valve-regulated type
4029.3	Part 3: Pure lead positive pasted plate type
4044	Battery chargers for stationary batteries
4070	Recommended practices for protection of low-voltage electrical installations and equipment in MEN systems from transient overvoltages
AS/NZS	
1768	Lightning protection
2293	Emergency evacuation lighting for buildings
2293.1	Part 1: System design, installation and operation
2293.2	Part 2: Inspection and maintenance
2293.3	Part 3: Emergency luminaires and exit signs
3013	Electrical installations—Classification of the fire and mechanical performance of wiring systems
3100	Approval and test specification—General requirements for electrical equipment
NZS	
4219	Specification for seismic resistance of engineering systems in buildings
ISO	
2314	Gas turbines—Acceptance tests
NOHSC	
1007	National standard for occupational noise
2009	National code of practice for noise management and protection of hearing at work
BCA	Building Code of Australia
NZBC	The New Zealand Building Code
Regulations	
1993/75	The Electricity Regulations of New Zealand
NZ ECP4	New Zealand Code of Practice for Electrical Installations—Supply by Generating Systems Not Exceeding Low Voltage
NZ ECP36	New Zealand Code of Practice for Harmonic Levels

1.4 DEFINITIONS For the purpose of this Standard, the definitions below apply.

1.4.1 Conditional circuits—those circuits which are not required to have power restored within 2 min and for which power restoration is not considered necessary for continued patient care, but which may, for other reasons, be connected to the emergency power supply.

1.4.2 Delayed vital circuits—those circuits identified in Table 2.1 which can tolerate interruption of power supply for up to 2 min.

1.4.3 Emergency circuits—lighting and power circuits which, in the event of failure of the normal supply, will operate to permit necessary patient care to be continued.

1.4.4 Emergency evacuation lighting—lighting which is provided to ensure that the means of escape can be safely and effectively used at all times.

1.4.5 Emergency lighting—lighting necessary for patient care.

1.4.6 Emergency supply—a supply system used in the event of failure of the normal supply, in order to maintain operation of the installation or part thereof, for safety reasons.

1.4.7 Essential services—the electrical installations of building services classified by AS 3000 in Australia and the Electricity Regulations in New Zealand as essential for the safe operation of fire detection, warning and extinguishing systems, smoke control systems, evacuation systems and the safety of persons using lifts.

1.4.8 Fire-resistance level—a grading in minutes in accordance with the Building Code of Australia or the New Zealand Building Code for—

- (a) structural adequacy;
- (b) integrity; and
- (c) insulation.

1.4.9 Hospital—any premises registered by the appropriate government authority as a hospital.

1.4.10 Instantaneous circuits—those emergency circuits identified in Table 2.1 as requiring power restoration within 1 s.

1.4.11 May—indicates the existence of an option.

1.4.12 Normal supply—the hospital electrical supply.

1.4.13 Patient-care equipment—equipment used directly for patient care, diagnosis and/or treatment.

1.4.14 Self-contained emergency luminaire (self-contained exit sign)—an emergency luminaire (exit sign) containing or having mounted within 2 m of it, a battery, battery charger, inverter (where used), and the controls necessary for sensing failure of the normal supply and for changing over to the emergency supply, and vice versa.

1.4.15 Shall—indicates that a statement is mandatory.

1.4.16 Should—indicates a recommendation.

1.4.17 Supply authority—any person or organization engaged in the supply of electricity to the public or in the generation of electricity for supply directly or indirectly to the public, whether by virtue of any statute or any franchise agreement under any act or otherwise.

1.4.18 Vital circuits—those circuits identified in Table 2.1 as requiring power restoration within 30 s.

1.5 COMPLIANCE WITH OTHER STANDARDS The materials, equipment and methods used in the installation of electrical wiring for the supply and control of emergency power supplies shall, in addition to complying with this Standard, also comply with the appropriate requirements of AS 3000 in Australia and the Electricity Regulations in New Zealand.

SECTION 2 PROVISION OF EMERGENCY LIGHTING AND POWER

2.1 GENERAL This Standard does not prescribe that all hospitals need have a comprehensive system of emergency lighting and power.

NOTE: The question of emergency evacuation lighting is covered separately in AS/NZS 2293.1, and in relevant building regulations.

The need for an emergency supply, the extent of its reticulation, and the maximum delay in power restoration that can be tolerated, shall be evaluated for each individual hospital, account being taken of many factors including the following:

- (a) The procedures which are regularly undertaken and which involve patients whose care would be adversely affected by interruption of the electrical supply.
- (b) The frequency at which such procedures are undertaken.
- (c) The frequency at which areas are used for their designated function.
- (d) The availability of battery-operated or gas-operated equipment to continue critical procedures or resuscitate a patient.
- (e) The proximity of other hospitals to which critical patients may be transferred.
- (f) The number and type of alternative routes for normal supply(ies) to a hospital (and hence the security of the normal supply).
- (g) The continued availability of normal supply to hospitals.
- (h) The availability of adequate lighting to carry out critical procedures.

NOTE: Discussion on these matters, intended to assist authorities in establishing the need and extent of an emergency lighting and power system, appears in Appendix A.

2.2 AREAS TO BE PROVIDED WITH EMERGENCY LIGHTING AND POWER

Areas of hospitals in which it is intended to regularly undertake procedures on patients whose care would be adversely affected by interruption of electrical supply to lighting or equipment shall be equipped with lighting and power as prescribed in Table 2.1.

In addition, those other areas of a hospital where interruption of the normal supply to the area lighting would jeopardize the immediate safety of patients or staff shall be equipped with lighting as prescribed in Table 2.1.

NOTE: Stairways and corridors are provided with emergency evacuation lighting to a level not inferior to that prescribed in AS/NZS 2293.1.

2.3 LUMINAIRES

2.3.1 General Luminaires with self-contained or central battery supplies are required to provide service illumination in intensive patient care areas (see Table 2.1).

2.3.2 Illumination level Luminaires shall provide an average illumination level of 5 lux in areas of intensive patient treatment.

2.3.3 Specification and installation Luminaires shall be in accordance with AS/NZS 2293.3 and shall be installed in accordance with AS/NZS 2293.1

2.3.4 Arrangement and control Luminaires required by this Standard may be integrated with emergency evacuation lighting installed in accordance with AS/NZS 2293.1

2.3.5 Inspection and maintenance Luminaires required by this Standard shall be inspected and maintained in accordance with AS/NZS 2293.2.

2.4 OPERATING SEQUENCE

2.4.1 Circuits requiring instantaneous restoration of supply Circuits classified in Table 2.1 as 'instantaneous' shall be arranged so that the circuit is automatically energized within 1 s of failure of the normal supply.

NOTE: The maximum delay of 1 s is identical with that specified in AS/NZS 2293.1 for emergency evacuation lighting. The use of static inverters or battery supplies will usually be necessary to achieve this performance. The use of engine-driven generators, other than continuously running generators, will not usually ensure compliance with this requirement.

2.4.2 Circuits classified as 'vital' Circuits classified in Table 2.1 as 'vital' shall be arranged so that they are automatically energized by the emergency supply within 30 s of failure of the normal supply.

NOTE: Any form of emergency power plant complying with the requirements of Section 3, 4, 5 or 6 may be used to service 'vital' circuits.

2.4.3 Circuits classified as 'delayed vital' Circuits classified in Table 2.1 as 'delayed vital' shall be arranged so that they are automatically energized by the emergency supply within 2 min of failure of the normal supply.

NOTES:

- 1 Any form of emergency power plant complying with the requirements of Section 3, 4, 5 or 6 may be used to service 'delayed vital' circuits.
- 2 The maximum delay of 2 min is considered to provide for the operation of smaller generators which may not be automatic in operation, e.g. remote push-button manual start.
- 3 Table 2.1 does not preclude the transferring to the emergency supply at one time of the loads of the vital circuits, the delayed vital circuits, or any or all of the other loads, e.g. conditional circuits, that are part of the electrical system. It is assumed, however, that this option may reduce the assurance that the vital circuit of the system will have power when required and therefore should be chosen only after a study of the system has shown that this is not the case.

2.5 EMERGENCY POWER SOURCE

2.5.1 Types of supply The power source to emergency lighting and power circuits may derive from—

- (a) engine-driven generating sets (see Section 3);
- (b) central battery systems (see Section 4);
- (c) static inverter systems (see Section 5);
- (d) self-contained, single-point supplies (see Section 6);
- (e) the supply authority, if the normal supply is an on-site generator; or
- (f) the supply authority, if from two independent reliable feeders (see Paragraph A7.3).

The emergency supply shall comply with the relevant requirements of Sections 3, 4, 5 and 6 as appropriate to the type of source.

2.5.2 Controls and instrumentation The controls and instrumentation for emergency power supplies, including transfer and changeover facilities shall comply with the requirements of Section 7.

2.5.3 Electrical installation The installation of wiring and equipment used to reticulate the power supply to emergency circuits shall comply with the requirements of Section 8.

2.5.4 Fire resistance Emergency power supplies shall—

- (a) where located internal to the building which they serve, be housed in a room or enclosures with a fire-resistance level of not less than 120/120/120 in accordance with the Building Code of Australia or the New Zealand Building Code; or

- (b) where not located internal to the buildings which they serve, be separated from the buildings which they serve by an air space of at least 6 m or by a physical barrier which has a fire-resistance level of not less than 120/120/120 in accordance with the Building Code of Australia or the New Zealand Building Codes.

NOTE: Power supplies housed in accordance with Item (b) above may need additional protection against local external conditions (e.g. fire breaks to guard against bush fires).

Wiring from the power source shall comply with the relevant requirements of Section 8.

TABLE 2.1
CLASSIFICATION OF EMERGENCY CIRCUITS

Area or facility	Extent and classification (delay) of emergency supply (1)					
	Proportion of emergency lighting to be provided and maximum time delay that can be tolerated (may be reduced where self-contained battery-operated luminaires are available)			Proportion of emergency power to be provided and maximum time delay that can be tolerated (may be reduced where battery-operated equipment is used or available)		
	Instantaneous (within 1 s)	Vital (within 30 s)	Delayed vital (within 2 min)	Instantaneous (within 1 s)	Vital (within 30 s)	Delayed vital (within 2 min)
Angiographic laboratories	1 unit (4)	1/3	—	—	Total	—
Bathrooms and toilets (other than ensuite)	—	Selected (2)	—	—	Selected (2)	—
Blood bank refrigerators	—	—	—	—	—	Total
Blood bank type and cross matching areas	—	—	1/3	—	—	Selected
Cardiac catheterization laboratories	1 unit (4)	1/3	—	—	Total (3)	—
Coronary care units	—	1/2	—	—	4 power points/bed	—
Diagnostic laboratories	—	1/3	—	—	—	Selected
Necessary communication systems	—	—	—	—	Total	—
Emergency department treatment rooms	—	1/2	—	—	2 power points/bed	—
Emergency nurse call systems	—	—	—	—	Total	—
Emergency power supply auxiliaries	1 unit (5)	1/3	—	—	Total	—
Food preparation areas (kitchens)	1 unit (5)	—	—	—	—	Selected
Hyperbaric facilities	—	1/3	—	—	Total	—
Intensive care units	—	1/2	—	—	Total	—
Labour and delivery suite	—	1/3	—	—	—	Selected
Lifts in which dependent patients may be transported	—	—	—	—	—	Selected (5)
Modification preparation and storage areas	—	—	Selected	—	—	Selected

(continued)