NZS 6104:1981

Specification for EMERGENCY ELECTRICITY SUPPLY IN BUILDINGS

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Declared on 22 May 1981 by the Standards Council to be a standard specification pursuant to the provisions of section 23 of the Standards Act 1965.

First published May 1981

The following SANZ references relate to this Standard:

Project No. P 976
Draft for comment No. DZ 6104
Printing code: 1M–1981/7006/16666

AMENDMENTS

No.	*Date of issue*	*Description*	*Entered by, and date*

Printed by Tolan Printing Co. Ltd.

NEW ZEALAND STANDARD

Specification for EMERGENCY ELECTRICITY SUPPLY IN BUILDINGS

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COMMITTEE REPRESENTATION

This Standard was prepared under the supervision of the Electrical Engineering Sectional Committee (61/-) for the Standards Council, established under the Standards Act 1965. The committee consisted of representatives of the following:

Department of Scientific and Industrial Research —
Christchurch Industrial Development Division
Physics and Engineering Laboratory
* Electric Supply Authority Engineers Institute of New Zealand
Ministry of Energy —
Electricity Division
* Ministry of Works and Development
New Zealand Electrical Contractors Federation
New Zealand Electrical Manufacturers Federation
New Zealand Government Railways Department
New Zealand Institute of Electricians
* New Zealand Institution of Engineers
New Zealand Vice-Chancellors Committee
Post Office
Technical Institutes Association

The Emergency Electric Power Supply Project Committee (61/1) was responsible for the preparation of the Standard and consisted of representatives from the following organizations in addition to those marked with an asterisk (*) above:

New Zealand Fire Service
Otis Elevator Company Limited
Insurance Council of New Zealand

RELATED DOCUMENTS

In this document reference is made to the following:

NEW ZEALAND STANDARDS

NZS 1900:—	*Model building bylaw* —
Chapter 5: 1963	*Fire-resisting construction and means of egress*
*NZS 4219:0000	*Seismic resistance of engineering systems in buildings*
NZS 4503:1974	*Code of practice for the distribution, installation and maintenance of hand operated fire fighting equipment for use in buildings*
*NZS 4541:0000	*Rules for automatic fire-sprinkler installations*
NZS 6742:1971	*Code of practice for emergency lighting in buildings*

*In course of preparation

BRITISH STANDARDS

BS 3863:1979	*Guide for gas turbines procurement*
BS 4999:—	*General requirements for rotating electrical machines*
BS 5514:—	*Specification for reciprocating internal combustion engines: Performance*

NEW ZEALAND LEGISLATION
Dangerous Goods Act 1974

The users of this Standard should ensure that their copies of the above mentioned New Zealand Standards or of overseas standards endorsed as suitable for use in New Zealand are the latest revisions or include the latest amendments. Such amendments are listed in the annual SANZ *Index* which is supplemented by lists contained in the monthly magazine *Standards* issued free of charge to committee and subscribing members of SANZ.

FOREWORD

This Standard provides a method of protecting the electricity supply to emergency services in buildings, to cater for the occurrence of emergencies and of interruptions in the normal public mains supply.

Background

Any building must contain provisions for coping with a variety of emergencies, the most likely of which is fire. Other emergencies may occur but since fire is usually the most complex, the others are deemed to be covered if fire is provided for.

The loss of power in itself is not usually serious, but it compounds the difficulties that arise in an emergency. The building design must provide for the safe and speedy evacuation of occupants at any time, and for fire control, rescue parties and the like to move quickly and freely through the building.

Safe evacuation is aided by emergency egress lighting, which is a bylaw requirement for many classes of building. Thereafter the basic essential in minimizing fire damage is to extinguish the fire. In a multi-storey building, prompt achievement of this object is assisted if electricity supply is maintained for lifts, ventilation (for smoke clearance), internal water-pumping facilities, and lighting.

Interruptions to the national or local electricity supply may be relatively infrequent, but usually arise from causes remote from the buildings affected. (For any particular locality periods of scheduled interruption may be significant.) If the cause is an earthquake, some fires may be expected to follow. Hence each large building should have an alternative power source to satisfy emergency needs. Duplicated service feeders to a building from the local supply system are not considered to result in any significant improvement to the security of the supply; this Standard recognizes only a generating plant installed on the premises.

Outline of requirements

The alternative power source specified is a generator driven by a prime mover, with a supply of fuel oil held on the premises so that in times of emergency the building and its services can, temporarily at least, remain self-sufficient. The customary prime movers are diesel engines, but the Standard also allows the use of gas turbines burning diesel fuel.

To ensure full realization of the potential of the emergency generating equipment, the electrical reticulation through the building should have comparable security. The requirements included are based on the use of normal 3-phase, 230/400 V reticulation. Other systems may need additional consideration.

The generator capacity specified is based on emergency needs, and does not require sufficient provision to allow business as usual for commercial convenience. If an owner elects to so require, precautions should be taken to ensure that the integrity of supply to the emergency services is not jeopardized.

The requirements of this Standard do not extend to the special features of applications where there is a necessity for highly reliable, or no-break supply. (Examples include hospitals, airport services, navigation aids, communications, military or civil defence, computer installations, or critical industrial processes.) In such cases, however this Standard may be found useful as a basic reference.

Suggestions for improvement of this Standard will be welcomed. They should be sent to the Director, Standards Association of New Zealand, Private Bag, Wellington.

NEW ZEALAND STANDARD

Specification for EMERGENCY ELECTRICITY SUPPLY IN BUILDINGS

GENERAL

1 SCOPE

1.1 This Standard specifies a means of providing an emergency electricity supply in a building served by conventional 230/400 V single-phase/three-phase reticulation. The quality of supply specified relates to general commercial multi-storey buildings and applies to general purpose emergency services where a short break can be readily tolerated. The Standard does not relate to installations having special requirements for high reliability or continuous (no-break) supply.

1.2 The electricity source specified is a generator driven by a diesel engine or a gas turbine. The Standard sets out requirements for this generating plant and its accommodation; specifies the emergency loads to be supplied, and the wiring distribution within the building; and describes the actions necessary to commission and maintain the installation.

NOTE (1) Attention is drawn to legal requirements which may apply, such as regulations concerning dangerous goods, electrical wiring, and radio interference; and rules concerning power lift installations.

(2) In any particular case, interested parties (for example building owners, architects, lending or insurance institutions) may wish to specify more exacting requirements to suit their particular interests. It is recommended that these requirements be considered at the preliminary design stage.

(3) An acceptable method of meeting requirements for emergency lighting is set out in NZS 6742. Power for emergency lighting may, at the building owners' choice, be derived from a separate supply (batteries or generator) or from the generating plant complying with this Standard. If the latter, the requirements of whichever Standard is most stringent must be met. (See Notes to 305.1.1 and 406.2.)

(4) Where pumps for secondary water supply to fire sprinklers in compliance with NZS 4541 are driven by an electric motor, the motor may be supplied by this generating plant at the owner's option.

(5) In cases such as small buildings, or very large buildings with high-voltage reticulation to transformers at different locations, the detailed requirements of this Standard may be modified at the discretion of the designer, provided that an installation of equivalent reliability is ensured.

2 REFERENCES

2.1 The full titles of reference documents cited in this Standard are given in the list of "Related Documents" immediately preceding the Foreword.

2.2 Where any other Standard named in this Standard has been declared or endorsed in terms of the Standards Act 1965, then –

(a) Reference to the named Standard shall be taken to include any current amendments declared or endorsed; or

(b) Reference to the named Standard shall be read as reference to any Standard currently declared or endorsed as superseding the named Standard, including any current amendments to the superseding Standard declared or endorsed.

NOTE – The date at which an amendment or superseding standard is regarded as "current" is a matter of law depending upon the particular method by which this standard becomes legally enforceable in the case concerned. In general, if this is by contract the relevant date is the date on which the contract is created, but if it is by Act, regulation, or bylaw then the relevant date is that on which the Act, regulation, or bylaw is promulgated.

3 DEFINITIONS

3.1 For the purpose of this Standard, unless inconsistent with the context the following definitions apply:

EMERGENCY means any unusual or undesirable event which jeopardizes the safety or security of a building or its occupants.

EMERGENCY SERVICES means all those service features and facilities installed in a building, which must be given priority as regards electricity supply during and after the occurrence of an emergency.

FIRE RESISTANCE RATING (FRR) is as defined in NZS 1900 Chapter 5.

PART 1 SEISMIC REQUIREMENTS

101 DESIGN FOR SEISMIC EFFECTS

101.1 The complete installation shall be designed and installed to allow for seismic loading and displacements, to a level commensurate with the loadings for which the building is designed. An installation which is designed in accordance with the requirements of NZS 4219 shall be deemed to satisfy this requirement.

PART 2 BUILDING REQUIREMENTS

201 LOCATION

201.1 Flood protection. The equipment shall not be housed in locations that are subject to flooding.

NOTE — Basements may be liable to be flooded by stormwater or burst pipes, and sump pumps do not normally have sufficient capacity to deal with these eventualities.

201.2 Accommodation. The room which accommodates the generator and its control panel shall be separate from the main switchboard room, with separate access and with a minimum 1 h FRR separation between the rooms. The emergency-supply switchboard may also require separate accommodation (see 403.1).

NOTE — To cope with accidental release of liquids such as fuel or water, it is desirable to provide means of containment and a low point for subsequent removal.

201.3 Accessibility. The access should be such that it is not liable to be blocked by any further building development in the area.

201.4 Environment. Provision shall be made for minimizing the adverse effects of noise and fumes when the generating plant is running for routine test purposes.

NOTE (1) As the plant is likely to run only intermittently (that is, once a month during routine testing), this clause should not be taken to require the exhaust system to extend above roof level. (See also 303.2)
(2) Compliance with this requirement must not impede the supply of air for aspiration and cooling. (See 205.)

202 CONSTRUCTION

202.1 Separation. The rooms shall be rodent-proof and fire-isolated from the rest of the building by fire-resistant construction as follows: in buildings protected by a water sprinkler system complying with the relevant standard the FRR shall be at least 1 h; in all other cases the FRR shall be at least 2 h.

202.2 Design loadings. The floor shall be of adequate bearing strength to allow the equipment to be installed and fixings provided for anchoring to resist seismic forces (see 101.1).

202.3 Services. No piped services, other than those required for this installation or for fire protection of the room, shall enter these rooms. Where penetrations of the walls, ceiling or floor are necessary for cables or pipes, the FRR and the noise rating shall be maintained after making good.

203 ACCESS

203.1 Access shall be suitable for the installation of equipment, daily servicing, and removal as necessary for replacement purposes. All doors must open outwards and be fitted with a self-closing device, unless there is a requirement for a fire-resistance rating which demands some other construction.

204 SPACE REQUIREMENTS

204.1 The space requirements will depend on the arrangement and size of the equipment determined by the capacity. A minimum of 750 mm clearance space shall be provided round all equipment for maintaining and operating such equipment. The space shall be used exclusively for this equipment.

205 VENTILATION

205.1 The ventilation shall be such that sufficient fresh air from outside the building is available to ensure that the correct operating temperature of the generating plant is not exceeded when operated continuously.

205.2 Ventilation ducts shall be protected for their length in the building by fire resistant construction as in 202.1. The room through which the duct passes may provide this protection.

205.3 The ventilation opening in the outside wall shall be not less than 3 m from any other opening in the same building or in any adjacent buildings.

206 FINISH

206.1 All internal surfaces of the rooms, including floors, shall have a surface finish which will minimize production of dust as far as possible. Painting will be an acceptable finish.

207 FIRE EXTINGUISHERS

207.1 Hand operated fire fighting equipment sufficient to cover the emergency plant shall be provided. Provision according to NZS 4503 will satisfy this requirement.

208 EMERGENCY SERVICING LIGHT

208.1 A permanently-fixed battery-operated light, with power supply independent of any starting battery and control battery, shall be provided in the generator room. The battery capacity shall be sufficient to maintain the lighting for at least 30 min.

NOTE — See also 305.5.2.

PART 3 EMERGENCY GENERATING PLANT

301 LOAD CAPACITY

301.1 Basic loads. The system shall cater for the following loads:

(a) Electrically-driven auxiliaries of the prime mover, and the starting-system recharge equipment

(b) Lifts required for emergency use, on the assumption that within each lift bank, only one lift at a time will operate

(c) Any permanent load required for absorbing regenerated power to comply with 502.1

(d) All fans required for smoke clearance

(e) Water supply pumps for fire sprinkler systems, hose reels, and riser mains, if not otherwise provided for

(f) Any other electrically-operated systems or equipment intended for use in the event of fire

(g) Emergency lighting when connected to this plant

(h) The sum of the loads of any other equipment which can be switched on to this generating plant, except as provided in 301.2.

301.2 Additional loads. Loads not covered above may be connected without requiring increased generating capacity, if facilities are provided for disconnecting these loads whenever the generator approaches the full load condition. This control shall be automatic unless the plant is under continuous manual supervision.

301.3 Sequence starting. In order to assist in obtaining an economical installation, sequence connection of motor loads will be acceptable. This sequence shall be in the following order where applicable:

1. Emergency lighting (within the time limit specified by any operative mandatory requirement)
2. Power for secondary water-supply sprinkler pumps.
3. Ventilating plant, when designed and required for smoke clearance
4. Lifts, if any
5. Power to fire hose reel booster pumps.
6. Power to wet riser main boost pumps
7. Any other loads.

301.4 Generator and prime mover capacity. The generator output (apparent power in kVA and active power in kW) shall be sufficient to carry the basic loads, and to handle any motor starting loads which may be imposed, without excessive fluctuation of the output voltage. The prime mover output power in kW required to serve as the generator input, is the total load (generator output) in kW divided by the efficiency of the generator. A suitable procedure to determine these power ratings is given in Appendix A.

302 DESIGN AND CONSTRUCTION

302.1 Response criterion. The emergency plant shall be such that full speed may be attained and initial load applied within 15 s from the initiating signal. The plant shall accept full load within a further 30 s (45 s total).

302.2 Prime mover. The prime mover shall be either a compression-ignition engine or a gas turbine operating on fuel oil as defined in the Dangerous Goods Act 1974. Diesel engines shall comply with BS 5514 in respect of definitions, standard operating conditions, power ratings, governing, testing and torsional critical speeds. Gas turbines shall be rated according to BS 3863. See Appendix B for rating requirements.

302.3 Generator. The generator shall comply with appropriate standard requirements as set out in Appendix C. When operating with its associated prime mover, on application of full load the voltage dip shall not exceed 25%, and within 500 ms the voltage shall be restored to within 5% from normal.

302.4 Assembly. The prime mover, generator, coupling and base shall be selected as compatible units. The assembly shall be shown to be torsionally satisfactory by computer analysis or extensive prototype testing. All media for transmission of power shall be rated within normally accepted limits specified in the appropriate standards. Provision shall be made to ensure that the units can be separated and reassembled and the alignment maintained.

NOTE – Attention is drawn to the advisability of using equipment for which adequate spare parts are available in stock in New Zealand. (See also 602.3.)

302.5 Works testing. The supplier shall test the operation of the prime mover and generator assembly with a controlled load and shall verify compliance with the performance and power rating requirements.

303 GENERATING PLANT INSTALLATION

303.1 Fuel supply

303.1.1 A separate fuel tank shall be provided in the generating plant room for each prime mover, having capacity for a minimum of 8 h operation of the generating

plant on full load. The filling point for each fuel tank shall be located so that fuel is not likely to spill on equipment or batteries.

303.1.2 A fuel-level gauge, readily visible, shall be provided for each of the above tanks. This gauge shall be marked at the 2/3 full level to indicate replenishment required. The gauge shall be of a type which, if damaged or broken, will not cause leakage of fuel.

303.1.3 Fuel line arrangements shall prevent the intake of sludge and sediment and the occurrence of air locks. Any valve in a fuel line shall have a clear indication of open and closed positions. Fuel lines shall be protected from excessive heat and from external mechanical damage.

303.2 Exhaust. Each exhaust system shall be provided with a silencer and a system of pipes or ducts to discharge all fumes to the outside of the building, well away from any window or fresh-air inlet to the building or to any adjacent buildings (see 201.4). All pipes and fittings shall be shielded as necessary to protect persons from the risk of burns and to ensure that no exposed combustible material is heated above 70 °C.

303.3 Cooling. Each prime mover shall have its own cooling system (where applicable), either air or water. Such cooling systems shall be independent of outside sources of supply including mains water. Where water is cooled outside the building, by means of a cooling tower or pond, or otherwise, steps shall be taken to ensure that effective cooling is not lost due to the action of fire on the cooling pipes.

303.4 Mounting. To minimize the effect of vibration from the plant, each assembly may be installed on suitable resilient mountings on foundations specifically designed for the purpose.

303.5 Danger notice. A warning notice shall be mounted in a conspicuous position over or near the generating plant, to draw attention to the possibility that sudden starting may pose a danger to persons in the vicinity. An example of suitable wording is –

DANGER:
THIS MACHINE MAY START AUTOMATICALLY WITHOUT WARNING
KEEP CLEAR!

304 STARTING POWER SUPPLY

304.1 For each prime mover an exclusive system shall be provided for the sole purpose of starting the prime mover, and shall comprise a reserve of stored energy together with automatic charging equipment. The system shall have capacity sufficient for two operations of a repeat-start cycle as described in 304.2, the first cycle beginning with a fully-charged energy reserve, and the second cycle after a 4 h recovery period. During this recovery period the charging equipment shall automatically replenish the reserve sufficiently to operate the second cycle. Thereafter, within a further period of 20 h the charging equipment shall achieve full replenishment of the reserve, ready for another two repeat-start cycles as before (and so on every 24 h). The reserve storage medium and the charging equipment shall be compatible to ensure that when no starts are attempted, the reserve is maintained against normal leakage without detriment.

304.2 The starting system shall operate with the prime mover unheated in an ambient temperature of 10 °C. The repeat-start cycle shall be:

(a) For diesel engines with electric starters or air-motor starters:
Three separate automatic starting attempts, each of not less than 5 s duration at intervals of not more than 5 s, followed by manual start attempts totalling a further 15 s

(b) For diesel engines having direct air starting:
Three successive automatic starting attempts of appropriate duration followed by three manual start attempts

(c) For gas turbines:
Comparable with (a) or (b) to ensure equivalent reliability.

304.3 Equipment in the form of hydrometers, pressure gauges and the like shall be provided in the engine room to facilitate checking the state of charge of the energy source. Any portable equipment shall be mounted or contained in a suitable cabinet.

304.4 For a diesel engine installed in a location where the ambient temperature is likely to fall below 10°C, provision shall be made to facilitate starting, either by use of heating or by an excess fuel device, automatically controlled.

NOTE – The latter will conserve energy, and is usually more effective for air-cooled engines.

304.5 Starter batteries shall be located close to the starter, in a position that will avoid the spilling or dripping of acid on to vital equipment. The batteries shall be covered with a lid of insulating material.

NOTE – See also 305.5.2.

305 CONTROLS

305.1 Automatic functions

305.1.1 The controls shall ensure the normal automatic operation of the emergency electricity supply including monitoring of the starting system, sensing of the supply voltage, starting of the generating plant, monitoring of generator voltage, transfer of load, monitoring of protection, unloading and stopping of generating plant.

NOTE – If this plant is to meet the requirements of NZS 6742, attention is drawn to the specific requirements for sensing of power failure in that Standard.

305.1.2 The operation of charging equipment for the starting energy reserve, and of any engine heating facility, shall be continuously monitored to ensure that the circuit is alive. Any defect occurring shall raise a FAULT alarm.

305.1.3 The voltage of the supply mains shall be continuously monitored. In the event of a fall in voltage, down to or below 80% of nominal for longer than 3 s, on one or more phases in any combination, the emergency load shall be disconnected from the mains supply and the automatic starting sequence of 304.2 shall be initiated.

305.1.4 If the plant does not start after completion of the automatic sequence, a FAIL TO START alarm shall be raised.

305.1.5 The generator output shall be monitored, and when it has stabilized the load shall be connected to the generator, subject to any sequence starting arrangements for large motor loads. A GENERATOR RUNNING signal shall be raised.

NOTE – Where the emergency load includes lifts, it will be necessary to ensure that the base load on the generating plant is never less than half the lift load which may be imposed during emergency running, to absorb regenerated power (see 502.1).

305.1.6 While the generating plant is running, prime mover auxiliary service conditions (for example, oil pressure, temperature and speed) shall be monitored continuously. When any parameter goes outside the limits specified by the supplier, the generating plant shall be unloaded and stopped, and a FAULT alarm shall be raised.

305.1.7 When the mains supply voltage returns to above 80% of nominal on all phases and remains so for at least 3 min, the emergency load shall be disconnected from the generator and reconnected to the mains. For large motor loads, a time delay of a few seconds may be necessary, to prevent out-of-synchronism connection of motors which generate power briefly while their momentum runs down. (See also 502.1, Note 3.)

305.1.8 Where the prime mover supplier has specified a light-load running period before stopping (for example, to avoid undue thermal stresses), compliance with this requirement shall be incorporated in the control system. The generating plant shall then be stopped and remain ready for the next occasion of service (subject only to replenishment of the starting energy reserve).

305.2 Alarms

305.2.1 All alarms and signals shall be displayed on the generating plant control panel, and extended to a regularly supervised central alarm location if one exists for the building.

305.2.2 The GENERATOR RUNNING signal shall in addition be displayed as an indicator light visible from outside the building, mounted near the Fire Service attendance point.

305.2.3 The FAIL TO START alarm and the SHUTDOWN alarm shall in addition be displayed adjacent to the generator running signal or in another readily observable location. Instructions to call the appropriate responsible person shall be located adjacent to the alarm display.

305.3 Manual facilities

305.3.1 A MANUAL START control shall be provided, mounted on the prime mover, and arranged to energize the fuel solenoid if appropriate, and start the plant, independently of all automatic control circuitry. A clear warning notice shall be associated with this control, stating that when started by this means the plant will not have the protection of automatic safety monitoring (see 305.1.6) and hence must not be left to run unattended.

305.3.2 The controls shall include a single MANUAL TEST switch coupled with such other devices as are necessary to enable the test switch to function as follows:

(a) The test switch in its first position, labelled TEST, shall break the mains supply to the emergency circuits and cause the starting sequences (see 305.1.3) to occur; the electrical load connected shall be not less than half the rated load of the generating plant.

NOTE – It may be necessary to provide some artificial load (inductive or resistive) to connect to the system when testing the generator at times when the load is very light.

(b) The test switch in its second position, labelled AUTOMATIC, shall restore the mains supply to the emergency circuits and cause the shutdown sequence (see 305.1.7 and 305.1.8) to occur.

305.4 Construction

305.4.1 All electrical relays and controls shall be accommodated in a non-combustible enclosure and protected against dust and fumes. Plug-in relays shall have a positive retaining device unless mounted vertically to prevent disconnection due to vibration.

305.5 Power supply

305.5.1 Controls, alarms and signals may have a separate battery and power supply system, or may be supplied from any starting battery system if specifically designed and type tested to operate under the low terminal voltage conditions of cold starting.

305.5.2 All batteries shall be located near each other.

305.6 Access

305.6.1 Provision shall be made for restricting access to control switches. This requirement may be met by a lock on the room door, provided that a key is mounted in a break-glass enclosure adjacent to the door.

305.7 Parallel connection of generators

305.7.1 If more than one generator is required, it is recommended that the emergency load be divided into separate sections so that parallel operation is avoided when under automatic control. However, for purposes of overall operating economy, it is permissible to have appropriate switching arrangements to enable sections of load to be combined and generators synchronized.

305.7.2 Where automatic parallelling is installed, provision shall be made for testing the facility without disruption to the building load. Special attention to protection facilities will be necessary.

306 INSTRUMENTS

306.1 Instruments shall be provided to indicate prime mover operating conditions (for example, lubricating-oil pressure, coolant temperature); fuel capacity; hours run; generator load (including frequency, voltage, instantaneous current, and maximum demand current with an integrating period of not more than 15 min); and battery charge/discharge current.

307 EXTERNAL CONNECTIONS

307.1 Where the generating plant is flexibly mounted all connections to it (including fuel, exhaust, wiring) shall include flexible portions.

308 OPERATING INSTRUCTIONS

308.1 Operating instructions, together with details of essential maintenance requirements as described in Part 8 of this Standard shall be prominently displayed in the generator room, in a glazed frame. The log book referred to in 801.3 shall also be kept in this room, or its location clearly indicated in the maintenance instructions.

PART 4 SWITCHBOARDS AND RETICULATION

401 CONSTRUCTION

401.1 All switchboards and control panels associated with the emergency power supply shall be constructed, as far as is practicable, of non-combustible materials, and so as to provide a close-fitting enclosure for all wiring.

402 LOCATION OF SWITCHBOARDS

402.1 Switchboards and control panels shall be located in rooms or cupboards or otherwise arranged to be not directly accessible to unauthorized interference.

403 EMERGENCY ELECTRICITY SUPPLY MAIN SWITCHBOARD

403.1 A separate switchboard exclusively for the supply of emergency circuits shall be installed for the emergency electricity supply. The switchboard shall be normally fed by a submain cable from the main building supply board. This switchboard must be totally metal-enclosed and if further than three floors from street access level shall be accommodated separately from the main switchboard in a room complying with 202.1. If within three floors from street access level the emergency switchboard may be located adjacent to the building main switchboard. There shall be either a 150 mm air gap or a non-combustible barrier between this switchboard's enclosure and that of the main building supply switchboard.

NOTE – Alternative construction of a composite switchboard with inherent internal segregation may be acceptable if subject in each case to specific design to ensure equivalent protection against spread of fire or arcing.

403.2 A device or devices shall be fitted in the emergency-supply-switchboard for automatically changing the connection from the public supply to the emergency supply. These changeover facilities shall incorporate precautions against the possibility of connection between the emergency supply and the public supply. Acceptable changeover facilities include:

(a) Two separate magnetically operated contactors, fitted with at least a mechanical interlocking device, and with contact separation on each pole large enough to prevent any possibility of feedback under any conditions of use;

(b) Interlocking or remotely closed circuit breakers, static switching devices, or other arrangements where equivalent safeguards are provided to the satisfaction of the local electrical supply authority.

NOTE (1) Public supply lines are on occasions isolated from the supply so that work may be done on them. Any power feedback into these lines from their load side would endanger those doing the work. By reverse transformation, high-voltage or extra-high-voltage lines might also become alive at full working voltage, thus extending the danger. Prevention of feedback is therefore of prime importance.

(2) Where mechanical interlocking cannot be provided readily, shunt trip devices shall be provided and connected so that even in the event of a malfunction which would allow two circuit breakers or the like to close simultaneously, one at least is immediately tripped.

403.3 Where not intrinsically incorporated, it is recommended that provision should be made by means of interlocked switches or a multiposition switch to bypass manually the automatic changeover facility in the event of failure. Any such provision must not defeat the interlocking safeguards required to comply with 403.2 as a precaution against power feedback. Further provision should be made for isolation of the automatic changeover facility by means of isolating switches, removable links, or withdrawable chassis.

404 EMERGENCY ELECTRICITY SUPPLY DISTRIBUTION

404.1 Emergency service distribution boards

404.1.1 For emergency services not dealt with in 404.2, sub-distribution switchboards, to which no connections are made other than for emergency services, shall be provided where appropriate throughout the building.

404.1.2 These emergency switchboards shall be metal-enclosed and may be adjacent to main distribution switchboards.

404.2 Emergency-service control panels

404.2.1 Control panels used exclusively for each of the emergency-service elements, lifts, smoke-clearance ventilators, riser-main pumps and sprinkler pumps, and housed in each case in its machine room, may incorporate main and emergency supplies within the same enclosure, provided the construction of the room complies with 202.1. Where changeover from main supply to emergency supply is to be effected within these panels, the relevant requirements of 403.2 shall be met.

404.2.2 Alternatively, the total supply to these control panels (except lifts – see 404.2.3) may be taken from the emergency service in the building and provision made by suitable control circuits to disconnect automatically that portion of the total load which is not required under emergency conditions.

NOTE – In this case, the main-switchboard changeover contactor or other device may need to have a higher rating.

404.2.3 The alternative supply arrangement of 404.2.2 is permitted for the lifts if the emergency supply main switchboard is within three floors from street access level, otherwise 404.2.1 applies.

405 SUPPLY TO EMERGENCY SERVICES

405.1 Lift supply. Supply shall be taken direct from the emergency supply main switchboard to the lift-machine room by a separate feeder cable or feeders.

405.2 Ventilation-plant supply. The control panel of any ventilation equipment required to operate for smoke clearance shall be connected directly from the emergency supply main switchboard.

405.3 Fire pump supply. Separate feeder cables shall be connected from the emergency supply main switchboard to each riser-main pump, each sprinkler-system pump and each fire hose reel booster pump.

405.4 Other distribution boards. For any emergency lighting supplied from this plant, and for any other emergency services not dealt with in 405.1 to 405.3, each distribution board shall be connected directly to the emergency supply main switchboard by a submain cable or by risers electrically separated from any other submain cables or risers.

406 FIRE PROTECTION OF EMERGENCY WIRING

406.1 Except for final subcircuits, lift supply, and control circuits within the generating plant room, the wiring of emergency services shall either be wired with MIMS cables, or be installed in shafts or ducts separated from the remainder of the building by construction having a FRR of at least 1 h.

406.2 Subcircuit wiring for emergency services may be run together with other subcircuit wiring provided that where emergency and main distribution boards are adjacent, the wiring shall be segregated at the distribution boards. This segregation may be achieved by reasonably sealing the access from conduit, trunking or ducting to the distribution boards. Any final subcircuits which exceed 30 m in length shall be wired with MIMS cable.

NOTE – Further requirements for wiring of emergency lighting in NZS 6742 may have to be satisfied.

406.3 Lift supply shall be routed via the lift shaft or via enclosures protected by fire resistant construction as in 202.1.

406.4 Where control circuits and systems are provided to link the controls of the emergency generator plant and any motors which are to be started in sequence to meet the requirements of 301.3, the wiring of such systems shall be protected as in 406.1.

NOTE – Steel conduit does not provide fire protection.

406.5 Submains or risers for emergency supplies shall not pass through structural air shafts.

406.6 Submain cables for other than emergency supplies are permitted in the same enclosure as emergency supplies provided that a 50 mm clearance is maintained between such cables and those of the emergency service.

406.7 Where cables, conduits or trunking penetrate walls, ceilings or floors, the fire-resistance rating shall be maintained by suitable barriers.

407 ELECTRICAL PROTECTION

407.1 Discrimination. All over-current devices shall be selected so that a short-circuit fault anywhere in the system will open-circuit only the over-current device nearest the fault.

NOTE – On larger plants, consideration should be given to field-forcing equipment to ensure clearing of circuit faults.

407.2 Power factor. Care must be taken to ensure that, in the event of the loss of mains power, emergency plant is not over-corrected by power-factor-correction capacitor banks.

407.3 Load balancing. Special attention shall be given to the disposition of single-phase loads to ensure that balance is reasonably satisfactory.

NOTE – Balancing of load to be supplied from an emergency generating plant is far more critical than is normally required for load supplied from a public supply system. In particular, unbalanced load on an emergency generator can cause poor voltage regulation. Much closer attention than normal should therefore be given to this balancing.

408 IDENTIFICATION

408.1 All switches and circuit-protection devices associated with emergency electricity supply shall be clearly identified as associated with the emergency supply, and shall be clearly marked with the name of the function that they control. Where several switches are mounted together, they may be identified as a group by location or colour or other suitable means. A single large label "EMERGENCY SUPPLY" may be provided to identify each such group.

408.2 To facilitate total isolation, a CAUTION label shall be mounted on the main switchboard to indicate the existence and location of the emergency-supply switchboard if it is not adjacent.

PART 5 SPECIAL REQUIREMENTS FOR LIFT INSTALLATIONS

501 CONTROL ARRANGEMENTS

501.1 Control circuits shall be provided between the emergency generator plant and the lift machinery, arranged so that appropriate control sequences are introduced whenever the lifts are being supplied from the emergency generator. The wiring of these circuits shall be protected as for the lift supply. (See 406.3.)

502 REGENERATED POWER

502.1 Permanently connected load shall be provided, sufficient to absorb any regenerated power from the lift plant.

NOTE (1) When a lift is operating with an overhauling load, such as full load downwards, power is generated by the a.c. drive motor of the lift motor-generator set. In normal operation, excess power is absorbed by the electrical supply system.
During emergency operation, if insufficient load were connected to the emergency generator, the excess power would cause the generator (and the lift) to overspeed. Therefore sufficient load must be provided to absorb this regenerated power, in the form of appliances, emergency lighting or other loads which are always connected when the emergency electricity supply is in use.
Where the base load provided by the emergency services is inadequate for this purpose, some form of extra load resistance must be provided. The emergency lighting, or if necessary, lighting additional to the basic requirements, would be an effective load resistance.
(2) The approximate order of magnitude of regenerated power from lifts is as follows:
(a) For variable-voltage gearless machines:
Running full load down : 40% of running full load up
Stopping full load down : 50% of starting full load up
(b) For variable voltage geared machines:
Running full load down : 20% of running full load up
Stopping full load down : 25% of starting full load up
It is desirable to confer with the lift manufacturer to confirm the actual figures for each particular installation.
(3) A time delay may have to be included in the restoration of mains supply to ensure that the lift motor-generator sets are not supplying regenerated power when the load is transferred to mains. (See 305.1.7.)

PART 6 DOCUMENTS, SPARES AND SERVICING EQUIPMENT

601 DOCUMENTS

601.1 One copy of each of the following documents shall be provided with the completed installation and kept in an appropriate enclosure in the generating plant room:

(a) Prime mover operators manual

(b) Prime mover parts manual including manuals relating to any auxiliary equipment

(c) Generator instruction manual

(d) Generator parts manual

(e) Voltage regulator manual if separate from generator

(f) Schematic and full wiring diagrams for control panel with written description of operation of controls

(g) Manuals for all miscellaneous items such as fuel transfer pumps, fuel level gauges, plant switches, and pressure switches

602 SPARE PARTS

602.1 A cabinet shall be provided in the generator room to contain all spare parts provided with the plant.

602.2 Parts which will enable rapid restoration of service in the event of minor breakdown shall be provided, including at least the following:

For a diesel engine
– complete set of drive belts
– set of flexible hoses (such as for water, oil, fuel).

For a gas turbine
– as agreed between supplier and owner.

For the generator
– set of brushes and springs if applicable
– set of diodes or rectifiers, together with any necessary installation materials (for example, silicone grease).

For a voltage regulator
– one complete regulator, including any associated accessories (such as coils, inductors, diodes, rectifiers).

For controls
– one relay of each type
– one set of coils for changeover contractors
– one set of fuse links for all control circuits
– one set of indicator lamp bulbs.

602.3 Additional spare parts for more extensive repair shall be provided whenever there is inadequate supply available in New Zealand.

603 SERVICING EQUIPMENT

603.1 Sufficient equipment shall be provided to enable routine servicing and lubrication to be carried out, including

– filler funnel
– grease gun
– bung spanner
– hydrometer

PART 7 COMMISSIONING

701 GENERAL

701.1 Manufacturers' specifications and any test certificates supplied shall be checked to ensure that the plant and equipment provided is adequate to meet the requirements of this Standard.

701.2 Sufficient tests shall be performed and records made, to prove that the complete installation meets the requirements of this Standard. These tests shall include those described in sections 702 and 703.

702 INSPECTION AND CHECKS

702.1 Visual inspection shall be made of the following items, and of any other special features that are relevant to each particular installation:

(a) Accommodation and access

(b) Fire protection and segregation

(c) Fixings for seismic restraint

(d) Ventilation system, continuity of ducting, and operation of automatic venting where applicable

(e) Interior surfaces of generator room

(f) Fire fighting equipment adequacy

(g) Fuel supply system, overall

(h) Level indicators, for operation and accuracy

(j) Pipe systems, for adequate support, and absence of leaks

(k) Starting system energy storage and recharging equipment

(m) Documentation and spares

(n) Labelling

702.2 Readiness for operation of all equipment shall be checked, including the following items:

(a) Any engine preheater system maintaining correct temperature

(b) Water level where applicable; oil level; pipework

(c) Governor control linkage

(d) Fuel or air solenoid

(e) Insulation of generator main winding (where applicable disconnect any electronic controls before applying high voltage tester)

(f) Fault circuits, test for continuity and operation by simulation of fault signals

(g) Check brush gear where applicable

(h) Ensure that panel lamps are operational

(j) Examine generator control panels, changeover controls, and interlocks

(k) Examine door panels

(m) Check that batteries are fully serviceable

703 OPERATIONAL TESTS

703.1 The complete operation of the entire emergency generating plant and all its facilities shall be tested and demonstrated sufficiently to prove that all operations are in accordance with the requirements of this Standard and the installation specification.

703.2 Tests shall include the following items (not necessarily in the order given) in addition to any other tests relevant to each particular installation:

(a) Effect a manual start using the controls mounted on the prime mover

NOTE – To minimize oiling-up of diesel-engine injectors, any test running with no load should not be continued for an extended period.

(b) Isolate the automatic changeover controls and test for a mains failure automatic start and stop

(c) Arrange an automatic changeover test on load

(d) During the foregoing tests, note any repeat-start attempts needed, and observe starting performance as evidence of the condition of the starting-energy reserve

(e) Perform an extended run (at least 4 h) carrying the full emergency load available in the building

(f) After the start, check that the starting-system reserve is being replenished at the proper rate

(g) During the load run, check all electrical metering to confirm correctness of calibration, scale range, and current-transformer ratios; check all prime mover gauges (for example temperature, oil pressure) for calibration and check the values indicated to confirm that values are within the normal operating range

(h) Check that any delay controls in the changeover system operate correctly

(j) During the automatic shut-down, see that the run-on timer functions correctly

(k) After the test run, check all changeover control equipment as to performance of current-carrying parts (for example, contacts)

(m) Check all bolts and fixings for tightness

(n) After all tests check that the starting system has maintained correct reserves of energy, and check that recharging is at the necessary rate. Recheck after 24 h to ensure that overcharging is being avoided.

704 CERTIFICATE OF COMPLIANCE

704.1 On completion of commissioning tests a certificate of compliance shall be issued to the building owner or his representative. The certificate shall be signed by an authorized person whose capacity as signatory shall be stated (for example: Manufacturer; Manufacturer's representative; Registered engineer). The certificate shall contain sufficient detail to define the system dealt with, and the extent of its compliance with this Standard.

NOTE – An acceptable format is as follows:

(a) Building .....
(b) Location.....
(c) Description of system.....
(d) Installation agent.....
(e) Maintenance agent.....
(f) Date of completion.....
(g) Certification.....

I hereby certify that this system has been inspected and tested in accordance with NZS 6104, and that as far as I am able to reasonably ascertain, the system complies with the Standard.

Signed ..... Date .....

(Print name).....

Capacity of signatory .....

PART 8 ESSENTIAL MAINTENANCE

801 GENERAL

801.1 Requirements. Maintenance shall comply with the requirements of this Part of this Standard and with any specific recommendations of the equipment manufacturers.

801.2 Supervision. The designation, location and telephone number of the person or persons responsible for the maintenance shall be prominently displayed close to the emergency generator.

801.3 Logbook. A logbook shall be kept in which shall be recorded the results of inspections and tests, and any action that has been taken or is required, according to section 802. The responsible person should sign the logbook to the effect that the tests required have been carried out.

801.4 Frequency of checks. For the purposes of this Standard, the emergency electricity supply installation shall be checked and test run at least monthly. (Shorter intervals may be necessary for other purposes.) In addition, the installation shall be checked and the fuel supply replenished if necessary, as soon as is practicable after every emergency operation.

802 INSPECTION

802.1 Preliminary checks. The following minimum preliminary tests and checks shall be made where applicable before any functional test or remedial action, and generally in the following order:

(a) Make a general observation of the installation

(b) Check to see that batteries are being charged, check level of electrolyte, and, where appropriate, record density of electrolyte. Attention should be given to the cleanliness of batteries and tightness and freedom from corrosion of all terminals

(c) Check any other system of stored energy for starting

(d) Check fuel, water and lubricating oil supply

(e) Check state of documents, spare parts, and servicing equipment

802.2 Servicing. Remedy any deficiencies discovered as a result of the preliminary checks (for example, add distilled water, fuel, and lubricating oil as appropriate; re-order fuse links, lamps or other spares). Record action and quantities in logbook. Note any abnormal deficiencies, ascertain the reason, and initiate the appropriate corrective action.

803 MONTHLY TEST RUN

803.1 Preparation. Carry out an inspection as in section 802.

803.2 Starting. Initiate a test run by operating the MANUAL TEST switch. (See 305.3.2.)

803.3 Duration. The test shall continue for at least 15 min, and preferably until the prime mover reaches normal operating temperature.

803.4 Observations. The following observations shall be made during the test run:

(a) Observe and record the time taken for the generating plant to take over the full emergency load, and record whether any repeat start attempts were necessary

(b) Verify that all emergency loads are operating satisfactorily

(c) Record any defects requiring attention

803.5 Return to normal. At the end of the test run, set all switches for normal operation and make the following checks:

(a) Where a starter battery is provided for the generating plant, ensure that the charger for this battery is operating

(b) Where some other source of energy for starting is provided, check that this is being replenished

(c) Ensure that the plant is left in a condition to start automatically in the event of failure of the normal electricity supply

804 ANNUAL TESTS

804.1 Preparation. Carry out an inspection as in section 802, and the monthly test run as in section 803, except as varied below.

804.2 Supplementary requirements. Tests shall be made at intervals of not more than 12 months as follows:

(a) Check the operation of all continuous monitoring circuits, the repeat-start facility, and all relevant alarms

(b) Conduct a test run, simulating a failure of the normal electricity supply by opening the installation main switch or power supply. Check operations of any sequence starting arrangements, and of the lifts

(c) At the end of the test run return the load to mains. After any necessary delay for cooling purposes simulate a failure of relevant prime mover auxiliary service monitoring (for example, low oil pressure or rise of engine temperature) as near as possible to the sensors, so as to check the operation of fault and shut-down alarms. Also check operation of the over-temperature sensor

NOTE – An oil-pressure switch is automatically checked at each start, so no separate check is needed.

(d) Generally check all emergency loads to ensure that the installation meets the functional requirements of this Standard. Record deficiencies and arrange for defects to be rectified

(e) Check the mains failure sensing to ensure that it operates for single phase failure on each phase, and for multiphase failure. This test may be made without starting the generating plant

(f) Check and record the maximum-demand ammeter indication, and if the load is approaching the rated capacity of the generator, notify the appropriate responsible party

APPENDIX A

SELECTION OF GENERATOR AND PRIME MOVER

A1 GENERAL

A1.1 After assessing load, the generator and prime mover ratings may be determined initially independently of each other, on the basis of the specific demand made on each machine. Subsequently, prospective prime movers and generators must be studied for compatibility and any necessary rating adjustments made. This need is most likely to arise with torsional vibration characteristics of a generator driven by a diesel engine.

A2 ASSESSMENT OF LOAD

A2.1 Procedure. To facilitate selection of plant which will adequately perform the duties required for a minimum outlay, the following procedures are recommended:

1. List all the loads to be carried in order of priority.

2. For each load show the apparent power for two conditions:
   (a) Steady running kVA
   (b) Starting kVA

3. Group the loads as they will be switched on to the generator. Generally, this will be individually, but in some instances, as for small loads or initial loads, they may be grouped. (See 301.3.)
   It may be that there are different groupings for different circumstances. For example, the generator may carry additional "commercial" loads which may be switched off in the event of an emergency requiring fire sprinkler or riser pumps. In such cases, a separate analysis for each grouping shall be made unless it is clearly evident that some are much less stringent than others.

4. Plot two graphs of apparent power against time for the total start-up period, one to show running kVA only, and a second to show the additional starting kVA superimposed on the running kVA

5. From these two curves, establish the total continuous rated kVA and short-time rated kVA.

6. Plot a graph of power factor against time, with the same time scale as above

7. From the apparent power graphs, by applying power factor derive another pair of curves showing active power against the same time scale, one curve to show running kW only and the second to show the additional kW demand for starting, superimposed
   NOTE – If no more precise information is available, for direct on-line starting the starting current can be assumed to be six times full load current, the initial starting power factor 0.25, and the maximum active power (kW), during starting, twice the full load power.

8. Modify the active power scales by applying generator efficiency to show the driving power required (see 301.4) and derive the appropriate prime mover power ratings according to Appendix B.

A2.2 Example of calculations. The following is a typical list of building loads in order of priority:

LOAD ITEM	STARTING			RUNNING		
	Apparent power kVA	*Power factor*	*Active power kW*	*Apparent power kVA*	*Power factor*	*Active power kW*
(a) Emergency lighting	10	0.95	9.5	10	0.95	9.5
(b) Fire sprinkler pump	72	0.25	18	12	0.8	9.6
(c) Ventilation fan	120	0.25	30	20	0.8	16
(d) Lift motor	180	0.25	45	30	0.8	24
(e) Fire hose reel pump	32	0.25	8	5	0.8	4
(f) Fire riser pump	60	0.25	15	10	0.8	8
(g) Commercial lighting	20	0.95	19	20	0.95	19
(h) Other						

The motors will be required to start either in sequence a + b, c, d, e, f; or in sequence a, c, d, g. The former is evidently the most arduous and so should be analysed.

A3 GENERATOR RATING

A3.1 A generator shall be selected which has adequate capacity to carry, for a period of 5 min, the maximum short time kVA derived from the curve for the start-up period.

A3.2 The kW capacity should be checked, also that the voltage dip at any time during starting and running complies with 302.3.

A4 PRIME MOVER RATING

A4.1 A prime mover shall be selected with a fuel stop power (or equivalent turbine output) equal to or in excess of the maximum driving power required during the starting sequence, and with a continuous power (or equivalent turbine output) not less than 90% of the steady driving power required during running.

NOTE – This latter requirement is to achieve economies by allowing design for the prime mover to run with a nominal 10% overload. This is deemed to be acceptable because, in service, an emergency requiring all services to operate at full load simultaneously is unlikely. In most cases the normal effects of load diversity will mean that designed full load will not be imposed for any sustained period.

A4.2 Prime mover power ratings shall be adjusted for the ambient operating conditions as stated in Appendix B.

A5 COMPATIBILITY

A5.1 The generator and prime mover shall be compared as in A1.

APPENDIX B

PRIME MOVER RATINGS AND TESTS

B1 RECIPROCATING COMPRESSION-IGNITION ENGINES

B1.1 Power ratings. For a diesel engine, the declared power ratings according to BS 5514 shall be determined as follows:

(a) Continuous power: Derived from the designed full load of the installation according to Appendix A of this New Zealand Standard

(b) Overload power: 110% of the continuous power

(c) Fuel stop power: Not less than the power required during starting, but in any case not less than 115% of the continuous power

The engine, after operating at the continuous power, shall be capable of operating at the overload power for 1 h in any 12 h, and thereafter at the fuel stop power for 5 min before reverting to continuous power.

B1.2 Governing. The governing shall be Type 1, class A2.

B1.3 Tests. Certificates shall be provided by the supplier, proving that the above requirements have been demonstrated by tests conducted according to BS 5514.

B2 TURBINES

B2.1 Design and rating of gas turbines shall be in accordance with BS 3863.

B2.2 Turbines shall be suitable for class A range IV operation, with automatic start and shutdown.

B2.3 Factory tests shall be made, including the required periods of running at full load and overload. Certificates shall be provided before delivery of the plant.

B3 OPERATING CONDITIONS

B3.1 Due allowance shall be made for the ambient conditions in which the plant will operate (temperature, altitude, and humidity) and the required power ratings shall be corrected accordingly.

APPENDIX C

SPECIFICATION FOR GENERATOR

C1 The generator of an emergency electricity supply plant shall comply with the following details, which are selected or modified from the stated Parts of BS 4999:

Part 4 Rating plate markings

The rating plate shall comply with the requirements stated in this Part of BS 4999.

Part 20 Classification of types of enclosures

The degree of protection shall be at least IP 11.

Part 30 Duty and rating

The duty type shall be S1, and the rating class shall be MCR.

In addition, the generator shall be capable of delivering 110% of rated output for 1 h during any period of consecutive 12 h running.

Part 31 Service and operating conditions

Standard site conditions apply unless specifically stated otherwise.

Electrical conditions are as follows:

Rated frequency shall be 50 Hz
Connections shall be suitable for 4-wire, 3-phase, solidly-earthed-neutral system
Rated voltage shall be 230/400 V
Rated power factor shall be 0.8

Output power rating shall be determined in accordance with section 301 of this New Zealand Standard.

Part 32 Limits of temperature rise and methods of temperature measurement

The requirements of this Part of BS 4999 shall be met except that when running over 100% load, no temperature rise limit is specified.

Part 40 Characteristics of synchronous generators

Voltage regulation grade shall be at least VR1, maintained while the prime mover speed is within the appropriate governing limits.

In addition, voltage dip and recovery shall satisfy 302.3 of this New Zealand Standard.

Additional current-forcing facilities to ensure fault clearance may be required as in 407.1 of this New Zealand Standard.

Standard waveform and telephone interference limits apply unless there are special requirements specified by the purchaser for such as computer loads.

Any special requirements for transient voltage performance shall be stated by the purchaser.

In addition, radio interference is subject to statutory Regulations.

Protection against adverse effects of underspeed is also recommended.

Part 41 General characteristics

The generator shall comply with the requirements for momentary overload, and for overspeed, as specified in this Part of BS 4999.

Part 50 Mechanical performance: Vibration

The requirements in column 2 of table 50.3 of this Part of BS 4999 shall be met when the generator is coupled to the associated prime mover.

In addition, for a generator to be driven by a diesel engine, harmful torsional vibration shall not arise at any load and speed combination likely to be encountered in service. The generator rotor shall be capable of withstanding continuously a vibratory inertia torque amplitude of ± 2.5 times rated full load torque over the speed range 95% to 110% rated speed, and ± 6 times when passing through critical speeds below 95% rated speed.

Part 60 Tests

Certificates of Type Tests and of Duplicate Tests shall be provided.

Tests shall be specified in this Part of BS 4999, and shall include overspeed and sudden short circuit.

Part 69 Tolerances

The requirements of this Part of BS 4999 shall be met.

Part 71 Winding terminations

Terminations shall comply with requirements of this Part of BS 4999 for Type 2 (sealed).

NOTE – THE STANDARD CERTIFICATION MARK SCHEME

Shown here is the Certification Mark of the Standards Association of New Zealand. This mark may be used only by those manufacturers licensed by the Standards Association and must be accompanied by the number of the relevant New Zealand Standard and the number of the authorizing licence. The presence of this mark on or in relation to a product is an assurance that the goods are manufactured under a system of supervision, control and testing (including periodical inspection of the manufacturer's works by SANZ) designed to ensure compliance with the standard.

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