



# Scottish Health Technical Memorandum 2011

(Part 3 of 4)

Validation and verification

## Emergency electrical services

### Disclaimer

The contents of this document are provided by way of guidance only. Any party making any use thereof or placing any reliance thereon shall do so only upon exercise of that party's own judgement as to the adequacy of the contents in the particular circumstances of its use and application. No warranty is given as to the accuracy of the contents and the Property and Environment Forum Executive, which produced this document on behalf of NHSScotland Property and Environment Forum, will have no responsibility for any errors in or omissions therefrom.

The production of this document was jointly funded by the Scottish Executive Health Department and the NHSScotland Property and Environment Forum.

## Contents

<b>1.</b>	<b>Scope</b>	<i>page 3</i>
<b>2.</b>	<b>Testing, handing over procedure and documentation</b>	<i>page 4</i>
2.1	Works testing	
2.3	Site testing	
2.6	Dynamic tests	
2.7	Final test inspection	
2.8	Generator phase rotation	
<b>3.</b>	<b>Emergency lighting</b>	<i>page 8</i>
3.2	Self-contained luminaires	
3.4	Battery load test	
3.6	Standby lighting	
<b>4.</b>	<b>Uninterruptible power supplies</b>	<i>page 9</i>
4.2	Inverter bypass operation	
4.4	Waveform	
4.5	Noise	
4.6	Indications and alarms	
	<b>References</b>	<i>page 10</i>

# 1. Scope

---

## General

- 1.1 Health care and social services premises are totally dependent upon electrical power supplies, not only to maintain a safe and comfortable environment for patients and staff, but also to give greater scope for treatment using sophisticated medical equipment at all levels of clinical and surgical care. Changes in application, design and statutory requirements have led to the introduction of a new generation of equipment and new standards of reliability.
- 1.2 Interruptions in electrical power supplies to equipment can seriously disrupt the delivery of health care with serious consequences for patient well-being. Health care and social services premises must therefore ensure that they can continue to provide electrical power to essential services in the event of prolonged or short disruption to supplies.

## Emergency electrical services

- 1.3 Emergency electrical services form an integral part of the health care and social services premises supply network in meeting both safety and functional requirements. They can be in the form of batteries, uninterrupted power supply (UPS) systems, or stand-by generators.
- 1.4 The provision of emergency electrical services in health care and personal social services premises is a management responsibility at both new and existing sites. This guidance is equally applicable to premises which offer acute health care services under the Registered Establishments (Scotland) Act 1998.

## 2. Testing, handing over procedure and documentation

### Works testing

- 2.1 Emergency generator sets should be tested as a complete unit, that is with their associated control equipment for output and performance in accordance with the relevant British Standards (BS 5514, BS 4999, BS 5000, Part 3 and BS EN 61000-4-1).
- 2.2 Type test certificates should be provided with the tender for engine and generator. Routine works test certificates should be provided for each engine and generator and be available before the site testing.

### Site testing

- 2.3 Before any dynamic tests are carried out on a new engine or generator, the following procedures and static tests should be carried out:
  - a. descaling of connecting pipework carrying lubricating oil, starting air and jacket water, using a dilute solution of citric acid. After an approved dwell time the pipework should be flushed with clean water. Ex works descaled pipework should be end-sealed before dispatch to site;
  - b. temporary strainers should be inserted into the oil pipework before the lubricating oil strainers, for periodic examination. The strainers must remain free of debris before their removal for the final test performance of the engine;
  - c. crankshaft deflection checks should be carried out at the engine main bearings for maintenance records;
  - d. the insurance inspection certificate for the starting air cylinders and associated pipework should be checked, if provided;
  - e. the insulation resistance of the generator stator winding should be checked by a megger-type instrument, with a preferred DC voltage output twice the stator-rated voltage;
  - f. using an electronic or motorised megger-type instrument, the Polarisation Index (PI) of the HV generator stator winding should be determined over a period of one and 10 minutes, for maintenance records. PI is defined as the final insulation reading (10 minutes) divided by the initial insulation reading (one minute). A value above "2" should be expected for a sound winding;
  - g. measurement of the insulation resistance across the bed plate insulating liner at the non-driving end bearing of the generator;

- h. measurement of the insulation resistance of the main field winding. The rectifying diodes should first be disconnected to avoid damaging them;
  - i. measurement of the insulation resistance of the 240V stator winding heaters;
  - j. measurement of the insulation resistance of the stator winding and connected power cables immediately before energisation;
  - k. measurement of the insulation resistance of the exciter stator winding and connected cables, with the AVR disconnected;
  - l. measurement of the insulation resistance of the primary and secondary windings and vector configurations of the HV power and voltage transformers. Oil and Buchholz tests will be required for the conservator-type transformer;
  - m. measurement of the insulation resistance of all control wiring. Solid state devices should be disconnected if possible. If not, the tests should be carried out at a voltage approved by the manufacturer, and in any case at not more than 25V DC;
  - n. the 240V stator winding heaters should be connected to a temporary supply on all HV generators on arrival at site, and stator winding insulation monitored weekly.
- 2.4 Dynamic tests on the engine should only be carried out after calibration and testing of the instrument sensors and the electrical protection relay and phase sequence rotation tests.
- 2.5 Protection tests to sensors and relays should be carried out as follows:
- a. make a record of the protection, indication and control current transformer serial number and type;
  - b. check current transformer ratio, resistance, polarity and magnetising curves;
  - c. check secondary injection of electrical protection relays;
  - d. test water jacket temperature alarm and trip;
  - e. test lubricating oil pressure alarm and trip by operation of sensor oil bypass valve;
  - f. test lubricating oil low pressure start interlock;
  - g. test overcrank (failure to start alarm);
  - h. check minimum drop out and close voltages of all control relays and contactor coils.

## Dynamic tests

- 2.6 The dynamic tests on site should include the following witnessed observations:
- a. lubricating oil pressure and pressure trip;
  - b. lubricating oil and jacket water bypass automatic valves opening during engine warm-up; and  
a series of test starts and checks, as follows:
  - c. the ability to start up within the specified time;
  - d. overspeed trip;
  - e. speed variation within specified limits;
  - f. voltage regulation and open circuit characteristic;
  - g. electrical trips of generator by overcurrent, reverse power protection relays at minimum plug settings with generator below 25% FL (or primary injection);
  - h. a full load run of not less than four hours, followed by a one hour, 10% overload test and full load protection trip. The test full load should be obtained by either a ballast load bank, or synchronised to the normal supply;
  - i. fuel oil inlet pressure;
  - j. fuel oil injector settings;
  - k. temperature rise of jacket cooling water;
  - l. temperature rise of lubricating oil;
  - m. temperature rise of charge air across turbocharger, if fitted;
  - n. temperature of exhaust gases at each cylinder head;
  - o. 240V stator winding heater disconnects when circuit breaker closes;
  - p. ambient conditions;
  - q. noise acoustic levels, engine/background.

## Final test inspection

- 2.7 Upon completion of the tests, a thorough mechanical inspection of the diesel generator set and examination of recorded test results must be made to ensure that it conforms to contract.

## Generator phase rotation

- 2.8 Standard phase sequence rotation is defined as electrical phase voltage rotation ABC when the generator shaft rotation is **clockwise** as viewed from the drive coupling end of the generator. BS 4999: Part 108, 1987 refers.

- 2.9 Before any electrical load is connected the rotation of every generator must be checked and the voltage standard phase sequence rotation set at the generator and confirmed at the circuit breaker. Synchronising equipment must be “phased in” before a generator is connected in parallel with another generator or to the supply.
- 2.10 Before emergency generator sets can be operated in parallel with other generators connected to the normal supply, electrical protection tests and operational procedures must be agreed with, and subsequently demonstrated to, the public electricity supply company’s nominated engineer.

### 3. Emergency lighting

---

- 3.1 It is desirable that all batteries intended for the provision of energy for emergency luminaires are checked for operation.

#### **Self-contained luminaires**

- 3.2 The operation of self-contained luminaires should be verified after the normal supply has been connected to the sub-circuit for at least 24 hours.
- 3.3 Luminaires should be disconnected from the normal supply, initially during daylight hours, to discover any malfunctions. When dark, the level of illumination should be measured and recorded under simulated escape conditions.

#### **Battery load test**

- 3.4 An emergency battery's source capacity should be verified after an adequate first charge, based on the battery's ampere-hour capacity rating. Discharge tests should be carried out into a load bank at the maximum rated current for the endurance period stated in the battery guarantee. If a load bank is not obtainable, discharge should be carried out into all emergency luminaires connected, for the required period of one to three hours.
- 3.5 DC auto-changeover switches should be checked for freedom of operation by removing/reinserting the control coil fuse link.

#### **Standby lighting**

- 3.6 All standby lighting should be checked for "stand alone" suitability and the illumination of the working area measured and recorded.



## 4. Uninterruptible power supplies

---

- 4.1 The uninterruptible power supply (UPS) must provide a no-break rated supply to the load equipment for the required endurance period. The equipment must continue to function normally when the normal supply is disconnected. The battery endurance capacity in ampere-hours should be verified under load conditions.

### Inverter bypass operation

- 4.2 The operation of the inverter bypass switch should be checked for failure of the inverter, battery charger or battery supply.
- 4.3 Auto-synchronisation of the inverter output frequency with the normal supply frequency at the inverter by-pass switch should be demonstrated and recorded, using a load bank, before connection of electronic/electrical equipment.

### Waveform

- 4.4 The UPS input and output harmonic on-load waveform voltage should be recorded and analysed.

### Noise

- 4.5 The acoustic noise levels emitted by the inverter under maximum load should be measured for comparison with guaranteed levels. Noise levels should also be measured in adjacent areas.

### Indications and alarms

- 4.6 All local and remote indications and associated alarm combinations relevant to normal use or failure in operation must be demonstrated and recorded.

## References

### NOTE:

Where there is a requirement to address a listed reference, care should be taken to ensure that all amendments following the date of issue are included.

Publication ID	Title	Publisher	Date	Notes
<b>Acts and Regulations</b>				
	Building (Scotland) Act	HMSO	1959	
	Clean Air Act	HMSO	1993	
	Control of Pollution Act	HMSO	1974	
	Electricity Act	HMSO	1989	
	Energy Act	HMSO	1983	
	Environment Protection Act	HMSO	1990	
	Registered Establishments (Scotland) Act	HMSO	1998	
	Water (Scotland) Act	HMSO	1980	
	Health and Safety at Work etc Act	HMSO	1974	
SI 3146	The Active Implantable Medical Devices Regulations	HMSO	1992	
SI 2179 & 187	The Building Standards (Scotland) Regulations (as amended)	HMSO	1990	
	The Building Standards (Scotland) Regulations: Technical Standards Guidance	HMSO	1998	
SI 1460	Chemicals (Hazard Information and Packaging for Supply) Regulations (CHIP2)	HMSO	1997	
SI 3140	Construction (Design and Management) Regulations	HMSO	1994	
SI 437	Control of Substances Hazardous to Health Regulations (COSHH)	HMSO	1999	
SI 635	Electricity at Work Regulations	HMSO	1989	
SI 1057	Electricity Supply Regulations (as amended)	HMSO	1988 (amd 1994)	
SI 2372	Electromagnetic Compatibility Regulations (as amended)	HMSO	1992	
SI 2451	Gas Safety (Installation and Use) Regulations	HMSO	1998	

<b>Publication ID</b>	<b>Title</b>	<b>Publisher</b>	<b>Date</b>	<b>Notes</b>
SI 917	Health & Safety (First Aid) Regulations	HMSO	1981	
SI 682	Health & Safety (Information for Employees) Regulations	HMSO	1989	
SI 2792	Health and Safety (Display Screen Equipment) Regulations	HMSO	1992	
SI 341	Health and Safety (Safety Signs and Signals) Regulations	HMSO	1996	
SI 1380	Health and Safety (Training for Employment) Regulations	HMSO	1990	
SI 2307	Lifting Operations and Lifting Equipment Regulations (LOLER)	HMSO	1998	
SI 3242	Management of Health and Safety at Work Regulations	HMSO	1999	
SI 2793	Manual Handling Operations Regulations	HMSO	1992	
SI 3017	The Medical Devices Regulations	HMSO	1994	
SI 1790	Noise at Work Regulations	HMSO	1989	
SI 3139	Personal Protective Equipment (EC Directive) Regulations (as amended)	HMSO	1992	
SI 2966	Personal Protective Equipment at Work (PPE) Regulations	HMSO	1992	
SI 128	Pressure Systems Safety Regulations (PSSR)	Stationary Office	2000	
SI 2306	Provision and Use of Work Equipment Regulations (PUWER)	HMSO	1998	
SI 3163	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)	HMSO	1995	
SI 3004	Workplace (Health, Safety and Welfare) Regulations	HMSO	1992	
<b>British Standards</b>				
BS 88	<b>Cartridge fuses for voltages up to and including 1000V AC and 1500V DC</b> <b>Part 1: General Requirements</b>	BSI Standards	1982	
BS 89	<b>Direct acting indicating electrical measuring instruments and their accessories</b> <b>Parts 1 to 9</b>	BSI Standards	1977	
BS 89	<b>Direct acting indicating electrical measuring instruments and their accessories</b> <b>Parts 1 to 9</b>	BSI Standards	1997	

<b>Publication ID</b>	<b>Title</b>	<b>Publisher</b>	<b>Date</b>	<b>Notes</b>
BS 171	<b>Power transformers</b>	BSI Standards	1970	
BS 417	<b>Galvanised mild steel cisterns and covers, tanks and cylinders (metric units) Part 2</b>	BSI Standards	1987	
BS 764	<b>Automatic change-over contactors for emergency lighting systems</b>	BSI Standards	1954 (1985) (1990)	
BS 799	<b>Oil storage tanks Part 5</b>	BSI Standards	1987	
BS 822	<b>Terminal markings for rotating electrical machinery Part 6</b>	BSI Standards	1964 (1988)	
BS 1361	<b>Cartridge fuses for AC circuits in domestic and similar premises Part 1</b>	BSI Standards	1971 (1986) AMD (1991)	
BS 1362	<b>General purpose fuse links for domestic and similar purposes (plugs)</b>	BSI Standards	1973 (1986) AMD (1991)	
BS 1363	<b>13A fused plugs and switched and unswitched socket-outlets and boxes</b>	BSI Standards	AMD (1997)	
BS 1650	<b>Capacitors for connection to power frequency systems</b>	BSI Standards	1971 AMD (1991)	
BS 1710	<b>Identification of pipelines and services</b>	BSI Standards	1984	
BS 2754	<b>Memorandum. Construction of electrical equipment for protection against electric shock</b>	BSI Standards	1976	
BS 2771	<b>Electrical equipment of industrial machines</b>	BSI Standards	1986	
BS 2869	<b>Fuel oil for engines and burners for non-marine use</b>	BSI Standards	1988	
BS 3535	<b>Safety isolating transformers for industrial and domestic purposes</b>	BSI Standards	1962 (1987)	
BS 3535-1	<b>Safety isolating transformers for industrial and domestic purposes EN 60742 Part 1</b>	BSI Standards	1996	

<b>Publication ID</b>	<b>Title</b>	<b>Publisher</b>	<b>Date</b>	<b>Notes</b>
BS 3938	<b>Current transformers</b>	BSI Standards	1973 (1982)	
BS 3941	<b>Voltage transformers</b>	BSI Standards	1975 (1982)	
BS 3951	<b>Freight containers</b>	BSI Standards	1969 (1977)	
BS 4196	<b>Sound power levels of noise sources Parts 0 – 8</b>	BSI Standards	1981 (1986)	
BS 4343	<b>Industrial plugs, socket-outlets and couplers for AC and DC supplies</b>	BSI Standards	1968	
BS 4417	<b>Specification for semi-conductor rectifier equipments</b>	BSI Standards	1969 (1981)	
BS 4752	<b>Circuit breakers Part 1</b>	BSI Standards	1977	
BS 4533-102.22	<b>Luminaires. Particular requirements. Specification for luminaires for emergency lighting. (EN 60598-2-22: 1990)</b>	BSI Standards	1990	
BS 4999	<b>Terminal markings for rotating electrical machinery Part 108</b>	BSI Standards	1987	
BS 4999-0	<b>General requirements for rotating electrical machines Part 0</b>	BSI Standards	1987	
BS 5000	<b>Rotating electrical machines of particular types or for particular applications: Index Parts 1 – 99</b>	BSI Standards		
BS 5000-3	<b>Generators to be driven by reciprocating internal combustion engines Part 3</b>	BSI Standards	1980 (1985) AMD 1988	
BS 5266	<b>Code of practice for the emergency lighting of premises Parts 1 – 3</b>	BSI Standards	1988	
BS 5304	<b>Code of practice for safeguarding machinery</b>	BSI Standards	1988	
BS 5378	<b>Safety signs and colours</b>	BSI Standards	1980	
BS 5410-3	<b>Code of practice for oil firing. Installations for furnaces, kilns, ovens and other industrial purposes</b>	BSI Standards	1976	

<b>Publication ID</b>	<b>Title</b>	<b>Publisher</b>	<b>Date</b>	<b>Notes</b>
BS 5424	<b>Contactors up to and including 1,000V AC and 1,200V DC Part 1</b>	BSI Standards	1977	
BS 5499-1	<b>Fire safety signs, notices and graphic symbols. Specification</b>	BSI Standards	1990	
BS 5514-1	<b>Reciprocating internal combustion engines. Performance. Standard reference conditions, declarations of power, fuel and lubricating oil consumptions and test methods. (ISO 3046-1: 1995)</b>	BSI Standards	1996	
BS 5514-4	<b>Reciprocating internal combustion engines. Performance. Speed governing. (ISO 3046-4:1997)</b>	BSI Standards	1997	
BS 5514	<b>Reciprocating internal combustion engine performance, etc Parts 1/6</b>	BSI Standards	1996	
BS 5992-1	<b>Electrical relays. Specification for contact performance of electrical relays.</b>	BSI Standards	1980	
BS 6132	<b>Code of practice for safe operation of alkaline cells</b>	BSI Standards	1983	
BS 6133	<b>Code of practice for safe operation of lead-acid cells</b>	BSI Standards	1995	
BS 6231	<b>PVC insulated cables for switchgear and control gear wiring</b>	BSI Standards	1981 1998	
BS 6260	<b>Open nickel-cadmium prismatic rechargeable single cells</b>	BSI Standards	1982 1988	
BS 6290	<b>Lead-acid stationary cells and batteries</b>	BSI Standards	1982 1988	
BS 6327	<b>Fire protection of reciprocating internal combustion engines</b>	BSI Standards	1982	
BS 6346	<b>PVC insulated cables for electricity supply up to and including 3300V between phases</b>	BSI Standards	1989 1997	
BS 6387	<b>Specification for performance requirements for cables required to maintain circuit integrity under fire conditions</b>	BSI Standard	1983	
BS 7625	<b>Voltage transformers</b>	BSI Standards	1993	
BS 7671	<b>Requirements for electrical installations. IEE Wiring Regulations</b>	HMSO	1992	Sixteenth edition

<b>Publication ID</b>	<b>Title</b>	<b>Publisher</b>	<b>Date</b>	<b>Notes</b>
BS 7676	<b>Current transformers</b>	BSI Standards	1993	
BS EN 60076	<b>Power transformers</b>	BSI Standards	1976	
BS EN 60146	<b>Specification for semi-conductor rectifier equipments</b>	BSI Standards	1981	
BS EN 60269	<b>Cartridge fuses for voltages up to and including 1000V AC and 1500V DC – General requirements Part 1</b>	BSI Standards		
BS EN 60309	<b>Metric units industrial plugs, socket-outlets and couplers for AC and DC supplies Part 2</b>	BSI Standards		
BS EN 60309-2	<b>Plugs, socket-outlets and couplers for industrial purposes. Dimensional interchangeability requirements for pin and contact-tube accessories</b>	BSI Standards	1992	
BS EN 60622	<b>Sealed nickel-cadmium prismatic rechargeable single cells</b>	BSI Standards	1996	
BS EN 60623	<b>Open nickel-cadmium prismatic rechargeable single cells</b>	BSI Standards	1982 1988	
BS EN 60896	<b>Lead-acid stationary cells and batteries Part 1</b>	BSI Standards	1982 1988	
BS EN 60947	<b>Circuit breakers Part 2</b>	BSI Standards		
BS EN 60947	<b>Contactors up to and including 1,000V AC and 1,200V DC Part 1</b>	BSI Standards	1998	
BS EN 61000	<b>Electromagnetic compatibility (EMC). Testing and measurement techniques (Parts 4-1 to 4-28). Part 4-1: Overview of immunity tests. Basic EMC publication (IEC 61000: 1992)</b>	BSI Standards	1995	
BS ISO 668	<b>Freight containers</b>	BSI Standards	1996	
EN 60204	<b>Electrical equipment of industrial machines IEC204 PT1 ZED 81 Part 1</b>	BSI Standards	1993	
ISO 3046	<b>Reciprocating Internal combustion engine performance Parts 1/6</b>	BSI Standards		
ISO 8528	<i>To replace ISO 3046 after harmonisation</i>			



<b>Publication ID</b>	<b>Title</b>	<b>Publisher</b>	<b>Date</b>	<b>Notes</b>
<b>Scottish Health Technical Guidance</b>				
SHTM 2007	Electrical services supply and distribution	P&EEx	2001	CD-ROM
SHTM 2011	Emergency electrical services	P&EEx	2001	CD-ROM
SHTM 2020	Electrical safety code for low voltage systems (Escode – LV)	P&EEx	2001	CD-ROM
SHTM 2021	Electrical safety code for high voltage systems (Escode – HV)	P&EEx	2001	CD-ROM
SHTM 2022	Medical gas pipeline systems	P&EEx	2001	CD-ROM
SHTM 2023	Access and accommodation for engineering services	P&EEx	2001	CD-ROM
SHTM 2035	Mains signalling	P&EEx	2001	CD-ROM
SHTM 2045	Acoustics	P&EEx	2001	CD-ROM
SHPN 1	Health service building in Scotland	HMSO	1991	
SHPN 2	Hospital briefing and operational policy	HMSO	1993	
SHTN 1	Post commissioning documentation for health buildings in Scotland	HMSO	1993	
SHTN 4	General Purposes Estates and Functions Model Safety Permit-to-Work Systems	EEF	1997	
	NHS in Scotland – PROCODE	P&EEx	2001	Version 1.1
<b>NHS in Scotland Firecode</b>				
SHTM 81	Fire precautions in new hospitals	P&EEx	1999	CD-ROM
SHTM 82	Alarm and detection systems	P&EEx	1999	CD-ROM
SHTM 83	Fire safety in healthcare premises: general fire precautions	P&EEx	1999	CD-ROM
SHTM 84	Fire safety in NHS residential care properties	P&EEx	1999	CD-ROM
SHTM 85	Fire precautions in existing hospitals	P&EEx	1999	CD-ROM
SHTM 86	Fire risk assessment in hospitals	P&EEx	1999	CD-ROM
SHTM 87	Textiles and furniture	P&EEx	1999	CD-ROM
SFPN 3	Escape bed lifts	P&EEx	1999	CD-ROM
SFPN 4	Hospital main kitchens	P&EEx	1999	CD-ROM
SFPN 5	Commercial enterprises on hospital premises	P&EEx	1999	CD-ROM
SFPN 6	Arson prevention and control in NHS healthcare premises	P&EEx	1999	CD-ROM
SFPN 7	Fire precautions in patient hotels	P&EEx	1999	CD-ROM
SFPN 10	Laboratories on hospital premises	P&EEx	1999	CD-ROM



Publication ID	Title	Publisher	Date	Notes
<b>UK Health Technical Guidance</b>				
EH 40	HSE Occupational Exposure limits	HSE	Annual	As required
MES	Model Engineering Specifications	NHS Estates	1997	
MES C44	Diesel Engine Driven Automatic Stand-by Generator Sets	NHS Estates		
	Code of practice for reducing the exposure of employed persons to noise	HSE		
ETR No. 113	Notes of guidance for the protection of private generating sets up to 5MW for operation in parallel with the Electricity Board's Distribution Network	Electricity Assn.	1989	
<b>Miscellaneous References</b>				
G 59	Recommendations for the connection of private generating plant to the Electricity Board's Distribution Systems	Electricity Assn.	1985	
G 5/3	Limits for Harmonics in the UK Electricity Supply System	Electricity Assn.	1976	
	Regulations for Electrical Installations (16th edition) Institution of Electrical Engineers (IEE)			
	Lighting guide for hospitals and health care buildings Chartered Institution of Building Services Engineers			
LG 9	Lighting for communal and residential buildings Chartered Institution of Building Service Engineers		1997	
IM/17	Code of practice for gas engines. British Gas			
(ANSI/UL) 1008	Automatic Transfer Switches. American National Standards Institute/Underwriters Laboratory		1983	
IEC 947-6-1	Low voltage switch gear: Automatic Transfer Switches			
HN (76) 126	Noise control			