

**5-7 CARLTON GARDENS
LONDON SW1**

**OPERATING & MAINTENANCE
INSTRUCTIONS
for the
ELECTRICAL SERVICES**

**VOLUME 3
3.1 – Sections A-F**

**THIS FOLDER WAS CHECKED BY
ARUP ON**

21.3.03

**The checking process was to ensure that 3 identical
sets of each Volume of the Operating and
Maintenance Manuals existed**

**5-7 CARLTON GARDENS
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**OPERATING & MAINTENANCE
INSTRUCTIONS
for the
ELECTRICAL SERVICES**

**VOLUME 3
3.1 - Sections A-F**

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5-7 Carlton Gardens, London SW1

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ITEM	GENERAL OPERATING INSTRUCTIONS	GENERAL MAINTENANCE INSTRUCTIONS	SPECIFIC SUPPLIER LITERATURE
FIRE ALARM SYSTEM & DETECTION & VOICE ALARM I.A.T. (Europe) Ltd.	D.1.3	E.1.7, E.1.2.1, E.1.3, E.1.5, E.2, E.3, E.7.3.1	H.8
STANDBY GENERATION AVK/SEG (UK) Ltd.	D.1.2, D.2, D.3, D4	E.1.2.1, E.1.3, E.1.5, E.2, E.3, E.7.1, E.7.1.1, E.7.1.2, E.7.1.3	H.3
L.V SWITCHGEAR & DIST. BOARDS (Anord Control Systems Ltd.)	D.1.1	E.1.1, E.1.2.1, E.1.3, E.1.5, E.2, E.3, E.7.1, E.7.1.1, E.7.1.2, E.7.1.3	H.1
SECURITY SYSTEM Blenheim Security Systems Ltd.	D.1.4	E.1.2.1, E.1.3, E.1.5, E.2, E.3, H.6	H.6

A

A.1

HOW TO USE THE MANUAL

This manual has been prepared to provide a guide to the operation and maintenance of the Building Services installed in this Development.

It details:

- a) What services and plant are installed.
- b) What the systems provide.
- c) How to operate the systems.
- d) What planned maintenance is recommended.
- e) How to deal with emergencies.
- f) How to avoid risks to Health and Safety.
- g) How to monitor the performance of the systems for the purpose of energy management.

This manual is not intended to replace the services of fully qualified Engineers.

It is recommended that any persons employed as Maintenance Engineers immediately become familiar with the installation and are available at all times to carry out regular inspections, maintenance and emergency repairs.

It is most important that this manual is read in conjunction with:

- 1) "As Fitted" Drawings.
- 2) Schematic diagrams and charts.
- 3) Specific Manufacturers Literature.

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The equipment and materials supplied under this contract are safe and no risk to health as installed, so long as the instructions that follow and those outlined in the suppliers literature contained in this manual are followed and an experienced Maintenance Engineer is engaged to effect any repairs.

A.2

HEALTH AND SAFETY AT WORK

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HEALTH AND SAFETY PROCEDURES

1. HEALTH AND SAFETY AT WORK ETC. ACT 1974

Everyone is expected to work in such a way that accidents and damage to health to themselves and others are avoided.

The attention of all employees is drawn to Clause 7 "Health and Safety at Work etc. Act 1974" which states:-

7. It shall be the duty of every employee while at work:-

- a) To take reasonable care for the health and safety of himself and of other persons who may be affected by his acts or omissions at work; and
- b) As regard any duty or requirements imposed on his employer or any other person by or under any of the relevant statutory provisions, to co-operate with him so far as is necessary to enable that duty or requirement to be performed or complied with.
- c) Operatives must follow their employers instructions to ensure the safety of themselves and their fellow operatives.
- d) Operatives must use and not misuse facilities provided for their individual Safety, Health and Welfare.

Communications to the Company on matters appertaining to Safety and Health etc. to be implemented through Supervisors, Appointed Safety Representatives, to the Company Safety Depts.

2. SAFETY OF OWN EMPLOYEES

The promotion of safety and health is regarded as a mutual objective for management and its own employees at all levels. Therefore:-

MANAGEMENT will:-

- a) Provide and maintain safe and healthy working conditions in accordance with the relevant statutory requirements.
- b) Provide safety/job training for all employees and additional safety training where appropriate.
- c) Provide all necessary safety devices and protective equipment and supervise their use.
- d) Set an example in safe behaviour.
- e) (1) arranging regular plant safety inspections
(2) stimulating joint consultation on safety matters
(3) setting management safety targets
(4) introducing and monitoring safety procedures
(5) drawing on the services of competent authorities, eg. Factory Inspectorate, Insurance Company Advisers, Trades Federations and Associations.

EMPLOYEES should respond to the above by:-

Safe use of plant, using safety equipment provided and

- a) Complying with statutory obligations.
- b) Reporting incidents or items of plant that may lead to injury.

- c) Adhering to Company procedures, jointly agreed on their behalf, for securing a safe workplace.
- d) Co-operating in the investigation of accidents with the object or preventing a recurrence.

The fundamental points of this policy are:-

- a) The safety of employees, plant and equipment and the public are paramount.
- b) Every effort will be made to reduce the possibility of accidents.
- c) Safety will take precedence over expediency.

3. BASIC ELEMENTS OF SAFETY ORGANISATION

MANAGEMENT LEADERSHIP

Assumption of Responsibility

Declaration of Policy

ASSIGNMENT OF RESPONSIBILITY

DETAILED RESPONSIBILITIES from Top Management down to the floor worker. To include instruction to all persons in the operating chain - Safety Officer, Managers, Supervision, Safety Committees.

MAINTENANCE OF SAFE WORKING CONDITIONS

Instruction in detail as to how the safe working conditions are to be carried out.

General: Specific Hazards

ESTABLISHMENT OF SAFETY TRAINING

For Supervisors: For Workers

What training - General Safety - Job Training

Specific Hazards

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ACCIDENT RECORD SYSTEM

Accident Analysis

Report on Injuries

Periodic Health Examinations - statutory and non-statutory

MEDICAL AND FIRST AID SYSTEMS

Treatment of Injuries

First Aid Service

Periodic Health Examinations - statutory and non-statutory

ACCEPTANCE OF SHARED RESPONSIBILITY BY EMPLOYEES

Training

Maintenance of Interest

Safety Schemes

Union Participation

4. SAFETY ON SITES

This safety checklist has been compiled to maintain safe methods on all installations. It is intended that each employee on Site should be aware of the contents of the checklist and should ensure that their Supervisors promote safety practice on the job.

It is important that it is understood that although the list has been made as exhaustive as possible, it is not intended to be complete in its description of every precaution to be observed. Local differences must be acknowledged by each Job and this checklist supplemented as necessary to make it all inclusive.

The checklist is cross referenced; for this reason the same safety item may be noted several times. This method was chosen to facilitate the use of the list.

The main safety headings are as follows:-

- A) COMMON HAZARDS
- B) BUILDING CONDITIONS
- C) FIRE HAZARDS
- D) ELECTRIC SHOCK
- E) INJURIES AND FIRST AID
- F) CLOTHING
- G) TOOLS AND INSTALLING EQUIPMENT
- H) LADDERS, LADDER SEATS, SCAFFOLDS AND STOOLS
- I) CABLING
- J) WIRING AND CONNECTING
- K) LIGHTING

- L) POWER
- M) BATTERIES
- N) MACHINE AND ENGINE EQUIPMENT

- A) COMMON HAZARDS

Appliances, Electrical - Disconnect ALL Electrical Appliances which are left attended.

Behaviour - Discourage and forbid horseplay or other physical roughness.

Clothes, Wet - Avoid the use of wet or moistened clothes where they might come in contact with live circuits.

Doors - Open cautiously to prevent collision with employees passing by or working within the door opening radius.

Electric Drills and Guns - Disconnect from power source when removing and inserting drills or bits. Cartridge operated tools shall only be used by suitable qualified persons.

Eye Protection - Wear goggles when it is necessary to look up at the work, or where there is danger from flying objects, when other operations are in process directly above, or adjacent to a work station, or when handling electrolyte or using a grinding wheel. The mounting of abrasive wheels above 55mm (approx. 2") shall not be undertaken by persons other than one who is suitably qualified.

Face, Position of - Look down at the work rather than up at it, or at face level.

Falling Objects - Extra care should be taken to safeguard personnel working below, adjacent to, or passing the work.

Observe the following practices:

- a) Do not congest the working area.
- b) Use sheets where it is necessary to protect personnel working below from

falling objects such as tools, material or equipment.

- c) Do not place tools, material or equipment where it might fall from superstructure, cable rack, ladder steps or scaffolds.

Framework - Do not stand on the tube, trunking or pipes to perform work or climb on temporary structures to reach work, use correct Plant/Equipment.

Glass, Broken - Avoid placing broken glass or other sharp objects in wast baskets.

Gloves - Wear gloves to protect hands when required. Do not wear gloves when working with moving or rotating machinery or when using electric drills or mechanical tools.

Hands - Do not wash hands with paraffin, or petroleum spirits and do not use hands where a tool is required.

Insecure Balance and Footing - Do not work at any locations where a safe position of balance and with secure footing cannot be ensured.

Lifts - Observe the following practices:

- a) Operated only by authorised person.
- b) Avoid crowding in getting on or off the lift.
- c) Do not hold heavy or unwieldy objects while the lift is running.
- d) Doors closed or shaft opening protected except when lift is at the floor.
- e) Do not overload any lift.

Lifting - Do not lift or carry loads which are too heavy or unwieldy for one person.

Moving and Rotating Equipment - Avoid adjusting or repairing moving and rotating equipment without stopping the equipment. Do not wear gloves when performing operations on moving or rotating equipment or when using electric drills or mechanical tools.

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Nails - Remove protruding nails, tacks and splinters before scraping or cleaning woodwork, or walls or before storing equipment. Do not put nails, tacks, pencils or other similar objects in the mouth or pocket.

Projections - Projecting ends should be covered with canvas pads, be removed, or caution signs placed to prevent employee injury.

Radiators - Do not stand on radiators to perform work. Use ladders, scaffold or steps.

Suspended Loads - Do not stand or walk under equipment being hoisted. Be alert when standing in the vicinity of hoisting operations.

Place caution signs and ensure that alarm bell operates when using street hoists.

Tools - Do not cover defective parts with paint or tape, discard defective tools. Inspect tools before using to determine that they are safe.

Keep sharp edged or pointed tools well covered when not in use. When using sharp edged tools cut away from the body.

Place tools conveniently with respect to work to prevent fatigue, or loss of footing. Do not place tools where they might fall from ladders, scaffolds or steps. Do not place tools on window sills or frames, where they might fall out on a passerby.

Tripping Hazards - Avoid storing or leaving tools, material, equipment and packing materials in the gangway where they might interfere with the operation of rolling ladders or might trip an employee passing through. Do not allow lamp or extension cords to lie on the floor in the gangway.

Tubes, Cold Cathode - Handle these tubes properly in accordance with special instructions due to the presence of radioactive material.

Windows - Avoid sitting in an open window; do not place tools on window sills or frames.

Working Conditions - Do not perform work operations above or below other operations without taking precautions to avoid accidents.

Use sheets to prevent injury from falling objects.

Use care, or wear head protection, where there is insufficient head clearance.

Provide sufficient lighting to prevent injury due to tripping over tools, steps or extension cords which might be carelessly left on the floor in the gangway.

B) **BUILDING CONDITIONS**

Blind Approaches - At main intersections where there is a general movement of personnel from several directions, caution signs should be placed to prevent collision.

Damaged, Obstructed or Slippery Stairways - No loose steps or hand rails, treads free of slippery substances and no obstructions to interfere with free passage.

Dirt and Dust - Accumulations of dirt and dust above work location should be removed before starting work to avoid eye injuries.

Fixtures Projecting - Projecting fixtures or projections in the building structure along approaches to the work location; storerooms, washrooms or lunch and locker facilities should be padded and neutralised or caution signs should be placed.

Floors and Partitions - Holes in floors or partitions should be closed or repaired and broken plaster on walls or ceilings repaired. These conditions are accident, fire and dust hazards.

Inadequate Lighting - Lighting at approaches to stairs, on stairs and at landings should be adequate to prevent accidental falling or tripping.

Lifts - Lift shafts should be kept closed with permanent or temporary doors or barricaded to prevent injury or death by falling.

Material Storage - Equipment, tools and supplies should be stored in such a manner as to avoid injuries due to falling objects, collision and tripping.

Slippery Floors - Floors should be free of oil drippings and water to prevent falls and injuries.

Step-Down - Hidden step-downs behind doors in work locations, storerooms, washrooms or lunch or locker facilities should be clearly marked with caution signs.

ACCESS & EGRESS TO THE WORK PLACE MUST BE KEPT CLEAN AND CLEAR AT ALL TIMES

C) **FIRE HAZARDS**

Be aware of Fire Exits, Routes and Fire Fighting Equipment.

Combustible Material - Do not place combustible material near or against heating units.

Fire Exits - Fire Exits must be unlocked and unobstructed. Emergency lighting on fire exit stairways should be in working order.

Fire Extinguishers - Carbon Dioxide, foam and soda acid extinguishers contain material which can cause physical injury. Handle them properly.

Fire Fighting Equipment - Fire fighting equipment should be available, operational and unobstructed by equipment, tools and supplies.

Fire Protection Equipment - Bulkheads, cable hold covers and fire screens should be in their proper place except when installing operations in process prevent it.

Packing Material and Scrap - Remove before accumulation presents a fire hazard.

Working Clothes - When not in actual use working clothes should be kept in clothing lockers or on coat racks.

D) **ELECTRIC SHOCK**

Direct Current Potential - Voltages of 110 or less are not normally considered dangerous to personnel ...however...

The involuntary muscular reaction to electric shock at DC voltages as low as 100 volts may result in injury by striking adjacent framework or projecting equipment, falling from ladders or steps, or from dropping tools or other equipment.

Disconnecting AC Services - Where it will not cause a service interruption when working on AC Service, open circuit fuses or switches to disable the power. Padlock the isolating device in the off position, before commencing work on the service.

When circuits are working, obtain approval before removing fuses or opening switches.

Hazardous Locations - Work locations should be carefully surveyed to determine if there are fuse panels or equipment where bodily contact may be made to AC or DC voltages of 100 volts or greater.

Such panels or equipment should be covered with canvas, sheet fibre or other insulation material. Adjacent ground connections should also be protected where contact with these potentials cannot be avoided.

Place caution signs at all equipment where potentials in excess of 100 volts are present.

Metallic Objects - metallic objects such as rings, watch bands and key chains should not be worn in the switch room as they may become caught in equipment or cause arcs of electrical current at live equipment.

Using Test Equipment of High Voltage or Current - Follow the following procedure:-

- a) Second person should be present.
- b) Check insulation of test leads.
- c) Check earth leads, mechanical and electrical connections.
- d) Use one hand, keep other hand away from apparatus.
Keep fingers of active hand away from the metal end of the test probe.
- e) Stand on insulation material and avoid contact with ground objects.
- f) If possible, attach test leads with the power off, when connected turn power on.

Work on Live AC Services - When unavoidably necessary to work on AC services two skilled men should be present. These men shall be aware of the hazard involved, measures necessary to avoid an accident and action necessary, in case of an emergency.

E) INJURIES AND FIRST AID

First Aid Care - Give injured person first aid care in all cases and determine the extent of the injury. Obtain professional medical care for all head, eye and back injuries and where doubt exists as to the extent of the injury.

First Aid Kits - A complete, sterile first aid kit should be available and its location should be known to all personnel. The kit should contain instructions for use.

F) CLOTHING

Badly Worn Shoes - Shoes with torn, loose or thin soles. Long shoe laces or badly turned over heels should not be worn to avoid injuries due to tripping and to prevent foot bruises and sprains.

Avoid wearing leather sole and heels on ladders, scaffolds and steps.

Loose Clothing and Ties - Avoid wearing loose clothing and ties around machines to avoid catching them on rotating parts.

Metallic Objects - Do not wear metallic objects such as rings, watch bands or key chains as they are liable to be caught in equipment or cause arcs or flashes at live equipment.

Working Clothes - When not in actual use working clothes should be kept in clothing lockers or hung on coat racks.

Do wear warm clothing on site in winter time.

Do use all the protective clothing supplied for specific jobs.

Do wear safety helmets on site.

G) **TOOLS AND INSTALLING EQUIPMENT**

Cable Cutters - Keep hands clear of closing cutting edges, close slowly and use a second person to keep the cable taut while cutting.

Cold Chisels and Hand Drills - Mushroomed or rounded and dull tools are liable to cause eye or hand injuries.

Electric Tools

Soldering Iron - Pick up by the handle and hold away from the face while tinning. Support the iron properly, prevent it from being pulled from the holder by the weight of the cord or by an accidental pull on the cord. Check for shorts between the heating element and the shell of the tool.

Electric Drill - Release pressure and strengthen grip when drill point is about to break through the work. Do not use electric drills on live bus bar.

General - Check to ensure the housing of all electric tools are earthed. Check for shorts between the housing and current supply. Secure core plugs of appliances to prevent accidental disconnection when subjected to a sudden strain.

Hoisting Equipment - Check ropes, chains, steel cables, Eye and 'U' bolts and hoisting hooks for any evidence of wear or chafing.

Mobile Scaffold - Do not ascend without all horizontal and diagonal braces in position.

Power Hacksaw - Ensure that the blade is sharp and properly positioned. Stand clear of falling out ends and of the power arm when it rises automatically at the end of the cut.

Propane Torch - Light the torch using only a cut type flint lighter. Avoid using the torch in bright sunlight where the flame may be invisible.

Scaffolds - Check scaffolds for damaged or loose parts. Check for slippery substances on the planks.

Stripping Tools - Move away from body when stripping cables. Use care to avoid striking hands against apparatus, terminals, or other equipment.

Steel Tape or Rule - Avoid use around live equipment to avoid shorts, arcs and flashes.

H) **LADDERS, SCAFFOLDS AND STEPS**

Ladder Hazards

- a) Avoid leaving tools, materials and apparatus unattended on ladders, etc.
- b) Avoid using nearby equipment to assist in ascending or descending ladders or in shifting position. Face the ladder when ascending or descending.
- c) Do not work with one foot on ladder and the other on adjacent equipment.
- d) Do not step from one ladder to another or reach too far as to become unbalanced.
- e) Ensure that there is no slippery substance on ladder steps.
- f) Do not place ladders on a box or boxes to gain additional height.
- g) Do not work with more than one man on a ladder or steps.
- h) Do not use painted ladders or steps as the paint may obscure broken or split wood.
- i) Avoid throwing tools or other material to another person on an adjacent ladder or on the floor.
- j) Avoid using a step ladder without spreaders fully extended or in a leaning position. Do not occupy the top step of the ladder.

Scaffold and Step Hazards

- a) Do not support scaffolds on ladders. Use specially designed scaffolds which are securely connected.
- b) Do not splice scaffold planks by lapping them one over another.
- c) Protect projections with a canvas padding to prevent head injuries to employees passing below.
- d) Mount scaffold using a step ladder held securely by another employee.
- e) Do not move mobile scaffolds while an employee is on the platform.
- f) Lock all wheels on mobile scaffold before using.
- g) Do not place steps on scaffolds without clamping them securely.

I) **CABLING**

Cable Holes - Place temporary guard rails or covers over all cable holes except when cables are actually being run.

Cross Connections - Protect arms to avoid scratches and cuts from terminals.

Dust and Dirt - Ensure that all cable runs are free of dust and dirt to avoid eye injuries and damage to equipment.

Lighting - Light cable runs to prevent injury when pulling and securing cable.

Projecting Details - Pad projections on cable rack to prevent hand and lower back injuries to employees.

Pulling Cable - position your body in a way to avoid an awkward twisting of the back. This will cause strains on the back muscles and spine possibly leading to injury.

Stripping Cable - Do not strip cable using a knife, use only a specially designed cable stripping tool.

Cable Drums - Avoid contact with inside edge of centre hole which may be sharp, causing a deep cut on the hand.

J) WIRING AND CONNECTING

When wiring, care should be taken particularly when pulling numbers of cables in conduits. Care should be taken that cables are not lying about for other operatives to trip over and care that cables are drawn in by use of a proper draw-wire and not a steel tape which may injure the hands.

When using steel armoured cable always use the gloves provided.

When connecting up most accidents are through the use of a knife. Where possible proper stripping tools should be used and connections should never be made to 'live' apparatus unless vitally necessary.

K) LIGHTING

Lighting - Avoid working on live circuits. Check earthing of flexible cord or thin strip connected to fluorescent fixtures to eliminate shock hazard.

L) POWER

Power - When installing near live power bus bars cover with a protective sheet fibre to prevent accidental contact.

Bus-Bar - Do not use electric drills for drilling live bus bars. Insulate all tools.

File off all burrs and sharp edges and handle with gloves.

Wear safety goggles when cutting and drilling.

Conduit - When pulling wires through conduit anticipate that the tape might break causing a sudden release of wires or cables potentially throwing the body off balance.

Power Board and Wiring

- a) When connecting leads to equipment that may be live, guard against arcs and flashes. Measure the potential on the leads to be joined with a voltmeter.
- b) Danger at power boards is intensified by voltages not normally considered hazardous due to large currents available.
- c) Stand on insulating material and always disconnect service when practical before working on power equipment.
- d) Ensure that nothing is done which might endanger any workers. Ensure that each worker is positioned to avoid slipping, stumbling or moving backward against live parts.
- e) Employees should be aware that capacitors will remain charged for some time after power is removed. The capacitors should be bled of all stored potential before working on the circuit.
- f) Test for temperature with the back of fingers and not fingertips. Reflex action will cause a release and not a grasping action of the arm and hand should the power bar be hot.
- g) When working on power equipment open switches and remove fuses when practicable. Place warning tags to prevent accidental closure of switches and replacement of fuses. Where facilities exist padlock switches in the open position.

Do not work on LIVE equipment unless it is a matter of LIFE or DEATH to maintain the Service.

If this is necessary in an emergency always have two skilled operatives backing up each other.

If work on LIVE equipment is required a "Permit to Work System" must be operated.

M) **BATTERIES**

Unpacking - Before unpacking cells or electrolyte check box or crate for indication of leakage. Use rubber gloves, apron, over shoes, goggles and acid-proof overalls when in danger of contacting electrolyte.

Electrolyte - Before handling lead-acid cells, have a soda solution and clear water available for use in case electrolyte comes in contact with the skin or eyes and ammonia available for clothing. For nickel cadmium cells, have boric acid and clear water available. Use clear water only for flushing acid or basic electrolytes from the eyes and contact a doctor immediately.

Gases - Gases emitted by storage batteries are flammable. Guard against ignition by sparks from static electricity or open flames. Warning signs should be posted. No smoking signs must be posted and observed.

Glass Jars - Encircle glass jars in a canvas blanket when moving them to avoid injury if the jars break. Older jars which must be re-located are extremely brittle and should not be moved while containing electrolyte. Extreme care is required.

N) **MACHINE AND ENGINE EQUIPMENT**

Machine and Engine Equipment - High voltages are dangerous; do not work on live machines when otherwise practicable.

Rotating Machines

- a) Keep floor areas free from oil or grease to prevent slipping.
- b) Remove automatic start supply fuses before working on, or near moving parts.
- c) Avoid contact with brushes which operate at temperature which can cause severe burns.
- d) Metallic objects such as nuts, bolts and screws should be kept away from generators as they may be attracted to pole pieces and be thrown by the armature.

GENERAL ADVICE

- i) These points are guide lines only. If you have a problem get in touch with your Safety Representative and Supervisors.
- ii) Notices relating to the state of all live circuits must be displayed at appropriate locations.

A.3

EMERGENCY INFORMATION

LOSS OF ELECTRICITY:

London Electricity
261 City Road
London EC1V 1LE

Tel: 0171 733 5611
Fax: 0171 250 7313

STANDBY GENERATION FAILURE

AVK/SEG (UK) Ltd.
Unit 9, Ministry Wharf
Saunderton, High Wycombe
Bucks HP14 4HW

Tel: 01494 564 541
Fax: 01494 564 543

FIRE ALARM SYSTEM / VOICE ALARM MALFUNCTION

I.A.T. (Europe) Ltd.
Parc House
25-37 Cowleaze Road
Kingston upon Thames
Surrey KT2 6DZ

Tel: 0181 546 1100
Fax: 0181 546 1122

Building Services Operating and Maintenance Instructions
5-7 Carlton Gardens, London SW1

SECURITY SYSTEM MALFUNCTION

Blenheim Security Systems Ltd.
3 Station Mews
Potters Bar
Hertfordshire EN6 1TL

Tel: 01707 646 232
Fax: 01707 646 234

ADDRESSABLE EMERGENCY LIGHTING TEST SYSTEM

JSB Electrical
Manor Lane
Holmes Chapel
Cheshire CW4 8AF

Tel: 01477 537 773
Fax: 01477 539 202

ELECTRICAL SERVICES CONTRACTOR

T. Clarke Plc
Stanhope House
116-118 Walworth Road
London SE17 1JY

Tel: 0171 252 7575
Fax: 0171 701 6265

A.4

CONTRACTUAL AND LEGAL DETAILS
(GUARANTEES AND WARRANTIES)

L.V. SWITCHGEAR & DIST. BOARDS

Anord Control Systems Ltd.
Industrial Estate, Coes Road
Dundalk, Co. Louth.

Tel: +353 (0) 42 32268
Fax: +353 (0) 42 38907

(Refer to Section H.1 of this O & M Manual for details)

STANDBY GENERATION

AVK/SEG (UK) Ltd.
Unit 9, Ministry Wharf
Saunderton, High Wycombe
Bucks HP14 4HW

Tel: 01494 564 541
Fax: 01494 564 543

(Refer to Section H.3 of this O & M Manual for details - Equipment guarantee is for 12 month from commissioning date given in Section I.7 of this O & M Manual)

FIRE ALARM SYSTEM / VOICE ALARM

I.A.T. (Europe) Ltd.
Parc House
25-37 Cowleaze Road
Kingston upon Thames
Surrey KT2 6DZ

Tel: 0181 546 1100
Fax: 0181 546 1122

(Refer to Section H.8 sub-section 9 of this O & M Manual for details)

SECURITY SYSTEM

Blenheim Security Systems Ltd.
3 Station Mews
Potters Bar
Hertfordshire EN6 1TL

Tel: 01707 646 232
Fax: 01707 646 234

(Refer to Section H.6 of this O & M Manual for details - Equipment guarantee is for 12 month from commissioning date given in Section I.9 of this O & M Manual)

ADDRESSABLE EMERGENCY LIGHTING TEST SYSTEM

JSB Electrical
Manor Lane, Holmes Chapel
Cheshire CW4 8AF

Tel: 02477 537 773
Fax: 01477 539 202

(Refer to Section H.14 of this O & M Manual for details - Equipment guarantee is for 12 month from commissioning date given in Section I.11 of this O & M Manual)

B

B THE INSTALLATION

B.1 SCOPE OF WORK

The building construction at 5-7 Carlton Gardens is generally steel frame with composite concrete and metal decking floors. The central core walls are in-situ reinforced concrete with some masonry walls. Dry lined wall construction is also used in some areas.

The building occupation is as follows:

Basement	-	Car park and plantroom
Lower ground	-	Office
Ground	-	Office, main office entrance, residential entrance
1, 2, 3, 4, 5	-	Office
6, 7	-	Residential units and plant area
Roof	-	Open plant area and space for satellite dishes

The electrical services have been installed in accordance with the Specifications and Drawings, the current IEE Wiring regulations (BS 7671), all relevant British Standards, Codes of Practice, Regulations and Requirements of the Local Authority.

The electrical installation including the fire alarm system is fully rewirable with access provided at all pulling points.

The installation is surface type in plantrooms, service risers and above false ceilings but concealed type in all other cases. The building structure is as described above.

The location of all equipment and outlets is as shown on the Record drawings.

The scope of works as herein described included the supply, installation, testing and commissioning of the following elements:

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5-7 Carlton Gardens, London SW1

- a) Main incoming power supply cables and equipment
- b) Standby generator installation
- c) Main LV switchboard
- d) Life Safety LV switchboard
- e) Sub-main cabling and distribution boards
- f) Earthing and equipotential bonding
- g) Final circuits and small power
- h) Lighting and lighting control system
- i) Emergency lighting and automatic testing system
- j) Lightning protection
- k) Fire detection and voice alarm system
- l) Office tenant communications containment
- m) Landlords communications and security system
- n) Power supplies for lifts
- o) Power supplies to mechanical and public health plant and equipment
- p) Residential unit electrical supplies
- q) Residential unit fit out
- r) Residential unit IT services infrastructure cabling
- s) Residential TV aerial system
- t) The provision of 'AS FITTED' project documentation.

B.2

DESIGN CRITERIA

The electrical building services design has been prepared by:

Ove Arup & Partners
13 Fitzroy Square
London W1P 6BQ

Tel: 0171 636 1531
Fax: 0171 580 3924

and has been carried out in accordance with the following standards and regulations:

a) Mechanical & Public Health Services

VOLUME 1 – Materials and Workmanship Specification; Job No. 54015 issued 15/5/98

b) Mechanical & Public Health Services

VOLUME 2 – Equipment Data sheets; Job No. 54015 issued 15/5/98

c) Electrical Services

VOLUME 3 – Particular Specification; Job No. 54015 issued 20/2/98

d) Electrical Services

VOLUME 4 – Materials and Workmanship Specification; Job No. 54015 issued 15/5/98

e) Electrical Services

VOLUME 5 – Security Specification; Job No. 54015 issued 15/5/98

f) BMS / Controls Specification

VOLUME 6 – Job No. 54015 issued 15/5/98

g) 16th Edition of the I.E.E. Wiring Regulations (BS 7671).

For relevant B.S. References, refer to Project Specification Documents as listed above.

B.3

DESCRIPTION OF SYSTEMS

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B.3

DESCRIPTION OF SYSTEMS

B.3.1

Incoming Electrical Supplies and Metres

The electricity supplies have been brought to site by London Electricity at 11,000 volts. A ring main unit and transformer is provided by London Electricity and they have also provided and installed cables from their transformer to their low voltage distribution frame. This equipment is located in the transformer chamber in the south east corner of the site at basement plantroom level.

The incoming cables run into the lightwell then down into the transformer chamber. Cable supports and fixings in accordance with LE's requirements have been provided and installed.

The Electrical Services Contractor has liaised with and arranged for the necessary works for the London Electricity (LE) supplies for the building with the following contact:

Mr Sabih Ahmed
London Electricity plc
Connections Business Projects
261 City Road
London EC1V 1LE

Three main LV services have been provided from LE, one to the landlord's main switchboard and one to each of the 2 No. 12 way TP&N distribution boards provided by the Electrical Services Contractor for the building tenant's supplies. The distribution boards for tenant supplies are of manufacture as shown on the record drawings.

The LV electrical supply is provided at 400V/230V, 50 Hz, three phase, 4 wire, TN-S system.

The supply to the main low voltage switchboard is metered as it enters the switchboard. The metering CT chamber includes removable links, sized for full load to London Electricity's requirements.

Each half office floor, each residential unit and the residential common parts receives a separately metered supply (24 No. in total). The tenant supplies are all 400V 100A TP&N in line metered with the meters being located together in the tenant meter room at basement level.

B.3.2

Main Electrical Distribution

The Electrical Services Contractor has provided all the low voltage switchgear as detailed and as shown on the Record drawings TC107802/E/400 to 403 inclusive.

The main LV switchboard SB.01 is a front access cubicle type board suitable for bottom entry cabling from London Electricity with top entry cabling to feed the building loads. The live safety switchboard SB.02 is a front access cubicle type board suitable for bottom entry cabling from the standby generator (and to/from the main LV switchboard) with top entry cabling to feed the building loads.

Automatic changeover panels for duplicate life safety supplies are installed as shown on the schematics and drawings. The general standard of construction of these changeover panels is as the main switchboards. The changeover panels are wall mounted generally adjacent to the relevant motor control panel (MCP).

Main Switchboard SB.01 and Life Safety Switchboard SB.02

- L.E. to Ryefield distribution board 'A' – 4 x 1c 185mm² XLPE/AWA/LSF
- L.E. to Ryefield distribution board 'B' – 4 x 1c 185 mm² XLPE/AWA/LSF

Feeders to Ryefield panel 'A' and 'B' are installed with a separate single core 240mm² G/Y LSF insulated circuit protective conductor.

The main switchboard and life safety switchboards are located in separate rooms in the basement as shown on the Record drawings. The two switchboards are linked with 16 No. single core 240mm² XLPE/SWA/LSF cables rated as the switchboard busbars.

For maintenance purposes and ACB lifter/loader is provided complete with all necessary rollers, winding gear etc.

The main L.E. feeders have been installed as follows:

- L.E. to SB.01 – 8 x 1c 400mm² XLPE/SWA/LSF with separate 1 x 300 mm² CPC in trench

The feeder link between the 525kVA standby generator and the life safety main switchgear SB.01 has been carried out utilising 8 x 1c 185mm² XLPE/AWA/LSF cables with 1 x 70mm² single core G/Y CPC. The 2000 amp bus coupler link between life safety switchgear SB.02 and the general load main distribution switchgear SB.01 has been carried out utilising 16 No. 240mm² single core XLPE/AWA/LSF insulated cables.

The following loads are served from the life safety distribution switchgear SB.02 and from distribution switchgear SB.01 (normal supplies) via local changeover panels:

- a) Sprinkler system panel via 4 x 50mm² MICC/LSF cables ref. 101 and 201
- b) Hosereel pump set via 4c 4.0mm² MICC/LSF cables ref. 102 and 202
- c) Lower ground floor MCP1 via 4 x 1c 25mm² MICC/LSF cables ref. 103 and 203
- d) Fire fighting lift 'L4' via 4 x 1c 10mm² MICC/LSF cables ref. 104 and 204
- e) Basement MCP2 via 4 x 1c 10mm² MICC/LSF cables ref. 105 and 205
- f) Basement MCP3 via 4 x 1c 16mm² MICC/LSF cables ref. 106 and 206
- g) Basement MCP4 via 4 x 1c 25mm² MICC/LSF cables ref. 107 and 207

4 x 1c 25mm² MICC/LSF feeder cable ref. 208 provides supply to office floor smoke dampers distribution board ref. B/EL4.

The majority of outgoing circuit protective devices installed on the main distribution switchgear SB.01 and SB.02 are fuse switches with fuse links to BS-88 and rated as shown on the Record drawing TC107802/E/400.

Chiller No. 1 and chiller No. 2 are provided with 4 pole 400 amp MCCB and the 300 kVAR power factor correction equipment is provided with 630 amp rated MCCB.

The switchboard's incoming supplies are controlled by air circuit breakers as follows:

2000A	ACB M1	Mains supply to SB.01
2000A	ACB G1	Generator supply to SB.02
2000A	ACB M2	Mains supply from SB.01 to SB.02
2000A	ACB G2	Generator supply from SB.02 to SB.01

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The switchboards, ACB's and the cable interconnector are rated to facilitate the removal of the small life safety generator and replacement with a single large generator capable of supplying all the landlord and office/residential tenant loads using the basebuild switchboards SB.01 and SB.02.

In order to effect the mains/generator changeover controls the switchboards have the following control switches incorporated:

- a) Changeover control system 'AUTO/MANUAL/TEST' switch (padlockable in all modes on SB.02).
- b) ACB's M1, G1, M2 & G2 electric 'TRIP/CLOSE' switches (spring loaded to be in the centre "off" position) on SB.01 and SB.02 respectively.
- c) Generator 'START' pushbutton on SB.02.
- d) Generator 'STOP' pushbutton complete with lift-up flap (to operate in 'AUTO' and 'MANUAL' and 'TEST' modes) on SB.02
- e) Generator emergency stop push button.

The life safety SB.02 switchboard also includes the following generator system indicators:

- a) Generator 'FAULT SHUTDOWN' lamp
- b) Generator 'ALARM' lamp (from generator control panel)
- c) Generator system 'AVAILABLE' (system normal) green lamp ie generator available to start and ACB G1 in the service position
- d) Generator system 'NOT AVAILABLE' red lamp ie generator not available and/or ACB G1 withdrawn or in test position.

Labels

All functional devices are labelled to indicate fuse ratings or current rating and purpose of device. Switchgear controlling fire detection and voice alarm equipment is labelled in accordance with BS 5839 i.e. device is painted red and labelled "Supply to fire alarms. Do not switch off other than for planned maintenance or in an emergency".

Air Circuit Breakers

All air circuit breaker are the withdrawable type with an automatic closing mechanism which is effected by using a motorised mechanism. The mechanical 'CLOSE' push button facility on the ACB has been made inoperative.

Protection Relays

Protection relays are provided from the GEC Midos range as indicated on the Record drawings, schedules and as specified below:

- a) Overcurrent and unrestricted earth fault protection is provided as time delayed overcurrent relay with three phase and one earth fault element and with high set elements. A 14 way test block is provided with this relay.
- b) Three phase mains under-voltage detection relay with a time delay feature incorporated.
- c) A lock-out relay is used in conjunction with each overcurrent relay. The lock-out delay is arranged to prevent closing of ACB's during the changeover control sequence in the event of an overcurrent or unrestricted earth fault condition.
- d) The relay circuits operate at 30 V DC and a battery and charger unit is provided for this purpose.
- e) All CT's are provided with shorting terminals.
- f) Relay provision is as follows for each ACB:

ACB M1	Time delayed overcurrent relay with three phase and one earth fault elements and high set elements.	Inverse time delayed overcurrent. Inverse time delayed earth fault.
--------	---	---

Under voltage relay 3 elements, high DO/PU, single, fixed settings. Static time delay. Delay on pick-up. Setting range 100/1 or 1000/1.	Time delayed undervoltage
---	---------------------------

Check synchronising relay, undervoltage check	Check switch
--	--------------

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	Tripping & control relay. Hand reset/instantaneous 4/10 contacts.	Lockout
	Trip supply & trip supervision relay. Breaker open/closed.	Trip circuit supervision
G59 Protection comprising of:		
	Static independent time, a.c. undervoltage relay.	Undervoltage
	Static independent time, A.C overvoltage relay.	Ovvoltage
	Digital, independent time under or over frequency relay.	Time delayed under frequency
	Rate of change of frequency.	Rate of change of frequency
ACB M2, G2	Single phase time delayed overcurrent relay with high set instantaneous element.	Directional inverse time delay earth fault
	Time delayed overcurrent relay with three phase fault elements and with high set elements.	Directional inverse time delayed overcurrent
	Tripping & control relay. Hand reset/instantaneous 4/10 contacts.	Lockout
	Trip supply & trip supervision relay. Breaker open/closed.	Trip circuit supervision.
ACB G1	Single phase time delayed overcurrent relay with high set instantaneous element.	Inverse time delayed earth fault

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Instantaneous overcurrent relay. Single element, tuned, differential.

Under voltage relay
3 elements, high DO/PU
single, fixed settings. Static
time delay. Delay on pick-up.
Setting range 100/1 or 1000/1.

Check synchronising relay, with undervoltage check.

Independent time
overpower/reverse power
relay.

Reverse power.

Voltage restrained over-current relay with independent time characteristic.

Voltage controlled overcurrent.

Tripping & control relay.
Hand reset/instantaneous
4/10 contacts.

Lockout No. 1
(generator).

Tripping & control relay.
Hand reset/instantaneous
4/10 contacts.

Lockout No. 2
(generator).

Trip supply & trip supervision relay. Breaker open/closed.

Trip circuit supervision.

Controls

ACB's include the following controls:

- a) Electric "TRIP/CLOSE" switch.
- b) Electric interlocking as detailed above.
- c) Interlocks which prevent a particular ACB from being closed in the "SERVICE" position is defeated when the particular ACB is in the "TEST" position by means of suitable carriage switch(es).

When an electrically interlocked ACB is fully withdrawn, any interlock contacts appearing in the closing circuits of other ACB's are defeated by a carriage contact as appropriate to ensure that the interlocking scheme operates as if the withdrawn circuit breaker is still "IN SERVICE" and open.

- d) All necessary 30V DC fused supplies are derived from the LV switchgear tripping system taken from the 30V buswires in the LV switchgear through the relevant protection relay contacts to terminals suitably placed to permit connection.

Instrumentation and Metering

Instrumentation and metering is provided in accordance with the drawings and schedules and in order to reduce the space requirements for the instrumentation, multi-function digital instruments have been provided. These instruments indicate readings of current, voltage, power factor, frequency and maximum demand on a digital display with selector buttons for the different functions. Pulse kWh outputs are taken to terminals for extension to the BMS.

Tripping Supplies

Tripping of the ACBs is effected using a 30V DC tripping source, comprising batteries and charger unit.

The tripping and protection auxiliary supply circuits for the switchboard ACBs is designed for operation with a 30V DC tripping source.

230V AC supplies to feed the tripping battery/chargers is provided from the local essential distribution board.

The trip/close control supply battery/charger unit sustains at the end of a period of 8 hours mains failure the following:

- a) Standing load of all protection relays and indicator lights.
- b) Simultaneous closing of 2 No. ACBs.
- c) Sequential closing of up to 10 No. ACBs in rapid succession.
- d) Simultaneous tripping of 5 No. ACBs.

- e) Sequential tripping of up to 20 No. ACBs in rapid succession.

At the end of an eight hour period, and following the sequential closing and tripping operations, the battery output voltage will not be less than 85% of its nominal value.

Each switchboard assembly is provided with its own set of common trip/close buswires derived from separately fused circuits at the battery charger unit. Each ACB is provided with its own separately fused trip circuit and its own separately fused closing control circuit.

Closing Supplies

Only control is effected using the same 30V DC source as used for tripping. Closing power is 230V AC motor wound spring release in the case of non-manual spring charged closing ACBs.

BMS Indications and BMS/Generator Marshalling Compartments

Voltage free contacts are provided and wired to a dedicated marshalling terminal compartments on the switchboards to indicate the status of all ACBs M1, M2, G1 & G2 to the BMS as follows:

- i) Open/Close
- ii) Fault Trip
- iii) Carriage position "IN SERVICE" (Available) or "OUT OF SERVICE" (Not Available)

In addition, voltage free contacts are provided to indicate the following conditions to the BMS:

- i) Under voltage relay contacts to indicate "MAINS FAIL" and "MAINS AVAILABLE" for mains feeder.
- ii) Generator "AVAILABLE" and "NOT AVAILABLE"
- iii) "SYSTEM NORMAL" signal to BMS is provided only when the following conditions are met:
 - ACBs 'M1', 'M2', 'G1' & 'G2', in 'SERVICE'
 - ACBs 'M1', 'M2' and 'G2' closed and 'G1' open
 - 'AUTO/MANUAL/TEST' switch in 'AUTO'
 - Generator 'AVAILABLE'
 - No ACB 'FAULT TRIP' indications

The terminals for BMS indications, 30V DC tripping and generator control system controls, are located inside separate terminal marshalling sections for each of the switchboards with the terminals clearly labelled.

Power Factor Improvement Capacitors

Stepped automatic power factor correction to 0.95 lagging is provided on the main LV switchboard, rated at 300 kVAr in 25 kVAr steps.

The capacitors are 600 volts rated and internal protection to disconnect faulty elements in the event of a dielectric breakdown.

Mains /Generator Control System

A padlockable 'AUTO/MANUAL/TEST' switch is provided on the life safety switchboard SB.02 to select either automatic mains failure operation or manual controller test generator against the building load.

Electrical interlocking is provided to prevent inadvertent simultaneous manual closing of ACB's M1 and G1 at any time when not synchronised.

All control calling is wired via marshalling compartments in order that the generator control system can be wired into the switchboards.

If an undervoltage condition on the incoming supply to ACBs M1, the generator start-up sequence is initiated. However, the start-up sequence will be inhibited if ACB M2 has tripped on overcurrent or unrestricted earth fault protection. If ACB M1 trips on overcurrent or unrestricted earth fault then it trips ACB M2 and the generator will start.

The generator changeover control sequence is dictated by the position of the 'AUTO/MANUAL/TEST' switch on the switchboard.

If the 'AUTO/MANUAL/TEST' switch is moved from 'AUTO' to 'MANUAL' or from 'TEST' to 'MANUAL', no ACB operation takes place as a result.

If the 'AUTO/MANUAL' switch is moved from 'MANUAL' to 'AUTO' or from 'MANUAL' to 'TEST', then ACBs switch to the dictates of the undervoltage relays and availability of the ACB's in relation to their protection status and carriage position.

When the system is in the 'AUTO' or 'TEST' mode the changeover from main supply to generator supply and back again is carried out automatically. In both cases reconnection to the main supply is a synchronised temporary parallel (soft) load re-transfer with no interruption of supply.

Anti-pumping circuits are provided to prevent continual energising of trip/closing coils and the circuits are designed so that reset buttons are not required.

When the system is in the 'MANUAL' mode the mains and generator ACB's must be opened and closed manually via the electric 'TRIP/CLOSE' switches. It is not possible to simultaneously operate 'CLOSE' switches for ACB's to parallel the generator and mains supplies.

Operation in 'Auto' Mode

Normal Operation

- i) ACB M1, M2 and G2 closed. ACB G1 open.
- ii) Electrical interlocking prevents the ACB's from being inadvertently closed when the ACB's are in the service position as detailed in i. above.
- iii) The 'CLOSE' function on all ACB's (in i. above) 'TRIP/CLOSE' control switches are disabled i.e. all ACB close control is carried out via the generator automatic synchronising and mains failure system.
- iv) The 'TRIP' function on the ACB's 'TRIP/CLOSE' control switch is always enabled (in 'AUTO', 'MANUAL' and 'TEST').
- v) The standby generator plant 'STOP' push-button is always enabled ('AUTO', 'MANUAL' and 'TEST').

Mains Failure Operation

- i) Mains failure is detected by the under voltage relays on the incoming mains supply to the switchboards at ACB M1.
- ii) After a time delay of 2 seconds (adjustable 0-60 seconds) a signal is received by the automatic synchronising and mains failure system to:
 - a) If the generator is not running, start the generator. When the generator is up to speed, and the voltage and frequency is within tolerance, open ACB M1 and then close ACB G1.
 - b) If the generator plant is already running and the voltage and frequency are within the required tolerances, open ACB M1 and then close ACB M2.

- iii) Only when the generator voltage is sensed at ACB G1, ACB M1 receives a signal to open.
- iv) Only when ACB M1 has opened, a signal sent to close ACB G1.
- v) PFC voltage sensing is switched via a pair of double pole auxiliary contacts on the generator ACB's to disable the connection and PFC operation under generator supply conditions.
- vi) If the mains supply returns during the time delay period before the generator start signal is initiated then the generator start and changeover operation will be aborted. However, once the sequence has been initiated it shall proceed without interruption until the main restoration sequence occurs as below.
- vii) Signal interfaces to the BMS and lift controllers are provided to allow the necessary restrictions on plant operation required for generator only (no mains) and generator only (no mains) plus simultaneous fire alarm.

Mains Restoration Operation

When the 'AUTO/MANUAL/TEST' switch is in the 'AUTO' mode, the generator has been started and ACB G1 is closed, the mains restoration is as follows:

- i) When mains voltage is detected at ACB M1 and is steady for a fixed period of time (adjustable 0 – 30 minutes), the generator control system will synchronise with the mains. ACB M1 will be closed and the mains and generator will run in parallel to facilitate a no break soft load re-transfer when ACB G1 is opened.
- ii) On successful load re-transfer, confirmed by ACB M1 being in 'Service' and closed, and ACB G1 in 'service' and open a signal is sent to the generator control panel to allow shut down if necessary, following any cooling run.
- iii) When ACB G1 has opened signal interfaces to the BMS and lift controllers will indicate the building is on mains supply thus allowing all plant to operate normally.

Operation in 'Manual' Mode

Normal Operation

When the 'AUTO/MANUAL/TEST' switch is in 'MANUAL' the following conditions apply at the switchboard under normal operation:

- i) ACB M1, M2 and G2 are closed, ACB G1 is open.
- ii) Electrical interlocking prevents ACB's being inadvertently closed when ACB's are in the service position, as detailed above.

- iii) Both the 'CLOSE' and 'TRIP' functions on all of the ACB's electric 'TRIP/CLOSE' control switches are enabled.
- iv) The generator local control switches are enabled.

When the control system 'AUTO/MANUAL/TEST' switch is in 'MANUAL' the generator 'START/STOP' push-buttons at the switchboard are enabled. The 'START' button sends a signal to the generator control panel to start the generator (if it is not already running). The 'STOP' push-button sends a signal to the generator control panel informing it that power is no longer required and allowing the control panel to instigate shutdown sequence.

Mains Failure Operation

When the 'AUTO/MANUAL/TEST' switch is in the 'MANUAL' mode the undervoltage relays still operate as detailed but the signal from the undervoltage relays to start the generator is inhibited and the generator will not start automatically. However, a signal is sent to the BMS on mains failure detection to alert operations personnel.

With the 'AUTO/MANUAL/TEST' switch in 'MANUAL' the generator 'START/STOP' control can be effected by push-buttons located at the switchboard.

If the generator is started manually, no auto changeover will take place at the switchboard while the 'AUTO/MANUAL/TEST' switch is in 'MANUAL'.

Therefore, with the system in 'MANUAL' the changeover must be carried out manually at the switchboard via the 'TRIP/CLOSE' control switches on the respective ACB's.

However, if the generator is started manually and the mains has failed and the 'AUTO/MANUAL/TEST' switch is selected back to 'AUTO' then an automatic changeover takes place.

Mains Restoration Operation

When the 'AUTO/MANUAL/TEST' switch is in the 'MANUAL' mode and the generator has been started and the changeover carried out manually then the reverse procedure is carried out to changeover back to the mains by operating the 'TRIP/CLOSE' switches.

However if the generator is started manually and the mains has failed and then seen restored when the 'AUTO/MANUAL/TEST' switch is selected back to 'AUTO' then an automatic no break soft load re-transfer will take place.

Operation in 'TEST' Mode

Normal Operation

When the 'AUTO/MANUAL/TEST' switch is in 'TEST' mode the following conditions apply at the switchboard under normal operation:

- i) ACM M1, M2, G2 closed. ACB G1 open.
- ii) Electrical interlocking prevents ACB's being inadvertently closed when ACB's are in the service position as detailed above.
- iii) The 'CLOSE' function on all ACB's (in i.) above 'TRIP/CLOSE' control switches are inoperable, i.e all ACB close control is carried out via the generator automatic synchronising and mains failure system.
- iv) The 'TRIP' function on the ACB's 'TRIP/CLOSE' control switch is always enabled.
- v) The standby generator start and stop push buttons are always enabled.

Testing the Generator

When the selector switch is moved to 'TEST' the generator 'START' button is enabled. When the start button is pressed the generator will start and synchronise with the mains. When the generator voltage and frequency parameters have been within tolerance for a predetermined period (0 – 10 mins adjustable) ACB G1 will be automatically closed by the generator control system and the mains and generator will run in parallel.

The generator control system monitors the supply and limits the kVA output to ensure electricity is not exported to the grid.

It is expected that the period of parallel operation will exceed 10 minutes and therefore the configuration of the system matches the requirements of Engineering Requirements G5.9 for parallel generation.

If during a generator test the mains should fail then the ACB protection will operate to isolate the generator from the mains. A subsequent moving of the selector switch to the 'AUTO' mode and resetting ACB G1 lockout relay (if it has operated).

B.3.3

Standby Generation

A landlord's diesel driven 525kVA standby generator is provided at basement level.

The primary function of the generator is to provide secondary supplies to statutory life safety and essential loads as follows:

- Sprinkler pumps
- Hosereel pumps
- Staircase pressurisation – 3 No. (including relief fans and dampers)
- Firefighting lift installation
- Basement car park smoke extract
- Basement plant room smoke extract
- Various automatic dampers and openings for smoke ventilation
- Return of all lift cars including the car lift to a pre-determined floor on a one-by-one basis, ie not simultaneously
- Sump pumps essential mechanical plant and essential final circuits on landlords distribution boards.

The secondary function of the landlords generator installation occurs during interruption of the main supply without a simultaneous fire alarm, the 'spare' capacity available because life safety plant is not running, is utilised to power specified non-essential mechanical plant. The BMS is configured so that at any time al non-essential loads are shed immediately a fire alarm occurs to ensure the generator can fulfil its primary function.

The generator controller is interfaced with the lift controllers so that no fire alarm and during generator only (mains failure) operation only one of the car lifts and one other passenger, firefighting or goods lift operate at a time. During a fire alarm the lifts return one at a time to ground floor unless the fire is at g round floor whereas the lifts will park at the nearest floor with doors open at a time (including one of the car lifts).

To facilitate automatic testing of the generator against the base building load (landlord's load) a microprocessor based generating set management and control module is provided. The peak lopping facility is configured to operate as Automatic Load Test (ALT) for the generator against the building load by temporarily paralleling with the main supply. However, power is not exported to the grid. Both AMF and ALT modes allow for soft load re-transfer back to the mains supply.

B.3.4

Generator Room

A common standby generator room is provided in the basement. The generator room is located directly below the office at lower ground floor and attenuation of airborne and structural sound and vibration has been provided. The room provides space for the landlord's statutory life safety generator and various combinations of up to 3 No. tenant generators.

The landlord's generator day tank and exhaust flue has been installed under the base build as shown on the Record drawings.

Bulk oil storage is provided at basement level. The tank capacity such that it is sufficient for 16 hours operation at full load for 1250 kVA of generator capacity (suitable for base build and all future scenarios). Automatic fuel transfer facilities and an external fill point has also been provided.

The following items have been installed during the basebuild:

- 3 No. flues for future tenant generators (1 x 1250 kVA, 2 x 400 kVA)
- Acoustic lining of complete generator room
- Fuel bulk storage/dump tank suitable for basebuild and future generator scenarios
- All noise attenuation to intake louvres into common generator room
- Attenuation from landlord generator into the exhaust plenum

B.3.5

Final Distribution – Lighting and Small Power Systems

Final distribution circuits are run from the distribution boards located in electrical services cupboards as indicated on the Record drawings and schedules. Final circuit cabling is run in single core LSF cables installed in galvanised steel trunking and conduit. For lighting circuits the minimum conductor size is 1.5mm². For small power circuits, either in the form of ring mains or radials the minimum conductor size is 2.5mm².

All distribution boards are 3 phase and incorporate an integral isolating switch rated the same as the upstream protection device.

All distribution boards are fitted with a transient surge protection unit.

Landlords distribution boards facilitate the shedding of non-essential loads when the mains fails and only generator is supplying the building. A remote signal from the mains and generator ACB's operates in each distribution board as detailed on the Record drawings.

Tenant distribution boards are of a similar construction as Landlord with the facility to provide load shedding during the fit out phase as detailed on the Record drawings.

Cable ladders and cable trays are sized for a single layer of cables with 25% spare capacity. Trunking is sized in accordance with regulations with 40% spare capacity.

Cable ladder, tray, trunking and conduit is surface mounted in plant areas but concealed in all other areas.

Cast-in conduits are provided in certain areas of the core. In particular for stair lighting and accessories mounted on concrete walls.

Miniature circuit breakers are used to protect the final circuits and are M16 rated and between 5 and 45 amp. All general socket outlet circuits are individually protected additionally by 30mA residual current devices.

Switched socket outlets and accessories are provided as indicated on the Record drawings. Outlets are recessed into the building fabric. All accessories are finished with satin stainless steel cover plates. The exceptions to this are the plantroom areas ceiling voids, riser and other non visible areas where socket outlets and accessories are of the metalclad type. For office areas, accessories are from the Wandsworth Series 3 range. For residential areas, accessories are from the Wandsworth Penthouse range.

Other than in plantrooms where a surface installation is provided, all other areas are provided with flush mounted outlets and accessories.

B.3.6

Other Containment System

The Electrical Services Contractor provided the necessary cable containment for the following systems:

- Security cables (Trunking & Conduit)
- Landlord communications (Tray & Conduit)
- Fire alarm (Tray & Conduit)

- Voice alarm (Tray & Conduit)
- Office tenant communications (intake room through riser inclusive (Tray)
 - 2 No. 300 trays from each intake to each riser
 - 2 No. 600 trays up each riser
- All residential fit-out equipment power & comms (Tray, Trunking & Conduit)

A minimum size of 100mm x 100mm main trunking runs have been allowed for the above systems at basement level up risers and in the 7th floor plantrooms.

Two compartment underfloor trunking is provided around the perimeter of the residential units. Full access is available via removable floor panel detail.

The wiring and containment for the following systems is provided by the Controls Contractor.

- Mechanical power and controls cables (Tray, Trunking & Conduit)
- BMS cables (Trunking & Conduit)

B.3.7

Earthing

A main earth bar is provided in the electrical switchroom of dimension 50 x 6mm and of sufficient length to accept all equipment bonding conductors with individual fixing bolts. 25% spare capacity is provided for future use. Each connection is made so that removal of any one can be made without affecting adjacent terminals. Every conductor is labelled according to its origin.

The main switchboard earth bar is connected to the main earth bar in the form of a ring connection.

The London Electricity supply earthing arrangement is PME (TN-C) but within the building is TN-S.

Equipotential bonding conductors are provided to meet the requirements of the regulations and connect to the building structure and all the main services and all the main services runs.

A clean earth system is provided for the offices. A clean earth bar is provided adjacent to each office tenant distribution board. These are individually connected back to one of two clean earth bars adjacent each Ryefield distribution boards. The clean bars are then connected to the distribution board earth bar.

B.3.8

Lighting

Artificial lighting is provided to all areas as indicated on the Record drawings and schedules.

All fluorescent and discharge luminaires are provided complete with built-in control gear and operate with a minimum power factor of 0.95. all fluorescent luminaires are fitted with high frequency control gear.

Low voltage tungsten halogen luminaires are supplied from Multiload Technology VM300 & VM400 intelligent transformers. Each luminaire is wired individually from the unit and voltage sensor connection is installed in accordance with the manufacturers recommendations.

All lamps are new and the type, rating and colour as detailed in the schedules.

Office Lighting

The office lighting installation complies with CIBSE LG3, Category 2.

The flexible principle in the office incorporates the luminaires and air handling diffusers into single 750 square tiles. Every tile with a luminaire also incorporates air handling slot diffusers. This allows plenum boxes to be fitted to the back of the tile for supply air purposes at any luminaire location. Where plenum boxes are not fitted the luminaire/diffuser tiles serve as return air paths.

Because of the need for the plenum boxes for the air handling facility of the luminaire tiles to fit over the luminaire backs, the luminaire back box is sealed.

The square luminaires are incorporated in the centre of the tiles with slot diffusers on all four sides of the luminaire.

The luminaire louvres have 16 cells.

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The office luminaires are supplied from marshalling and control boxes mounted in the ceiling void. These provide flexibility for office location changes and are locally controlled from switches located at the core together with the emergency lighting key test switches.

The system is upgraded for the later provision of a central control computer, able to address each of the outputs of the marshalling and control boxes. The future upgrade path is Echelon base.

The design of the system on the Record drawings is based on Delmatic Delmate Z, which allows for 8 controlled outputs with 4 control inputs. The outputs are controlled in pairs. In the base build installation only 3 of the 4 pairs of controlled outputs are used. The fourth spare pair of controlled output is for future use.

The Electrical Services Contractor has allowed for the provision of the RJ 45 buswires loop data highway for the future central control computer. This is wired back to boxes located in the risers and to the switch positions. The initial switching of the lighting is in 2 zones, east and west. Two way and intermediate switches are provided at each of the three main entrance to the office space from the core area for LG1, 2, 3, 4 & 5 floors. At ground floor the only switching is north and south. One way switching is provided at each of the main entrances to the office space from the core area. Future amendments and cellularisation of the offices will be achieved by the tenant by adding control inputs to the marshalling and control boxes within the fit out phase.

Connections between the marshalling control boxes and the luminaires, and between luminaires is with flexible LSF insulated LSF sheathed cable, with Weiland type connectors, suitable for the number of conductors required including unswitched live or emergency luminaires.

In order to protect the cable that is connected to the luminaire terminals from damage when the plenum box is fitted, all luminaires are provided with a 1 metre length of flexible conduit fitted with a through T Weiland 6 way connector for a linked luminaire arrangement.

Common Area Luminaires

Luminaires in the common areas are controlled either by local PIR detectors or centrally controlled from timeclocks. Timeclocks have override switches in the security control room. Specific luminaire circuits remain on in order to provide a low level of security lighting. This normally is half the stair lights and one circuit at each level on the office floors lobbies.

Plantrooms and Car Park

Luminaires in plantrooms and car park are mounted on chains fixed directly onto conduit and suspended 2.5m above floor level. Wiring to the luminaire is in the form of a LSF/LSF flex from a plug in rose, tie wrapped to one chain and glanded into the fitting. This allows for the luminaire to be removed for maintenance and the wiring left safe by fitting a cover over the plug in rose. Luminaires are controlled by local switches and PIR detectors as shown on the Record drawings.

External Area Luminaires

External lighting is provided for the building as shown on the Record drawings. External lighting is photocell and timeclock controlled via Contactors with a manual override switch at the main security desk.

All external luminaires are labelled to indicate the relevant circuit number and voltage warning.

Residential

Luminaires are controlled from local one way/two way/dimmer switches. Dimmer switches are rotary push on, push off suitable for use with a two way switch elsewhere.

B.3.9

Emergency Lighting

The luminaires designated for emergency lighting purposes are provided as indicated on the Record drawings. They incorporate a battery pack, inverter, charger and changeover device which, upon local main failure provides 3 hours emergency lighting cover.

An addressable system for automatic monitoring and testing of the emergency lighting luminaires is provided. The central master panel is located in the BMS/security room. Each emergency luminaire is fitted with an addressable interface along with switching and monitoring devices to enable communications with the central panel via a 2 core data cable.

Emergency exit signage is of the pictogram type utilising the current European Standard.

Emergency luminaires are ICEL approved. Where possible all luminaires have integral battery packs. Where remote packs are necessary they are fixed to the soffit or on a support bracket within 300mm of the luminaire. Interconnecting cable is fire rated. A separate charger indicator is provided in the luminaire in addition to the remote pack indicator.

Each emergency luminaire has a warning notice indicating that they are maintained live at the relevant voltage by the internal batteries even when isolated from the mains supply.

Each emergency lighting luminaire has an unswitched live feed direct from the local lighting circuit so that the luminaire operates on local circuit failure. A local key switch is provided for isolation purposes incorporated into the local circuit switchplate. The plate is engraved to indicate the charging and isolated positions.

In office areas the emergency key tests switch operates to test the luminaires via the SELV RJ 45 buswire loop.

B.3.10

Lightning Protection

A lightning protection system is provided in accordance with the Record drawings, specifications and BS 6651.

The air terminal network comprises of PVC covered copper tapes where indicated on the drawings. All exposed roof plant and extraneous metalwork is bonded by copper tape to ensure inclusion within the protection zone.

The down conductors comprise of the structural steel columns. The connections between the air terminal network and the structure is provided at roof level as indicated on the Record drawings.

The structural steel in the foundations raft forms the earth electrode. The downconducting columns are connected to the rafts as detailed.

The effectiveness of the raft as the earth electrode has been established by test in accordance with BS 6651.

The electrical system earth is bonded to the lightning protection system by means of a copper link between the earth bar in the LV switchroom and two structural steel connections at two separate locations.

B. 3.11 - Voice Alarm (Additional Info.)

Federal Signal Limited

Installation, Operation & Maintenance Manual
Carlton Gardens P.A./V.A. System

1 INTRODUCTION

The Akusta microprocessor controlled Public Address and General Alarm system is comprised of Akusta manufactured and proprietary components, housed in 2 Rittal Equipment racks, (bolted together to form one rack Drg No. 728192001). The system has provision for monitoring the input signals and broadcasting of public address and emergency announcements, there is also provision for pre-recorded voice messages to be broadcast over the system.

The system is comprised of 1) control rack, comprising, the Apcams control module, amplifiers, uninterruptable power supply units. The system covers a number of building levels.

Access control of alarms and broadcasts is via the Security and the Fireman's microphone panel. This document contains a description of the system, its installation and commissioning. It also contains information in sufficient detail to repair parts of the system in an emergency. The equipment, being of solid state design has a minimum number of user serviceable parts, therefore reference should be made to Akusta before any repairs or modifications are carried out.

1.1 Revisions

Issue 1 June 1999

B.3.11

Fire Detection and Voice Alarm System

A fully analogue addressable fire detection system and voice alarm has been provided in accordance with the Record drawings, specifications, fire strategy report, building control requirements for a section 20 building with phase evacuation and to L3 category of BS 5839.

Car park areas and plantrooms are fully covered by automatic detectors.

The system has the following components:

- a) Main fire alarm panel
- b) Repeater panel
- c) Detectors
- d) Break glass units
- e) Voice alarm racks including amplifiers and the loudspeakers
- f) Flashing Xenon beacons
- g) Plant control interfaces
- h) Fire door control interface, the lift interfaces, BMS interfaces, security interfaces and interfaces to control mechanical plant and gas valves

All power supplies for this system are provided via fused spur units.

The installation is wired with multi-core mineral insulated copper cable with red LSF sheath for fire detection and white LSF sheath for voice alarm, with a minimum conductor size of 1.5mm². Sufficient system capacity is available to add detectors on the office floors on a 1 per 25m² basis for all floor simultaneously. Detectors are of the combination optical and heat type.

The system is a two stage system which is configured to follow the fire strategy for the building subject to the requirements of building control and any procedures required by the fire brigade.

Smoke detection is provided as indicated on the Record drawings and in extract ductwork. In the event of smoke being detected in an extract system or in area served by that system, that particular plant system automatically shuts down.

In the event of a fire being detected in the plantroom itself, all plant except life safety equipment also shuts down.

In a fire alarm situation, the lifts home to ground floor unless the fire is on the escape route at ground floor then the lifts park at the nearest floor with doors open. The firefighting lift switches to firefighting mode and park at ground floor firemans control. Where the fire is detected in the lift shaft, lift motor room or lift lobby, the lift shuts down with the doors open.

In a fire alarm situation all magnetic door holders are de-energised and all security doors unlock. Smoke vents and dampers operate as required for the fire strategy. Non essential mechanical plant shuts down and gas valves close.

The voice alarm is split into zones as indicated on the Record drawings.

Each zone is served by a minimum of two amplifier circuits as indicated on the Record drawings. Each zone amplifiers circuit has sufficient spare capacity for a 35% increase in speakers in the office zones and 15% in the speakers in other zones.

Overview of Fire Strategy

The overall fire strategy for the building is complicated by there being in effect two buildings (office and residential) rolled into one. The view of Building Control with regard to the functions initiated by the fire detection and voice alarm system is as far as practical to treat the 'two' building separately with regard to alarm and evacuation. However, the complete building is covered by single system.

Therefore any first or second stage alarm in the office zones do not initiate evacuation of the residential units. In the case of a fire in the office requiring evacuation of the residential units, this will be manually initiated from the fire control centre master control panel.

Similarly an alarm in the specific unit does not initiate evacuation of the offices or adjacent units (except when a sprinkler floor switch operates on the specific floor – 6 or 7). In the case of a fire in a unit requiring evacuation of the offices or adjacent units this is initiated manually from the fire control centre master control panel.

B.3.12

Security System

A security system is provided as indicated on the Record drawings and in the security specification.

The Electrical Services Contractor has provided all wireways for the base build and fit out security system, comprising CCTV, intruder detection and access control. This includes all conduits necessary at each security controlled access door for card readers, release buttons, door contacts etc to link back to the access control unit generally located above the ceiling adjacent to the door.

B.3.13 Residential Systems – Voice, Data and Cable TV

The Electrical Services Contractor has provided and installed cables for the following systems to each residential unit:

- a) Telephone - 4 lines
- b) ISDN - 2 lines
- c) Cable TV

The Contractor has liaised with the service providers for the above and arranged for the necessary incoming services into the IT intake room in the basement. All necessary racks for terminating the incoming cables are provided

The cables between the IT intake room frame and the function boxes residential units are provided together with the final wiring to outlets in the residential units.

Wiring to outlet positions in each unit is reconfigureable at the junction box to the unit to suit the purpose of the tenant.

c

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C SCHEDULES

C.1 SCHEDULE OF SUPPLIERS

SUPPLIER

EQUIPMENT

Anord Control Systems Ltd.
Industrial Estate, Coes Road
Dundalk, Co. Louth.

L.V. Switchgear & Dist. Boards

Tel: +353(0)42 32268
Fax: +353(0)42 38907

Arena Cable Management Systems
Cornwallis Road
West Bromwich
West Midlands B70 7JF

Containment System, Ladderack, Cable
Tray & Trunking

Tel: 0121 553 5111
Fax: 0121 500 6290

AVK/SEG (UK) Ltd.
Unit 9, Ministry Wharf
Saunderton
High Wycombe
Bucks HP14 4HW

Standby Generation

Tel: 01494 564 541
Fax: 01494 564 543

A & J Installations Ltd.

Lightning Protection

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<u>SUPPLIER</u>	<u>EQUIPMENT</u>
B.I.C.C. Plc P.O. Box 1 Prescot, Merseyside L34 5SZ	Distribution Cables XLPE/SWA, S.C./LSF & MICC
Tel: 0151 430 2000 Fax: 0151 430 2117	
Blenheim Security Systems Ltd. 3 Station Mews Potters Bar Hertfordshire EN6 1TL	Security System
Tel: 01707 646 232 Fax: 01707 646 234	
Delmatic Ltg. Management 117 Cleveland Street London W1P 5PN	Lighting Control
Tel: 0171 927 6500 Fax: 0171 927 6525	
I.A.T. (Europe) Ltd. Parc House 25-37 Cowleaze Road Kingston upon Thames Surrey KT2 6DZ	Fire Alarm System, Detection and Voice Alarm
Tel: 0181 546 1100 Fax: 0181 546 1122	

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SUPPLIER

JSB Electrical
Manor Lane
Holmes Chapel
Cheshire CW4 8AF

Tel: 01477 537 773
Fax: 01477 539 202

EQUIPMENT

Addressable Emergency Lighting
Test System

M.E.M. Ltd.
Reddings Lane
Birmingham B11 3EZ

Tel: 0121 706 3300
Fax: 0121 706 2012

Isolators

M.K. (Caradon) Ltd.
The Arnold Centre
Paycocke Road
Basildon, Essex SS14 3BR

Tel: 01268 563 000
Fax: 01268 563 563

Wiring Accessories

Ryefield Engineering Co. Ltd.
Delamare Road
Cheshunt, Herts EN8 9TA

Tel: 01992 625 243
Fax: 01992 636 157

Tenants Fuseboards

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SUPPLIER

Wandsworth Electrical Ltd.
Albert Drive, Sheerwater
Woking, Surrey GU21 5SE

Tel: 01483 740 740
Fax: 01483 740 384

EQUIPMENT

Disabled Toilet System

Wieland Electric Ltd.
Unit 5, Riverside Business Centre
Walnut Tree Close
Guildford, Surrey GU1 4UG

Tel: 01483 312 13
Fax: 01483 505 029

Modular Wiring System

Luminaires

Avanti Ltd.

Type E, AL

Concord - Bega Ltg. Ltd.
174 High Holborn
London WC1V 7AA

Tel: 0171 497 1400
Fax: 0171 497 1404

Type X, Z, A5, L, M, AA, AB,
AC, AE, AF, AG, AJ

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SUPPLIER

EQUIPMENT

Emergilite Ltg.

Type EX01, EX02, EX03, EX04

Iguzzinni

Type K

Briton Door Controls Ltd.

Brescot Crescent

Walsall, West Midlands WS1 4NF

Tel: 01922 38 101

Fax: 01922 38 118

Kreon (UK) Ltd.

Type AH

4 Hutton Grove

Finchley

London N12 8DS

Tel: 0181 343 8035

Fax: 0181 445 2767

Marlin - Limburg Ltg.

Type B1, D, G, H, N, O, AK

Hanworth Trading Estate

Hampton Road West

Feltham, Middlesex TW13 6DR

Tel: 0181 898 6661

Fax: 0181 893 4980

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SUPPLIER

EQUIPMENT

Menvier (Electronic Engineers)
Southam Road
Banbury, Oxon OX16 7RX

Type T, EXIT

Tel: 01295 256 363
Fax: 01295 270 102

Outdoor Ltg.
Argent Court
Hook Rise South
Tolworth KT6 7LD

Type P, W1, AD

Tel: 0181 974 2211
Fax: 0181 974 2333

Sill Ltg.
3 Thaime Park Business Centre
Wenman Road
Thaime
Oxfordshire OX9 3XA

Type U, V, Y

Tel: 01844 260 006
Fax: 01844 260 760

Zumtobel Staff Ltg.
Unit 4 The Argent Centre
Pump Lane, Hayes
Middlesex UB3 3BL

Type A1, A2, A4, A6

Tel: 0181 573 3556
Fax: 0181 573 3560

Building Services Operating and Maintenance Instructions
5-7 Carlton Gardens, London SW1

SUPPLIER

Multiload Technology Ltd.
2 Rosemont Road
Hampstead
London NW3 6NE

Tel: 0171 794 9152
Fax: 0171 794 9257

EQUIPMENT

L.V. Lighting Transformers

Designed Architectural Lighting Co. Ltd. Type - Q
6 Conqueror Court
Spilsby Road
Harold Hill
Romford, Essex RM3 8SB

Tel: 01708 381 1999
Fax: 01708 381 585

J.A.M. Limited
24 Farriers Way
Southend-on-Sea
Essex SS2 5RY

Tel: 01702 602 333
Fax: 01702 602 330

Underfloor Heating & Control Panel

C.2

SCHEDULE OF DIESEL GENERATOR

550 KVA STANDBY GENERATING SET

Phase Voltage	415/230 V 3 phase 4 wire
Frequency	50 Hz
Phase Current	700 AMPS
Phase Angle Tolerance (NO Load)	A S BS 4999
Voltage Tolerance (Steady State)	+1.5% -1.5%
Frequency Tolerance (Nominal)	+1% -1%
Voltage Trip	200 Volts 5%
Max. Duration of Continuous Running	100 hrs.
Changeover Switchgear	Interlocked Air Circuit Breakers
Main Switch	Air Circuit Breaker
Special Earthing	Solidly Bonded Earth (Refer to AVK/SEG (UK) Ltd. Drg. No. 380799.01)

C.3

SCHEDULE OF DISTRIBUTION BOARDS

MAIN L.V. SWITCHBOARD REF. SB.01

MAIN L.V. SWITCHBOARD REF. SB.02 (LIFE SAFETY
SWITCHBOARD)

8 WAY TPN	MCB DIST. BOARD	REF. B/L1
8 WAY TPN	MCB DIST. BOARD	REF. B/L2
8 WAY TPN	MCB DIST. BOARD	REF. B/EL1
8 WAY TPN	MCB DIST. BOARD	REF. B/EL2
8 WAY TPN	MCB DIST. BOARD	REF. B/EL3
8 WAY TPN	MCB DIST. BOARD	REF. B/EL4
8 WAY TPN	MCB DIST. BOARD	REF. B/EL5
8 WAY TPN	MCB DIST. BOARD	REF. LG/L1
8 WAY TPN	MCB DIST. BOARD	REF. LG/EL1
8 WAY TPN	MCB DIST. BOARD	REF. G/L1
8 WAY TPN	MCB DIST. BOARD	REF. G/EL1
8 WAY TPN	MCB DIST. BOARD	REF. G/EL2
8 WAY TPN	MCB DIST. BOARD	REF. I/L1
8 WAY TPN	MCB DIST. BOARD	REF. I/EL1
8 WAY TPN	MCB DIST. BOARD	REF. 2/L1
8 WAY TPN	MCB DIST. BOARD	REF. 2/EL1
8 WAY TPN	MCB DIST. BOARD	REF. 3/L1
8 WAY TPN	MCB DIST. BOARD	REF. 3/EL1
8 WAY TPN	MCB DIST. BOARD	REF. 4/L1
8 WAY TPN	MCB DIST. BOARD	REF. 4/EL1
8 WAY TPN	MCB DIST. BOARD	REF. 5/L1
8 WAY TPN	MCB DIST. BOARD	REF. 5/EL1
8 WAY TPN	MCB DIST. BOARD	REF. 6/L1
8 WAY TPN	MCB DIST. BOARD	REF. 6/EL1
8 WAY TPN	MCB DIST. BOARD	REF. 7/L1
8 WAY TPN	MCB DIST. BOARD	REF. 7/EL1
8 WAY TPN	MCB DIST. BOARD	REF. LG/T1
8 WAY TPN	MCB DIST. BOARD	REF. LG/T2
8 WAY TPN	MCB DIST. BOARD	REF. G/T1

C.3

SCHEDULE OF DISTRIBUTION BOARDS (Cont.)

8 WAY TPN	MCB DIST. BOARD	REF. G/T2
8 WAY TPN	MCB DIST. BOARD	REF. 1/T1
8 WAY TPN	MCB DIST. BOARD	REF. 1/T2
8 WAY TPN	MCB DIST. BOARD	REF. 2/T1
8 WAY TPN	MCB DIST. BOARD	REF. 2/T2
8 WAY TPN	MCB DIST. BOARD	REF. 3/T1
8 WAY TPN	MCB DIST. BOARD	REF. 3/T2
8 WAY TPN	MCB DIST. BOARD	REF. 4/T1
8 WAY TPN	MCB DIST. BOARD	REF. 4/T2
8 WAY TPN	MCB DIST. BOARD	REF. 5/T1
8 WAY TPN	MCB DIST. BOARD	REF. 5/T2
8 WAY TPN	MCB DIST. BOARD	REF. 6/R5
8 WAY TPN	MCB DIST. BOARD	REF. 6/R6
8 WAY TPN	MCB DIST. BOARD	REF. 7/R1
8 WAY TPN	MCB DIST. BOARD	REF. 7/R2
8 WAY TPN	MCB DIST. BOARD	REF. 7/R3
8 WAY TPN	MCB DIST. BOARD	REF. 7/R4

T. Clarke Plc

Date:

JULY 99

Distribution Schedule

Area Ref.	Basement		Sheet No.:	1 OF 1		
Board Ref.:	B/L1		TC No.:	10802		
Service:	Lighting & Power		Serving Area:	BASEMENT		
Board Location:			TP & N Rating:	100A TP&N		
No. of Ways	8					
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1 R	1.50	LSF	10	3	PLANT ROOM LTG	RADIAL
1 Y	1.50	LSF	10	3	PLANT ROOM LTG	RADIAL
1 B	1.50	LSF	10	3	PLANT ROOM LTG	RADIAL
2 R	1.50	LSF	10	3	PLANT ROOM LTG	RADIAL
2 Y						
2 B	1.50	LSF	10	3	PLANT ROOM LTG	RADIAL
3 R						
3 Y						
3 B						
4 R	1.50	LSF	15	3	TRACE HEATER	RADIAL
4 Y						
4 B						
5 R			32	RCD		
5 Y	4.00	LSF	32	RCD	PLANT ROOM POWER	RING
5 B	4.00	LSF	32	RCD	PLANT ROOM POWER	RING
6 R	4.00	LSF	32	RCD	PLANT ROOM POWER	RING
6 Y						
6 B			16	C		
7 R						
7 Y						
7 B						
8 R	4.00	LSF	15	3	WATER COND.	RADIAL
8 Y	1.50	LSF	15	3	WATER COND.	RADIAL
8 B	2.50	LSF	15	3	HEAT MAINTENANCE	RADIAL
9 R						
9 Y						
9 B						
10 R						
10 Y						
10 B						
11 R						
11 Y						
11 B						
12 R						
12 Y						
12 B						
13 R						
13 Y						
13 B						
14 R						
14 Y						
14 B						

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Date:

JULY 99

Distribution Schedule

Area Ref.	Basement			Sheet No.:	1 OF 1	
Board Ref.:	B/L2			TC No.:	10802	
Service:	Lighting & Power			Serving Area:		
				Board Location:	BASEMENT	
No. of Ways	8			TP & N Rating:	100A TP&N	
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1 R	1.50	LSF	10	3	CAR PARK LIGHTING	RADIAL
1 Y	2.50	LSF	10	3	CAR PARK LIGHTING	RADIAL
1 B	2.50	LSF	10	3	CAR PARK LIGHTING	RADIAL
2 R	2.50	LSF	10	3	STAFF COMP. LGT	RADIAL
2 Y	1.50	LSF	10	3	CORRIDOR LIGHTING	RADIAL
2 B	1.50	LSF	10	3	SPIRAL STAIRCASE LGT	RADIAL
3 R						
3 Y						
3 B			10	3		
4 R	1.50	LSF	10	3	OFF STAIR LIGHTING	RADIAL
4 Y	1.50	LSF	10	3	OFF STAIR LIGHTING	RADIAL
4 B	1.50	LSF	10	3	RES STAIR LIGHTING	RADIAL
5 R	1.50	LSF	10	3	RES STAIR LIGHTING	RADIAL
5 Y	1.50	LSF	10	3	FIRE STAIR LIGHTING	RADIAL
5 B	4.00	LSF	32	RCD	CAR PARK SMALL POWER	RING
6 R	1.50	LSF	16	RCD	OFF STAIR SMALL POWER	RADIAL
6 Y			32	RCD		
6 B	2.50	LSF	16	RCD	FIRE STAIR SMALL POWER	RING
7 R	4.00	LSF	15	3	HEAT MAINT. SMALL POWER	RADIAL
7 Y	4.00	LSF	32	RCD	STAFF AREA SMALL POWER	RING
7 B	4.00	LSF	32	RCD	CORE AREA SMALLM POWER	RING
8 R	}					
8 Y	} 4.00	LSF	20	3	WASTE COMPACTOR	RADIAL
8 B	}					
9 R						
9 Y						
9 B						
10 R						
10 Y						
10 B						
11 R						
11 Y						
11 B						
12 R						
12 Y						
12 B						
13 R						
13 Y						
13 B						
14 R						
14 Y						
14 B						

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Date:

JULY 99

Distribution ScheduleArea Ref.
Board Ref.:Basement
B/EL1Sheet No.:
TC No.:1 OF 1
10802

Service: Lighting & Power

Serving Area:
Board Location:

BASEMENT

No. of Ways 8

TP & N Rating:

100A TP&N

Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	10	C	EM. PLANT E/LIGHTING	RADIAL
	Y 1.50	LSF	10	C	EM. PLANT E/LIGHTING	RADIAL
	B 1.50	LSF	10	C	EM. PLANT E/LIGHTING	RADIAL
2	R					
	Y					
	B					
3	R					
	Y					
	B					
4	R 1.50	LSF	15	C	GAS VALVE SPUR	RADIAL
	Y 2.50	LSF	32	C	CONSUMER LMR	RADIAL
	B					
5	R					
	Y					
	B					
6	R					
	Y					
	B					
7	R					
	Y					
	B					
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					
14	R					
	Y					
	B					

Distribution Schedule

Area Ref.: Basement
 Board Ref.: B/EL2

Sheet No.: 1 OF 1
 TC No.: 10802

Service:		Serving Area: Board Location:		Comments	
No. of Ways	TP & N Rating:			100A TP&N	
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description
1	R 1.50	LSF	10	C	CAR PARK E/LIGHTING
	Y 1.50	LSF	10	C	CAR PARK E/LIGHTING
	B 1.50	LSF	10	C	CAR PARK E/LIGHTING
2	R 1.50	LSF	10	C	STAFF AREA E/LIGHTING
	Y 1.50	LSF	10	C	CORRIDOR E/LIGHTING
	B 1.50	LSF	10	C	LOBBY AREA E/LIGHTING
3	R 1.50	LSF	10	C	LOBBY AREA LIGHTING
	Y		10	C	
	B		10	C	
4	R				
	Y				
	B				
5	R 2.50	LSF	15	C	CCTV CAMERA
	Y 2.50	LSF	15	C	CCTV CAMERA
	B 2.50	LSF	15	C	CARD READER
6	R 2.50	LSF	15	C	CARD READER
	Y 2.50	LSF	15	C	CARD READER
	B		10	C	
7	R				
	Y 2.50	XLP/SWA/LSF	32	C	CONSUMER LMRL4
	B 2.50	XLP/SWA/LSF	32	C	CONSUMER LMRL5
8	R				
	Y 2.50	XLP/SWA/LSF	32	C	CONSUMER LMRL7
	B 2.50	XLP/SWA/LSF	32	C	CONSUMER LMRL8
9	R				
	Y				
	B				
10	R				
	Y				
	B				
11	R				
	Y				
	B				
12	R				
	Y				
	B				
13	R				
	Y				
	B				
14	R				
	Y				
	B				

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Date:

JULY 99

Distribution ScheduleArea Ref.
Board Ref.:Basement
B/EL3Sheet No.:
TC No.:1 OF 1
10802

Service:	Lighting & Power			Serving Area: Board Location:	BASEMENT	
No. of Ways	TP & N Rating:			100A TP&N		
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 4.00	LSF	32	RCD	SEC. BMS SMALL POWER	RING
	Y 1.50	LSF	10	C	SEC. BMS LIGHTING	RADIAL
	B					
2	R					
	Y					
	B					
3	R					
	Y					
	B					
	R					
	Y					
	B					
5	R					
	Y					
	B					
6	R					
	Y					
	B					
	R					
7	Y					
	B					
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					
14	R					
	Y					
	B					

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Date:

JULY 99

Distribution Schedule

Area Ref.	Basement				Sheet No.:	1 OF 1
Board Ref.:	B/EL4				TC No.:	10802
Service:	Lighting & Power		Serving Area:	Board Location:		BASEMENT
No. of Ways	8			TP & N Rating:	100A TP&N	
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R					
	Y					
	B					
2	R					
	Y 1.50	LD/MIC(LSF)NE	10	3	LG/SCP	RADIAL
	B 1.50	LD/MIC(LSF)NE	10	3	LG/SCP	RADIAL
3	R					
	Y 1.50	LD/MIC(LSF)NE	10	3	GND/SCP	RADIAL
	B 1.50	LD/MIC(LSF)NE	10	3	GND/SCP	RADIAL
4	R					
	Y 1.50	LD/MIC(LSF)NE	10	3	1ST/SCP	RADIAL
	B 1.50	LD/MIC(LSF)NE	10	3	1ST/SCP	RADIAL
5	R					
	Y 1.50	LD/MIC(LSF)NE	10	3	2ND/SCP	RADIAL
	B 1.50	LD/MIC(LSF)NE	10	3	2ND/SCP	RADIAL
6	R					
	Y 1.50	LD/MIC(LSF)NE	10	3	3RD/SCP	RADIAL
	B 1.50	LD/MIC(LSF)NE	10	3	3RD/SCP	RADIAL
7	R					
	Y 1.50	LD/MIC(LSF)NE	10	3	4TH/SCP	RADIAL
	B 1.50	LD/MIC(LSF)NE	10	3	4TH/SCP	RADIAL
8	R					
	Y 1.50	LD/MIC(LSF)NE	10	3	5TH/SCP	RADIAL
	B 1.50	LD/MIC(LSF)NE	10	3	5TH/SCP	RADIAL
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					
14	R					
	Y					
	B					

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Date:

JULY 99

Distribution Schedule

Area Ref.	Basement	Sheet No.:	1 OF 1
Board Ref.:	B/EL5	TC No.:	10802

Service:		Serving Area: Board Location:		BASEMENT		
No. of Ways	8	TP & N Rating:		100A TP&N		
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R }					
	Y 6.00	LSF	30	C	FUEL PUMP GEN	RADIAL
	B }					
2	R }					
	Y 2.50	LSF	20	C	SUMP PUMP CPMH4	RADIAL
	B }					
3	R }					
	Y 2.50	LSF	20	C	SUMP PUMP LPMH1	RADIAL
	B }					
4	R }					
	Y 2.50	LSF	20	C	SUMP PUMP FWMH4	RADIAL
	B }					
5	R }					
	Y 2.50	LSF	20	C	SUMP PUMP SWMH3	RADIAL
	B }					
6	R }					
	Y 2.50	LSF	20	C	SUMP PUMP SWMH2	RADIAL
	B }					
7	R }					
	Y 2.50	LSF	20	C	SUMP PUMP SWMH1	RADIAL
	B }					
8	R }					
	Y 6.00	LSF	30	C	SUMP PUMP FWMH3	RADIAL
	B }					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					
14	R					
	Y					
	B					

Distribution Schedule

Area Ref.	Lower Ground	Sheet No.:	1 OF 1
Board Ref.:	LG/L1	TC No.:	10802

Service:	Lighting & Power	Serving Area:	
		Board Location:	LOWER GROUND

No. of Ways		8		TP & N Rating:		100A TP&N	
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description		Comments
1	R 4.00	LSF	32	C	SOCKETS SMALL POWER		RADIAL RCD
	Y 2.50	LSF	20	C	MECHANICAL SPUR		RADIAL
	B 4.00	LSF	20	C	WC SHAVERS		RADIAL
2	R 4.00	LSF	20	C			RADIAL
	Y 4.00	LSF	20	C	MECHANICAL SPUR		RADIAL
	B 4.00	LSF	20	C	TRACE HEATING WC		RADIAL
3	R 1.50	LSF	10	C	EXT. LGT		RADIAL
	Y 1.50	LSF	10	C	EXT. LGT		RADIAL
	B 1.50	LSF	10	C	EXT. LGT		RADIAL
4	R 1.50	LSF	10	C	PLANT LGT		RADIAL
	Y 2.50	LSF	15	C	L7, L8 AREA LGT		RADIAL
	B 4.00	LSF	16	C	KIOSK LTG - PWR		RADIAL RCD
5	R 2.50	LSF	10	C	CONTROL CIRCUIT ...		RADIAL
	Y				... OUTSIDE LIGHTS		
	B 2.50	LSF	10	C	WC CESTERMISER (MALE)		RADIAL
6	R						
	Y						
	B						
7	R						
	Y						
	B						
8	R						
	Y						
	B						
9	R						
	Y						
	B						
10	R						
	Y						
	B						
11	R						
	Y						
	B						
12	R						
	Y						
	B						
13	R						
	Y						
	B						
14	R						
	Y						
	B						

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Date:

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Distribution Schedule

Area Ref.	Lower Ground			Sheet No.:	1 OF 1	
Board Ref.:	LG/EL1			TC No.:	10802	
Service:	Lighting & Power			Serving Area:		
				Board Location:	LOWER GROUND	
No. of Ways	8			TP & N Rating:	100A TP&N	
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1 R	1.50	LSF	10	C	LV. UPLGT (LIFT LIGHTS)	RADIAL
1 Y	1.50	LSF	10	C	DOWNLGT	RADIAL
1 B	1.50	LSF	10	C	MAINTAINED E/LGT	RADIAL
2 R	1.50	LSF	10	C	TLT. LGT (MALE)	RADIAL
2 Y	1.50	LSF	10	C	TLT. LGT (FEMALE)	RADIAL
2 B	1.50	LSF	10	C	PLANTROOM LGT	RADIAL
3 R	2.50	LSF	16	C	SEC SPURS	
3 Y						
3 B						
4 R	1.50	LSF	10	C	SEC SPURS	RADIAL
4 Y						
4 B			10	C	CONTROL CIRCUIT ...	
5 R	1.50	LSF	10	C	... LIFT LOBBY LIGHTS	RADIAL
5 Y	1.50	LSF	10	C	SD. PANEL	RADIAL
5 B	1.50	LSF	10	C	SD. PANEL	RADIAL
6 R						
6 Y	1.50	LSF	10	C	DIS ALARM SPUR	RADIAL
6 B						
7 R	}					
7 Y	1.50	LSF	15	C	SPRKL COMPRESSOR	RADIAL
7 B)					
8 R						
8 Y						
8 B						
9 R						
9 Y						
9 B						
10 R						
10 Y						
10 B						
11 R						
11 Y						
11 B						
12 R						
12 Y						
12 B						
13 R						
13 Y						
13 B						
14 R						
14 Y						
14 B						

Distribution Schedule

Area Ref.	Lower Ground			Sheet No.:	1 OF 1
Board Ref.:	LG/T1			TC No.:	10802
Service:	Lighting & Power			Serving Area: Board Location:	LOWER GROUND
No. of Ways	8			TP & N Rating:	100A TP&N
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description
1 R	1.50	LSF	16	3	LIGHTING
1 Y	1.50	LSF	16	3	LIGHTING
1 B	1.50	LSF	16	3	LIGHTING
2 R	1.50	LSF	16	3	LIGHTING
2 Y	1.50	LSF	16	3	LIGHTING
2 B	1.50	LSF	16	3	LIGHTING
3 R	1.50	LSF	16	3	LIGHTING
3 Y	1.50	LSF	16	3	LIGHTING
3 B	2.50	LSF	16	3	LIGHTING
4 R	2.50	LSF	16	3	LIGHTING
4 Y	2.50	LSF	16	3	LIGHTING
4 B	2.50	LSF	16	3	LIGHTING
5 R	4.00	LSF	32	3	FCU
5 Y	4.00	LSF	32	3	FCU
5 B	6.00	LSF	32	3	FCU
6 R	4.00	LSF	32	3	FCU
6 Y	4.00	LSF	32	3	FCU
6 B	1.50	LSF	10	3	RISER LIGHTING
7 R	6.00	LSF	32	RCD	SOCKETS SMALL POWER
7 Y	6.00	LSF	32	RCD	SOCKETS SMALL POWER
7 B	1.50	LSF	15	3	FCU CONTROL
8 R					
8 Y					
8 B					
9 R					
9 Y					
9 B					
10 R					
10 Y					
10 B					
11 R					
11 Y					
11 B					
12 R					
12 Y					
12 B					
13 R					
13 Y					
13 B					

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Date:

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Distribution Schedule

Area Ref.	Lower Ground	Sheet No.:	1 OF 1
Board Ref.:	LG/T2	TC No.:	10802

Service:		Serving Area: Board Location:		LOWER GROUND		
No. of Ways	8	TP & N Rating:		100A TP&N		
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
2	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
3	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 2.50	LSF	16	C	LIGHTING	RADIAL
4	R 2.50	LSF	16	C	LIGHTING	RADIAL
	Y 2.50	LSF	16	C	LIGHTING	RADIAL
	B 2.50	LSF	16	C	LIGHTING	RADIAL
5	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
	B 4.00	LSF	32	C	FCU	RADIAL
6	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
	B 1.50	LSF	10	C	RISER LIGHTING	
7	R 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	Y 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	B 1.50	LSF	15	C	FCU CONTROL	RADIAL
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

Distribution Schedule

Area Ref.	Ground	Sheet No.:	1 OF 1
Board Ref.:	G/L1	TC No.:	10802

Service:		Serving Area:		Board Location:		GROUND	
No. of Ways	8	TP & N Rating:		100A TP&N			
Way No.	Cable Size	Cable Type	Fuser/MCB Rating	MCB Type	Description		Comments
1	R 4.00	LSF	32	RCD	SOCKETS SMALL POWER		RING
	Y 2.50	LSF	20	C	SHAVERS		RADIAL
	B 4.00	LSF	20	C	HMT & SYS		RADIAL FCC ROOM
2	R 4.00	LSF	20	C	S/O		RADIAL
	Y 4.00	LSF	20	C	FAN COIL		RADIAL
	B 4.00	LSF	20	C	S/O STAIRS		RADIAL
3	R 4.00	LSF	32	RCD	SOCKETS SMALL POWER		RING DESK
	Y 4.00	LSF	32	RCD	SOCKETS SMALL POWER		RING CHAIRS/LOBBY
	B 4.00	SWA	20	C	O/DR HEAT		RADIAL
4	R 4.00	LSF	20	C	O/DR HEAT Tx14		RADIAL
	Y						
	B 4.00	LSF	20	C	MECH SPUR		RADIAL
5	R 4.00	LSF	32	RCD	SOCKETS SMALL POWER		RING
	Y 1.50	LSF	15	C	DIS UP LGT		RADIAL
	B 4.00	LSF	30	C	LOBBY LIGHTER		RADIAL
6	R						
	Y						
	B						
7	R						
	Y						
	B						
8	R						
	Y 1.50	LSF	10	C	LIGHTING CONTROL		RADIAL
	B						
9	R						
	Y						
	B						
10	R						
	Y						
	B						
11	R						
	Y						
	B						
12	R						
	Y						
	B						
13	R						
	Y						
	B						
14	R						
	Y						
	B						

Distribution Schedule

Area Ref.	Ground				Sheet No.:	1 OF 1		
Board Ref.:	G/EL1				TC No.:	10802		
Service: Lighting & Power			Serving Area: Board Location:		GROUND			
No. of Ways 8			TP & N Rating:		100A TP&N			
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments		
1	R 1.50	LSF	10	C	LV UPLGT	RADIAL		
	Y 1.50	LSF	10	C	DOWNLGT	RADIAL		
	B 1.50	LSF	10	C	MAINTAINED E/LGT	RADIAL		
2	R 1.50	LSF	10	C	TLT LGT	RADIAL		
	Y 1.50	LSF	10	C	TLT LGT	RADIAL		
	B 1.50	LSF	10	C	LV UPLGT	RADIAL		
3	R	SWA	10	C	DISABLED DOORS	RADIAL		
	Y	SWA	10	C	FANCY LIGHTS 2ND	RADIAL		
	B 1.50	LSF	10	C	FIRE C.C LGT	RADIAL		
4	R 1.50	LSF	16	C	FAP	RADIAL		
	Y 1.50	LSF	10	C	RECEPTION LGT	RADIAL		
	B 1.50	LSF	10	C		RADIAL		
5	R 1.50	LSF	10	C	SPRINKLER FS	RADIAL		
	Y 1.50	LSF	10	C	SD PANEL	RADIAL		
	B 1.50	LSF	10	C	SD PANEL	RADIAL		
6	R		10	C				
	Y 1.50	LSF	16	C	SECURITY CARD READER	RADIAL		
	B 1.50	LSF	16	C	SPRINKLER	RADIAL		
7	R							
	Y 1.50	LSF	16	C	SECURITY CCTV	RADIAL		
	B				SUPPLY TO COIL			
8	R							
	Y							
	B				LSR			
9	R							
	Y							
	B							
10	R							
	Y							
	B							
11	R							
	Y							
	B							
12	R							
	Y							
	B							
13	R							
	Y							
	B							

Distribution Schedule

Area Ref.	Ground				Sheet No.:	1 OF 1
Board Ref.:	G/EL2				TC No.:	10802
Service:		Lighting & Power		Serving Area:	GROUND	
No. of Ways		TP & N Rating:		100A TP&N		
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 2.50	LSF	20	C	FLOOR HEAT } 3 phase	RADIAL
	Y 2.50	LSF	20	C	FLOOR HEAT } breaker	RADIAL
	B 2.50	LSF	20	C	FLOOR HEAT } required	RADIAL
2	R 4.00	LSF	32	RCD	SOCKETS SMALL POWER	RING
	Y 4.00	LSF	32	RCD	SOCKETS SMALL POWER	RING
	B 1.50	LSF	10	C	SPUR MECH RISER	
3	R 1.50	LSF	10	C		RADIAL
	Y 4.00	LSF	20	C	O/DR HEATER	RADIAL
	B 1.50	LSF	10	C	LOBBY E/LGT	RADIAL
4	R 1.50	LSF	10	C	UPLIGHTS	RADIAL
	Y 1.50	LSF	10	C	BRICK LGT	RADIAL
	B 1.50	LSF	10	C	LOBBY LGT	RADIAL
5	R 2.50	LSF	32	C	CONSUMER LMLR6	RADIAL
	Y 1.50	LSF	16	RCD	RES STAIR SMALL POWER	RADIAL
	B 1.50	LSF	15	C	FEED TO TIME CLOCK IN	RADIAL
6	R 2.50	LSF	16	C	F/A REPEATER PANEL	
	Y 2.50	LSF	16	C	TRANSFORMER Tx15+16	
	B 2.50	LSF	16	C	TRANSFORMER Tx17	
7	R 2.50	LSF	16	C	BRIDGE LTG	
	Y 2.50	LSF	16	C	BRIDGE LTD	
	B 2.50	LSF	20	C	PORTERS RM LTG	
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

Distribution Schedule

Area Ref.	Ground Floor				Sheet No.:	1 OF 1
Board Ref.:	G/T1				TC No.:	10802
Service:	Lighting & Power				Serving Area:	
					Board Location:	GROUND FLOOR
No. of Ways	8				TP & N Rating:	100A TP&N
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	16	3	LIGHTING	RADIAL
	Y 1.50	LSF	16	3	LIGHTING	RADIAL
	B 1.50	LSF	16	3	LIGHTING	RADIAL
2	R 1.50	LSF	16	3	LIGHTING	RADIAL
	Y 1.50	LSF	16	3	LIGHTING	RADIAL
	B 1.50	LSF	16	3	LIGHTING	RADIAL
3	R 1.50	LSF	16	3	LIGHTING	RADIAL
	Y 1.50	LSF	16	3	LIGHTING	RADIAL
	B 2.50	LSF	16	3	LIGHTING	RADIAL
4	R 2.50	LSF	16	3	LIGHTING	RADIAL
	Y 2.50	LSF	16	3	?	RADIAL
	B					
5	R 4.00	LSF	32	3	FCU	RADIAL
	Y 4.00	LSF	32	3	FCU	RADIAL
	B 6.00	LSF	32	3	FCU	RADIAL
6	R 4.00	LSF	32	3	FCU	RADIAL
	Y					
	B 1.50	LSF	10	3	RISER LIGHTING	RADIAL
7	R 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	Y 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	B 1.50	LSF	15	3	FCU CONTROL	RADIAL
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

Distribution Schedule

Area Ref.	Ground Floor	Sheet No.:	1 OF 1
Board Ref.:	G/T2	TC No.:	10802

Service:		Serving Area: Board Location:		GROUND FLOOR		
No. of Ways	TP & N Rating:	100A TP&N				
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
2	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
3	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 2.50	LSF	16	C	LIGHTING	RADIAL
4	R 2.50	LSF	16	C	LIGHTING	RADIAL
	Y 2.50	LSF	16	C	LIGHTING	RADIAL
	B					
5	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
	B 4.00	LSF	32	C	FCU	RADIAL
6	R 4.00	LSF	32	C	FCU	RADIAL
	Y					
	B 1.50	LSF	10	C	RISER LIGHTING	RADIAL
7	R 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	Y 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	B 1.50	LSF	15	C	FCU CONTROL	RADIAL
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

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Distribution Schedule

Area Ref.	1st Floor				Sheet No.:	1 OF 1
Board Ref.:	1/L1				TC No.:	10802
Service:	Lighting & Power			Serving Area:		
				Board Location:	1ST FLOOR	
No. of Ways	8		TP & N Rating:		100A TP&N	
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 4.00	LSF	32	C	SOCKETS SMALL POWER	RING
	Y 2.50	LSF	20	C	TRACE HEATING WC	RADIAL
	B 4.00	LSF	20	C	SHAVERS & CISTIMIZER	RADIAL
2	R		20	C		
	Y 4.00	LSF	20	C	SPUR ENTRANCE SOUTH	RADIAL
	B		20	C		
3	R					
	Y 1.50	LSF	10	C	EXT. LIGHTING	RADIAL
	B 1.50	LSF	10	C	EXT. LIGHTING CONTACTOR	RADIAL
4	R					
	Y 2.50	LSF	20	C	SPUR ENTRANCE WEST	RADIAL
	B					
5	R					
	Y 2.50	LSF	10	C	FEED FOR CONTACTOR COIL	RADIAL
	B					
6	R					
	Y					
	B					
7	R					
	Y					
	B					
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

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Distribution ScheduleArea Ref. 1st Floor
Board Ref.: 1/EL1Sheet No.:
TC No.:1 OF 1
10802Service: **Lighting & Power**Serving Area:
Board Location:**1ST FLOOR**

No. of Ways		TP & N Rating:		100A TP&N		
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	10	C	LV UPLGT	RADIAL
	Y 1.50	LSF	10	C	DOWNLGT	RADIAL
	B 1.50	LSF	10	C	MAINTAINED E/LGT	RADIAL
2	R 1.50	LSF	10	C	TOILET LGT MALE	RADIAL
	Y 1.50	LSF	10	C	TOILET LGT FEMALE & DIS	RADIAL
	B		10	C		
3	R					
	Y 2.50	LSF	10	C	DISABLED TOILET ALARM	RADIAL
	B					
4	R					
	Y					
5	B 2.50	LSF	10	C	SPUR FOR SECURITY RISER	RADIAL
	R 1.50	LSF	10	C	SPRINKLER FS	RADIAL
	Y 1.50	LSF	10	C	SD PANEL	RADIAL
6	B 1.50	LSF	10	C	SD PANEL	RADIAL
	R					
	Y					
7	B 2.50	LSF	16	C	SPUR FOR SECURITY RISER	RADIAL
	R					
	Y					
8	B 2.50	LSF	16	C	SPUR FOR SECURITY RISER	RADIAL
	R					
	Y					
9	B 2.50	LSF	2	C	LSR	RADIAL
	R					
	Y					
10	B					
	R					
	Y					
11	B					
	R					
	Y					
12	B					
	R					
	Y					
13	B					
	R					
	Y					
B						

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Distribution Schedule

Area Ref.	1st Floor		Sheet No.:	1 OF 1		
Board Ref.:	1/T1		TC No.:	10802		
Service:	Lighting & Power		Serving Area: Board Location:	1ST FLOOR		
No. of Ways	8		TP & N Rating:	100A TP&N		
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1 R	1.50	LSF	16	3	LIGHTING	RADIAL
1 Y	1.50	LSF	16	3	LIGHTING	RADIAL
1 B	1.50	LSF	16	3	LIGHTING	RADIAL
2 R	1.50	LSF	16	3	LIGHTING	RADIAL
2 Y	1.50	LSF	16	3	LIGHTING	RADIAL
2 B	1.50	LSF	16	3	LIGHTING	RADIAL
3 R	1.50	LSF	16	3	LIGHTING	RADIAL
3 Y	1.50	LSF	16	3	LIGHTING	RADIAL
3 B	2.50	LSF	16	3	LIGHTING	RADIAL
4 R	2.50	LSF	16	3	LIGHTING	RADIAL
4 Y	2.50	LSF	16	3	LIGHTING	RADIAL
4 B	2.50	LSF	16	3	LIGHTING	RADIAL
5 R	4.00	LSF	32	3	FCU	RADIAL
5 Y	4.00	LSF	32	3	FCU	RADIAL
5 B	6.00	LSF	32	3	FCU	RADIAL
6 R	4.00	LSF	32	3	FCU	RADIAL
6 Y	4.00	LSF	32	3	FCU	RADIAL
6 B	1.50	LSF	10	3	RISER LIGHTING	RADIAL
7 R	6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
7 Y	6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
7 B	1.50	LSF	15	3	FCU CONTROL	RADIAL
8 R						
8 Y						
8 B						
9 R						
9 Y						
9 B						
10 R						
10 Y						
10 B						
11 R						
11 Y						
11 B						
12 R						
12 Y						
12 B						
13 R						
13 Y						
13 B						

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Distribution Schedule

Area Ref.

2nd Floor

Sheet No.:

1 OF 1

Board Ref.:

2/L1

TC No.:

10802

Service: **Lighting & Power**

Serving Area:

Board Location:

2ND FLOOR

No. of Ways

8

TP & N Rating:

100A TP&N

Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 4.00	LSF	32	C	SOCKETS SMALL POWER	RING
	Y 2.50	LSF	20	C	HMT SPUR IN MALE TOILET	RADIAL
	B 4.00	LSF	20	C	SHAVERS & CISTIMIZER	RADIAL
2	R		20	C		
	Y 4.00	LSF	20	C	TRACE HEATER	RADIAL
3	B		20	C		
	R 1.50	LSF	15	C	EXT LIGHTING	RADIAL
	Y 1.50	LSF	15	C	EXT LIGHTING	RADIAL
4	B 2.50	LSF	15	C	EXT LIGHTING	RADIAL
	R 2.50	LSF	15	C	EXT LIGHTING	RADIAL
	Y 1.50	LSF	15	C	EXT LIGHTING	RADIAL
5	B 2.50	LSF	15	C	EXT LIGHTING	RADIAL
	R 1.50	LSF	15	C	EXT LIGHTING	RADIAL
	Y 2.50	LSF	15	C	EXT LIGHTING	RADIAL
6	B 1.50	LSF	15	C	EXT LIGHTING	RADIAL
	R 1.50	LSF	15	C	EXT LIGHTING	RADIAL
	Y 2.50	LSF	20	C	SPUR ENTRANCE SOUTH	RADIAL
7	B					
	R					
	Y					
8	B					
	R					
	Y					
9	B					
	R					
	Y					
10	B					
	R					
	Y					
11	B					
	R					
	Y					
12	B					
	R					
	Y					
13	B					
	R					
	Y					

Distribution Schedule

Area Ref. 2nd Floor Sheet No.: 1 OF 1
 Board Ref.: 2/EL1 TC No.: 10802

Service:		Lighting & Power		Serving Area: Board Location:	2ND FLOOR	
No. of Ways	8	TP & N Rating:			100A TP&N	
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	10	C	LV UPLGT	RADIAL 0.75
	Y 1.50	LSF	10	C	DOWNLGT	RADIAL 0.82
	B 1.50	LSF	10	C	MAINTAINED E/LTG	RADIAL 0.84
2	R 1.50	LSF	10	C	TOILET LGT MALE & DIS	RADIAL 0.89
	Y 1.50	LSF	10	C	TOILET LGT FEMALE	RADIAL 0.84
	B		10	C		
3	R		10	C		
	Y 2.50	LSF	10	C	DISABLED TOILET ALARM	RADIAL
	B					
4	R					
	Y					
	B		10	C		
5	R 1.50	LSF	10	C	SPRINKLER FS	RADIAL
	Y 1.50	LSF	10	C	SD PANEL	RADIAL
	B 1.50	LSF	10	C	SD PANEL	RADIAL
6	R					
	Y					
	B					
7	R					
	Y					
	B					
8	R					
	Y					
	B 2.50	LSF	2	C	LSR	
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

Distribution ScheduleArea Ref. 2nd Floor
Board Ref.: 2/T1Sheet No.:
TC No.:1 OF 1
10802Service: **Lighting & Power** Serving Area:
Board Location: **2ND FLOOR**No. of Ways 8 TP & N Rating: **100A TP&N**

Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	16	3	LIGHTING	RADIAL
	Y 1.50	LSF	16	3	LIGHTING	RADIAL
	B 1.50	LSF	16	3	LIGHTING	RADIAL
2	R 1.50	LSF	16	3	LIGHTING	RADIAL
	Y 1.50	LSF	16	3	LIGHTING	RADIAL
	B 1.50	LSF	16	3	LIGHTING	RADIAL
3	R 1.50	LSF	16	3	LIGHTING	RADIAL
	Y 1.50	LSF	16	3	LIGHTING	RADIAL
	B 2.50	LSF	16	3	LIGHTING	RADIAL
4	R 2.50	LSF	16	3	LIGHTING	RADIAL
	Y 2.50	LSF	16	3	LIGHTING	RADIAL
	B 2.50	LSF	16	3	LIGHTING	RADIAL
5	R 4.00	LSF	32	3	FCU	RADIAL
	Y 4.00	LSF	32	3	FCU	RADIAL
	B 6.00	LSF	32	3	FCU	RADIAL
6	R 4.00	LSF	32	3	FCU	RADIAL
	Y 4.00	LSF	32	3	FCU	RADIAL
	B 1.50	LSF	10	3	RISER LIGHTING	RADIAL
7	R 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	Y 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	B 1.50	LSF	15	3	FCU CONTROL	RADIAL
8	R					
	Y					
9	B					
	R					
10	Y					
	B					
11	R					
	Y					
12	B					
	R					
13	Y					
	B					

Distribution Schedule

Area Ref. 2nd Floor
Board Ref.: 2/T2

Sheet No.: 1 OF 1
TC No.: 10802

Service: Lighting & Power Serving Area:
Board Location: 2ND FLOOR

No. of Ways 8 TP & N Rating: 100A TP&N

Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	16	3	LIGHTING	RADIAL
	Y 1.50	LSF	16	3	LIGHTING	RADIAL
	B 1.50	LSF	16	3	LIGHTING	RADIAL
2	R 1.50	LSF	16	3	LIGHTING	RADIAL
	Y 1.50	LSF	16	3	LIGHTING	RADIAL
	B 1.50	LSF	16	3	LIGHTING	RADIAL
3	R 1.50	LSE	16	3	LIGHTING	RADIAL
	Y 1.50	LSF	16	3	LIGHTING	RADIAL
	B 2.50	LSF	16	3	LIGHTING	RADIAL
4	R 2.50	LSF	16	3	LIGHTING	RADIAL
	Y 2.50	LSF	16	3	LIGHTING	RADIAL
	B 2.50	LSF	16	3	LIGHTING	RADIAL
5	R 4.00	LSF	32	3	FCU	RADIAL
	Y 4.00	LSF	32	3	FCU	RADIAL
	B 6.00	LSF	32	3	FCU	RADIAL
6	R 4.00	LSF	32	3	FCU	RADIAL
	Y 4.00	LSF	32	3	FCU	RADIAL
	B 1.50	LSF	10	3	RISER LIGHTING	RADIAL
7	R 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	Y 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	B 1.50	LSF	15	3	FCU CONTROL	RADIAL
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

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Distribution Schedule

Area Ref.	3rd Floor	Sheet No.:	1 OF 1
Board Ref.:	3/L1	TC No.:	10802

Service:		Serving Area: Board Location:				
No. of Ways	8	TP & N Rating:		100A TP&N		
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 4.00	LSF	32	RCD	SOCKETS SMALL POWER	RING
	Y 2.50	LSF	20	C	TRACE HEATING / SPURS	RING
	B 4.00	LSF	20	C	SHAVERS & CISTIMIZER	RING
2	R					
3	Y					
4	B					
5	R					
6	Y					
7	B					
8	R					
9	Y					
10	B					
11	R					
12	Y					
13	B					
	R					
	Y					
	B					

Distribution Schedule

Area Ref. 3rd Floor
Board Ref.: 3/EL1

Sheet No.: 1 OF 1
TC No.: 10802

Service: **Lighting & Power** Serving Area:
Board Location: **3RD FLOOR**

No. of Ways 8 TP & N Rating: **100A TP&N**

Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	10	C	LV UPLGT	RADIAL
	Y 1.50	LSF	10	C	DOWNLGT	RADIAL 0.82
	B 1.50	LSF	10	C	MAINTAINED E/LTG	RADIAL 0.81
2	R 1.50	LSF	10	C	TOILET LGT MALE	RADIAL 0.91
	Y 1.50	LSF	10	C	TOILET LGT DIS & FEMALE	RADIAL 0.96
3	B		10	C		
	R		10	C		
	Y 2.50	LSF	10	C	DISABLED TOILET ALARM	RADIAL 0.83
4	B					
	R					
	Y					
5	B		10	C		
	R 2.50	LSF	16	C	SPRINKLER FS	RADIAL
	Y 1.50	LSF	10	C	SD PANEL	RADIAL 0.81
6	B 1.50	LSF	10	C	SD PANEL	RADIAL 0.81
	R 2.50	LSF	16	C	SECURITY SPUR	
7	Y					
	B					
	R					
8	Y					
	B 2.50	LSF	2	C	LSR	
	R					
9	Y					
	B					
10	R					
	Y					
11	B					
	R					
12	Y					
	B					
13	R					
	Y					
	B					

Distribution Schedule

Area Ref. 3rd Floor Sheet No.: 1 OF 1
 Board Ref.: 3/T1 TC No.: 10802

Service:		Lighting & Power		Serving Area:	Board Location:	3RD FLOOR
No. of Ways	8	TP & N Rating:			100A TP&N	
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
2	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
3	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 2.50	LSF	16	C	LIGHTING	RADIAL
	B 2.50	LSF	16	C	LIGHTING	RADIAL
4	R 2.50	LSF	16	C	LIGHTING	RADIAL
	Y 2.50	LSF	16	C	LIGHTING	RADIAL
	B 2.50	LSF	16	C	LIGHTING	RADIAL
5	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
	B 4.00	LSF	32	C	FCU	NOT IN
6	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
	B 1.50	LSF	10	C	RISER LIGHTING	RADIAL
7	R 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	Y 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	B 4.00	LSF	15	C	FCU CONTROL	4MM RADIAL
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

Distribution Schedule

Area Ref.	3rd Floor	Sheet No.:	1 OF 1
Board Ref.:	3/T2	TC No.:	10802

Service:		Lighting & Power		Serving Area:	Board Location:	3RD FLOOR
No. of Ways	8	TP & N Rating:			100A TP&N	
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
2	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
3	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 2.50	LSF	16	C	LIGHTING	RADIAL
	B 2.50	LSF	16	C	LIGHTING	RADIAL
4	R 2.50	LSF	16	C	LIGHTING	RADIAL
	Y 2.50	LSF	16	C	LIGHTING	RADIAL
	B 2.50	LSF	16	C	LIGHTING	RADIAL
5	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
	B 4.00	LSF	32	C	FCU	RADIAL
6	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
	B 1.50	LSF	10	C	RISER LIGHTING	RADIAL
7	R 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	Y 6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
	B 4.00	LSF	15	C	FCU CONTROL	RADIAL
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

Distribution Schedule

Area Ref.	4th Floor	Sheet No.:	1 OF 1
Board Ref.:	4/L1	TC No.:	10802

Service:		Serving Area: Board Location:		4TH FLOOR		
No. of Ways	8	TP & N Rating:		100A TP&N		
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 4.00	LSF	32	RCD	SOCKETS SMALL POWER	RING
	Y 2.50	LSF	20	C	SHAVER & TRACE HEATING	RING
	B 2.50	LSF	20	C	SHAVER	RADIAL
2	R		20	C		
	Y 2.50	LSF	20	C	SPUR ENTRANCE SOUTH	RADIAL
	B 2.50	LSF	20	C	SPUR SYSTEM	RADIAL
3	R 1.50	SWA	10	C	EXT LTG	RADIAL
	Y 1.50	SWA	10	C	EXT LTG	RADIAL
	B					
4	R					
	Y 1.50	LSF	20	C	SPUR "MALE" WEST	RADIAL
	B					
5	R					
	Y					
	B					
6	R					
	Y					
	B					
7	R					
	Y					
	B					
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

Distribution Schedule

Area Ref.

4th Floor

Sheet No.:

1 OF 1

Board Ref.:

4/EL1

T.C. No.:

10802

Service:

Lighting & Power

Serving Area:

Board Location:

4TH FLOOR

No. of Ways

8

TP & N Rating:

100A TP&N

Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1 R	1.50	LSF	10	C	LV LIGHT	RADIAL
1 Y	1.50	LSF	10	C	DOWN LGT	RADIAL
1 B	1.50	LSF	10	C	MAINTAINED E/LTG	RADIAL
2 R	1.50	LSF	10	C	TOILET LGT DIS & MALE	RADIAL
2 Y	1.50	LSF	10	C	TOILET LGT FEMALE	RADIAL
2 B			10	C		
3 R			10	C		
3 Y			10	C		
3 B						
4 R						
4 Y	2.50	LSF	10	C	DISABLES TOILET ALARM	RADIAL
4 B			10	C		
5 R	1.50	LSF	10	C	SPRINKLER FS	RADIAL
5 Y	1.50	LSF	10	C	SD PANEL	RADIAL
5 B	1.50	LSF	10	C	SD PANEL	RADIAL
6 R						
6 Y						
6 B						
7 R						
7 Y						
7 B						
8 R						
8 Y						
8 B						
9 R						
9 Y						
9 B						
10 R						
10 Y						
10 B						
11 R						
11 Y						
11 B						
12 R						
12 Y						
12 B						
13 R						
13 Y						
13 B						

Distribution Schedule

Area Ref. 4th Floor
Board Ref.: 4/T1

Sheet No.: 1 OF 1
TC No.: 10802

Service: **Lighting & Power** Serving Area:
Board Location: **4TH FLOOR**

No. of Ways 8 TP & N Rating: **100A TP&N**

Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
2	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
3	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 2.50	LSF	16	C	LIGHTING	RADIAL
	B 2.50	LSF	16	C	LIGHTING	RADIAL
4	R 2.50	LSF	16	C	LIGHTING	RADIAL
	Y 2.50	LSF	16	C	LIGHTING	RADIAL
	B 2.50	LSF	16	C	LIGHTING	RADIAL
5	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
	B 4.00	LSF	32	C	FCU	RADIAL
6	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
	B 1.50	LSF	10	C	RISER LIGHTING	NOT IN
7	R 4.00	LSF	32	RCD	SOCKETS SMALL POWER	6MM RADIAL RCD
	Y 4.00	LSF	32	RCD	SOCKETS SMALL POWER	6MM RADIAL RCD
	B 1.50	LSF	15	C	FCU CONTROL	NOT IN
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

Distribution Schedule

Area Ref.

4th Floor

Sheet No.:

1 OF 1

Board Ref.:

4/T2

TC No.:

10802

Service:	Lighting & Power	Serving Area:	
		Board Location:	4TH FLOOR

No. of Ways	8	TP & N Rating:	100A TP&N
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Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
2	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
3	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 2.50	LSF	16	C	LIGHTING	RADIAL
	B 2.50	LSF	16	C	LIGHTING	RADIAL
4	R 2.50	LSF	16	C	LIGHTING	RADIAL
	Y 2.50	LSF	16	C	LIGHTING	RADIAL
	B 2.50	LSF	16	C	LIGHTING	RADIAL
5	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
	B 4.00	LSF	32	C	FCU	RADIAL
6	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
	B 1.50	LSF	10	C	RISER LIGHTING	RADIAL
7	R 4.00	LSF	32	RCD	SOCKETS SMALL POWER	6MM RADIAL
	Y 4.00	LSF	32	RCD	SOCKETS SMALL POWER	6MM RADIAL
	B 1.50	LSF	15	C	FCU CONTROL	NOT IN
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

Distribution Schedule

Area Ref.

5th Floor

Sheet No.:

1 OF 1

Board Ref.:

5/L1

TC No.:

10802

Service:

Lighting & Power

Serving Area:

Board Location:

5TH FLOOR

No. of Ways

8

TP & N Rating:

100A TP&N

Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 4.00	LSF	10	RCD	SOCKETS SMALL POWER	RING
	Y 2.50	LSF	10	C	HMT & MECH SPURS	RADIAL
	B 2.50	LSF	10	C	SHOWER & CISTINS	RADIAL
2	R					RADIAL
	Y					RADIAL
	B					RADIAL
3	R 1.60	LSF	10	C	EXT LIGHTING	RADIAL
	Y 1.50	LSF	10	C	EXT LIGHTING	RADIAL
	B 1.50	LSF	10	C	EXT LIGHTING	RADIAL
4	R 1.50	LSF	10	C	EXT LIGHTING	RADIAL
	Y					
	B					
5	R					
	Y					
	B					
6	R					
	Y					
	B					
7	R					
	Y					
	B					
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

Distribution Schedule

Area Ref. 5th Floor
Board Ref.: 5/EL1

Sheet No.:
TC No.:

1 OF 1
10802

Service: **Lighting & Power** Serving Area:
Board Location: **5TH FLOOR**

No. of Ways 8 TP & N Rating: **100A TP&N**

Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	10	C	LV UPLGT	RADIAL
	Y 1.50	LSF	10	C	DOWNLGT	RADIAL
	B 1.50	LSF	10	C	MAINTAINED E/LTG	RADIAL
2	R 1.50	LSF	10	C	TLT LGT	RADIAL
	Y 1.50	LSF	10	C	TLT LGT	RADIAL
3	B					
	R					
	Y 2.50	LSF	10	C	DISABLED WC ALARM	RADIAL
4	B					
	R					
	Y					
5	B		10	C		
	R 1.50	LSF	10	C	SPRINKLER FS	RADIAL
	Y 1.50	LSF	10	C	SD PANEL	RADIAL
6	B 1.50	LSF	10	C	SD PANEL	RADIAL
	R					
	Y					
7	B					
	R					
	Y					
8	B					
	R					
	Y					
9	B					
	R					
	Y					
10	B					
	R					
	Y					
11	B					
	R					
	Y					
12	B					
	R					
	Y					
13	B					
	R					
	Y					
	B					

Distribution ScheduleArea Ref.
Board Ref.:5th Floor
5/T1Sheet No.:
TC No.:1 OF 1
10802Service: **Lighting & Power**Serving Area:
Board Location:**5TH FLOOR**

No. of Ways 8

TP & N Rating:

100A TP&N

Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
2	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
3	B 1.50	LSF	16	C	LIGHTING	RADIAL
	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 2.50	LSF	16	C	LIGHTING	RADIAL
4	B					
	R					
	Y					
5	B					
	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
6	B 4.00	LSF	32	C	FCU	RADIAL
	R					
	Y					
7	B 1.50	LSF	10	C	RISER LIGHTING	NOT IN
	R 4.00	LSF	32	RCD	SOCKETS SMALL POWER	6MM RADIAL RCD
	Y 4.00	LSF	32	RCD	SOCKETS SMALL POWER	6MM RADIAL RCD
8	B 1.50	LSF	15	C	FCU CONTROL	4MM RADIAL
	R					
	Y					
9	B					
	R					
	Y					
10	B					
	R					
	Y					
11	B					
	R					
	Y					
12	B					
	R					
	Y					
13	B					
	R					
	Y					

Distribution Schedule

Area Ref. 5th Floor
Board Ref.: 5/T2

Sheet No.: 1 OF 1
TC No.: 10802

Service: **Lighting & Power** Serving Area:
Board Location: **5TH FLOOR**

No. of Ways 8 TP & N Rating: **100A TP&N**

Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
2	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 1.50	LSF	16	C	LIGHTING	RADIAL
	B 1.50	LSF	16	C	LIGHTING	RADIAL
3	R 1.50	LSF	16	C	LIGHTING	RADIAL
	Y 2.50	LSF	16	C	LIGHTING	RADIAL
	B					
4	R					
	Y					
	B					
5	R 4.00	LSF	32	C	FCU	RADIAL
	Y 4.00	LSF	32	C	FCU	RADIAL
	B 4.00	LSF	32	C	FCU	RADIAL
6	R					
	Y					
	B 1.50	LSF	10	C	RISER LIGHTING	NOT IN
7	R 4.00	LSF	32	RCD	SOCKETS SMALL POWER	6MM RADIAL RCD
	Y 4.00	LSF	32	RCD	SOCKETS SMALL POWER	6MM RADIAL RCD
	B 1.50	LSF	15	C	FCU CONTROL	4MM RADIAL
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

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Date:

JULY 99

Distribution Schedule

Area Ref.	6th Floor	Sheet No.:	1 OF 1
Board Ref.:	6/L1	TC No.:	10802

Service:		Lighting & Power		Serving Area:	Board Location:	6TH FLOOR
No. of Ways	8	TP & N Rating:			100A TP&N	
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R 1.50	LSF	10	3	UP LGT	RADIAL
	Y 1.50	LSF	10	3	UP LGT	RADIAL
	B					
2	R					
	Y					
	B					
3	R 4.00	LSF	20	3	HEATER	RADIAL
	Y		10	3		
	B		10	3		
4	R 4.00	LSF	32	RCD	SOCKETS SMALL POWER	RING
	Y 1.50	LSF	10	3	EXT. FANS	RADIAL
	B		10	C		
5	R					
	Y					
	B					
6	R					
	Y					
	B					
7	R					
	Y					
	B					
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

T. Clarke Plc

Date:

JULY 99

Distribution Schedule

Area Ref. 6th Floor Sheet No.: 1 OF 1
 Board Ref.: 6/EL1 TC No.: 10802

Service:		Serving Area: Board Location:				
No. of Ways	8	TP & N Rating:		100A TP&N		
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1	R					
	Y					
	B	1.50	LSF	10	3 LOBBY LTG	RADIAL
2	R	1.50	LSF	10	3 LOBBY LTG	RADIAL
	Y	1.50	LSF	10	3 LOBBY LTG	RADIAL
	B	1.50	LSF	10	3 EX. SIGNS	RADIAL
3	R					
	Y	1.50	LSF	15	3 DOOR HOLD	RADIAL
	B	1.50	LSF	15	3 CARD READER	RADIAL
4	R					
	Y	1.50	LSF	15	3 DOOR OPEN	RADIAL
	B					
5	R					
	Y					
	B					
6	R					
	Y					
	B					
7	R					
	Y					
	B					
8	R					
	Y					
	B					
9	R					
	Y					
	B					
10	R					
	Y					
	B					
11	R					
	Y					
	B					
12	R					
	Y					
	B					
13	R					
	Y					
	B					

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FLAT 1

DISTRIBUTION BOARD SCHEDULE					ELEMENT		SHEET OF 1 OF 1					
DIST. BD REF:-7/R1			LOCATION:-FLAT 1									
DIS.BD FED FROM:-TENANTS SWITCHBOARD			SUPPLY MCCB RATING-200A									
SUPPLY CABLE,SIZE&TYPE:-4C 25MM XLPE/SWA/LSF			NO. OF WAYS:-8 WAY TP&N									
WAY NO & PHASE	DESCRIPTION	MCB/FUSE RATING	CABLE		C.P.C.		CONTACTOR	RCD				
			SIZE	TYPE	SIZE	TYPE						
1	R SPARE	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	Y LOUNGE LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	B CONTROL PANEL LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
2	R HALLWAY LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	Y KITCHEN LIGHTING	10	1.5	1C,LSF	1.5	1C,LSF	NO	NO				
	B MASTER BEDROOM LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
3	R GUEST BEDROOM LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	Y KITCHEN POWER	32	4	1C,LSF	4	1C,LSF	NO	YES				
	B UPSTAIRES POWER	32	4	1C,LSF	4	1C,LSF	NO	YES				
4	R DOWNSTAIRES POWER	32	4	1C,LSF	4	1C,LSF	NO	YES				
	Y DIMMER RACK F.A.P	32	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	B V.E.V UNIT	32	4	1C,LSF	4	1C,LSF	NO	NO				
5	R ROOF											
	Y SPLIT	40	6	3C,SWA	6	3C,SWA	NO	NO				
	B UNIT											
6	R MECHANICAL CONTROL PANEL	32	4	1C,LSF	4	1C,LSF	NO	NO				
	Y KITCHEN EXTRACT FAN	20	4	1C,LSF	4	1C,LSF	NO	NO				
	B IMMERSION HEATER	32	4	1C,LSF	4	1C,LSF	NO	NO				
7	R BATTERY HEATER	32	4	1C,LSF	4	1C,LSF	NO	NO				
	Y TRACE HEATING	20	4	1C,LSF	4	1C,LSF	NO	NO				
	B COOKER	40	10	1C,LSF	10	1C,LSF	NO	NO				
8	R SPARE											
	Y DOOR BELL	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	B SHOWER	32	10	1C,LSF	10	1C,LSF	NO	NO				

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DISTRIBUTION BOARD SCHEDULE					ELEMENT	SHEET OF 1 OF 1			
DIST. BD REF:-6/R2			LOCATION:-FLAT 2						
DIS.BD FED FROM:-TENANTS SWITCHBOARD			SUPPLY MCCB RATING-200A						
SUPPLY CABLE,SIZE&TYPE:-4C 25MM XLPE/SWA/LSF			NO. OF WAYS: 8 WAY TP&N						
WAY NO & PHASE	DESCRIPTION	MCB/ FUSE RATING	CABLE		C.P.C.		CONTACTOR	RCD	
			SIZE	TYPE	SIZE	TYPE			
1	R SPARE	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO	
	Y LOUNGE LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO	
	B CONTROL PANEL LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO	
2	R HALLWAY LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO	
	Y KITCHEN LIGHTING	10	1.5	1C,LSF	1.5	1C,LSF	NO	NO	
	B MASTER BEDROOM LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO	
3	R GUEST BEDROOM LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO	
	Y KITCHEN POWER	32	4	1C,LSF	4	1C,LSF	NO	YES	
	B UPSTAIRES POWER	32	4	1C,LSF	4	1C,LSF	NO	YES	
4	R DOWNSTAIRES POWER	32	4	1C,LSF	4	1C,LSF	NO	YES	
	Y DIMMER RACK F.A.P	32	2.5	1C,LSF	2.5	1C,LSF	NO	NO	
	B V.E.V UNIT	32	4	1C,LSF	4	1C,LSF	NO	NO	
5	R ROOF								
	Y SPLIT	40	6	3C,SWA	6	3C,SWA	NO	NO	
	B UNIT								
6	R MECHANICAL CONTROL PANEL	32	4	1C,LSF	4	1C,LSF	NO	NO	
	Y KITCHEN EXTRACT FAN	20	4	1C,LSF	4	1C,LSF	NO	NO	
	B IMMERSION HEATER	32	4	1C,LSF	4	1C,LSF	NO	NO	
7	R BATTERY HEATER	32	4	1C,LSF	4	1C,LSF	NO	NO	
	Y TRACE HEATING	20	4	1C,LSF	4	1C,LSF	NO	NO	
	B COOKER	40	10	1C,LSF	10	1C,LSF	NO	NO	
8	R SPARE								
	Y DOOR BELL	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO	
	B SHOWER	32	10	1C,LSF	10	1C,LSF	NO	NO	

T. Clarke plc

DISTRIBUTION BOARD SCHEDULE					ELEMENT		SHEET OF 1 OF 1					
DIST. BD REF:-7/R3			LOCATION:-FLAT 3									
DIS.BD FED FROM:-TENANTS SWITCHBOARD			SUPPLY MCCB RATING-200A									
SUPPLY CABLE SIZE&TYPE:-4C 25MM XLPE/SWA/LSF			NO. OF WAYS:-8 WAY TP&N									
WAY NO & PHASE	DESCRIPTION	MCB/ FUSE RATING	CABLE		C.P.C.		CONTACTOR	RCD				
			SIZE	TYPE	SIZE	TYPE						
1	R SPARE	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	Y LOUNGE LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	B CONTROL PANEL LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
2	R HALLWAY LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	Y KITCHEN LIGHTING	10	1.5	1C,LSF	1.5	1C,LSF	NO	NO				
	B MASTER BEDROOM LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
3	R GUEST BEDROOM LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	Y KITCHEN POWER	32	4	1C,LSF	4	1C,LSF	NO	YES				
	B HALLWAY POWER	32	4	1C,LSF	4	1C,LSF	NO	YES				
4	R DOWNSTAIRES POWER	32	4	1C,LSF	4	1C,LSF	NO	YES				
	Y DIMMER RACK F.A.P	32	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	B V.E.V UNIT	32	4	1C,LSF	4	1C,LSF	NO	NO				
5	R ROOF											
	Y SPLIT	40	6	3C,SWA	6	3C,SWA	NO	NO				
	B UNIT											
6	R MECHANICAL CONTROL PANEL	16	6	1C,LSF	6	1C,LSF	NO	NO				
	Y KITCHEN EXTRACT	20	4	1C,LSF	4	1C,LSF	NO	NO				
	B IMMERSION HEATER	32	4	1C,LSF	4	1C,LSF	NO	NO				
7	R MECHANICAL CONTROL PANEL	32	6	1C,LSF	6	1C,LSF	NO	NO				
	Y TRACE HEATING	20	4	1C,LSF	4	1C,LSF	NO	NO				
	B COOKER	40	10	1C,LSF	10	1C,LSF	NO	NO				
8	R SPARE											
	Y DOOR BELL	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	B SHOWER	32	10	1C,LSF	10	1C,LSF	NO	NO				

T. Clarke plc

DISTRIBUTION BOARD SCHEDULE					ELEMENT		SHEET OF 1 OF 1			
DIST. BD REF:-7/R4			LOCATION:-FLAT 4							
DIS.BD FED FROM:-TENANTS SWITCHBOARD			SUPPLY MCCB RATING-200A							
SUPPLY CABLE,SIZE&TYPE: 4C 25MM XLPE/SWA/LSF			NO. OF WAYS:-8 WAY TP&N							
WAY NO & PHASE	DESCRIPTION	MCB/ FUSE RATING	CABLE		C.P.C.		CONTACTOR	RCD		
			SIZE	TYPE	SIZE	TYPE				
1	R SPARE	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO		
	Y LOUNGE LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO		
	B CONTROL PANEL LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO		
2	R HALLWAY LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO		
	Y KITCHEN LIGHTING	10	1.5	1C,LSF	1.5	1C,LSF	NO	NO		
	B MASTER BEDROOM LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO		
3	R GUEST BEDROOM LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO		
	Y KITCHEN POWER	32	4	1C,LSF	4	1C,LSF	NO	YES		
	B UPSTAIRES POWER	32	4	1C,LSF	4	1C,LSF	NO	YES		
4	R DOWNSTAIRES POWER	32	4	1C,LSF	4	1C,LSF	NO	YES		
	Y DIMMER RACK F.A.P	32	2.5	1C,LSF	2.5	1C,LSF	NO	NO		
	B V.E.V UNIT	32	4	1C,LSF	4	1C,LSF	NO	NO		
5	R ROOF									
	Y SPLIT	40	6	3C,SWA	6	3C,SWA	NO	NO		
	B UNIT									
6	R MECHANICAL CONTROL PANEL	32	4	1C,LSF	4	1C,LSF	NO	NO		
	Y KITCHEN EXTRACT FAN	20	4	1C,LSF	4	1C,LSF	NO	NO		
	B IMMERSION HEATER	32	4	1C,LSF	4	1C,LSF	NO	NO		
7	R BATTERY HEATER	32	4	1C,LSF	4	1C,LSF	NO	NO		
	Y TRACE HEATING	20	4	1C,LSF	4	1C,LSF	NO	NO		
	B COOKER	40	10	1C,LSF	10	1C,LSF	NO	NO		
8	R SPARE									
	Y DOOR BELL	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO		
	B SHOWER	32	10	1C,LSF	10	1C,LSF	NO	NO		

T. Clarke plc

DISTRIBUTION BOARD SCHEDULE					ELEMENT		SHEET OF 1 OF 1					
DIST. BD REF:-6/R5			LOCATION:-FLAT 5									
DIS.BD FED FROM:-TENANTS SWITCHBOARD			SUPPLY MCCB RATING-200A									
SUPPLY CABLE,SIZE&TYPE:-4C 25MM XLPE/SWA/LSF			NO. OF WAYS:-8 WAY TP&N									
WAY NO & PHASE	DESCRIPTION	MCB/ FUSE RATING	CABLE		C.P.C.		CONTACTOR	RCD				
			SIZE	TYPE	SIZE	TYPE						
1	R SPARE	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	Y LOUNGE LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	B CONTROL PANEL LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
2	R HALLWAY LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	Y KITCHEN LIGHTING	10	1.5	1C,LSF	1.5	1C,LSF	NO	NO				
	B MASTER BEDROOM LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
3	R GUEST BEDROOM LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	Y KITCHEN POWER	32	4	1C,LSF	4	1C,LSF	NO	YES				
	B UPSTAIRES POWER	32	4	1C,LSF	4	1C,LSF	NO	YES				
4	R DOWNSTAIRES POWER	32	4	1C,LSF	4	1C,LSF	NO	YES				
	Y DIMMER RACK F.A.P	32	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	B V.E.V UNIT	32	4	1C,LSF	4	1C,LSF	NO	NO				
5	R ROOF											
	Y SPLIT	40	6	3C,SWA	6	3C,SWA	NO	NO				
	B UNIT											
6	R MECHANICAL CONTROL PANEL	32	4	1C,LSF	4	1C,LSF	NO	NO				
	Y KITCHEN EXTRACT FAN	20	4	1C,LSF	4	1C,LSF	NO	NO				
	B IMMERSION HEATER	32	4	1C,LSF	4	1C,LSF	NO	NO				
7	R BATTERY HEATER	32	4	1C,LSF	4	1C,LSF	NO	NO				
	Y TRACE HEATING	20	4	1C,LSF	4	1C,LSF	NO	NO				
	B COOKER	40	10	1C,LSF	10	1C,LSF	NO	NO				
8	R SPARE											
	Y DOOR BELL	10	2.5	1C,LSF	2.5	1C,LSF	NO	NO				
	B SHOWER	32	10	1C,LSF	10	1C,LSF	NO	NO				

T. Clarke plc

DISTRIBUTION BOARD SCHEDULE					ELEMENT		SHEET OF 1 OF 1					
DIST. BD REF:-6/R6			LOCATION:-FLAT 6									
DIS.BD FED FROM:-TENANTS SWITCHBOARD			SUPPLY MCCB RATING-200A									
SUPPLY CABLE,SIZE&TYPE:-4C 25MM XLPE/SWA/LSF			NO. OF WAYS:-8 WAY TP&N									
WAY NO & PHASE		DESCRIPTION	MCB/ FUSE RATING	CABLE		C.P.C.		CONTACTOR RCD				
1	R	SPARE	10	2.5	1C,LSF	2.5	1C,LSF	NO NO				
	Y	CONTROL PANEL LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO NO				
	B	LOUNGE LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO NO				
2	R	HALLWAY LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO NO				
	Y	KITCHEN LIGHTING	10	1.5	1C,LSF	1.5	1C,LSF	NO NO				
	B	MASTER BEDROOM LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO NO				
3	R	GUEST BEDROOM LIGHTING	10	2.5	1C,LSF	2.5	1C,LSF	NO NO				
	Y	KITCHEN POWER	32	4	1C,LSF	4	1C,LSF	NO YES				
	B	LOUNGE POWER	32	4	1C,LSF	4	1C,LSF	NO YES				
4	R	BEDROOM POWER	32	4	1C,LSF	4	1C,LSF	NO YES				
	Y	DIMMER RACK F.A.P	32	2.5	1C,LSF	2.5	1C,LSF	NO NO				
	B	V.E.V UNIT	32	4	1C,LSF	4	1C,LSF	NO NO				
5	R	ROOF										
	Y	SPLIT	40	6	3C,SWA	6	3C,SWA	NO NO				
	B	UNIT										
6	R	MECHANICAL CONTROL PANEL	16	6	1C,LSF	6	1C,LSF	NO NO				
	Y	DOOR BELL	10	2.5	1C,LSF	2.5	1C,LSF	NO NO				
	B	IMMERSION HEATER	32	4	1C,LSF	4	1C,LSF	NO NO				
7	R	BATTERY HEATER	32	4	1C,LSF	4	1C,LSF	NO NO				
	Y	SPARE										
	B	COOKER	40	10	1C,LSF	10	1C,LSF	NO NO				
8	R	SPARE										
	Y	TRACE HEATING	32	4	1C,LSF	4	1C,LSF	NO NO				
	B	SHOWER	32	10	1C,LSF	10	1C,LSF	NO NO				

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C.4 SCHEDULE OF LUMINAIRES

REF.	LAMP DETAILS				EMERGENCY TYPE		CONTROL GEAR		MANUFACTURER CAT. REF.	
	TYPE	NO.	WATTS	COLOUR	TEMP.	TYPE	LED	TYPE	pf	
A1	LINEAR FLUOR.	2	50	WHITE	3500	A	INTEGRAL	HF	0.94	ZUMTOBEL - FT 2/50W
A2	LINEAR FLUOR.	1	50	WHITE	3500	A	INTEGRAL	HF	0.94	ZUMTOBEL - FT 1/50W
A3	COMPACT FLUOR.	2	24	WHITE	3500	A	INTEGRAL	HF	0.94	
A4	LINEAR FLUOR.	1	32	WHITE	3500	A	INTEGRAL	HF	0.94	ZUMTOBEL - REL 1/32W
A5	COMPACT FLUOR.	1	18	WHITE	3500	B	INTEGRAL	ELECTRONIC	0.94	CONCORD - 2151500
A6	LINEAR FLUOR.	1	32	WHITE	3500	A	INTEGRAL	HF DIMMABLE	0.94	ZUMTOBEL - RED 1/32W LME (LMT)
B1	COMPACT FLUOR.	1	26	WHITE	3500	A	INTEGRAL	ELECTRONIC	0.94	MARLIN - SDGR 266
D	COMPACT FLUOR.	1	32	WHITE	3500	B	INTEGRAL	ELECTRONIC	0.94	MARLIN - LXH132TF3HF
E	LINEAR FLUOR.	1	36/58	WHITE	TBC			LL + ESS	0.94	AVANTI - KOVE LITE LINEAR
G	COMPACT FLUOR.	1	26	WHITE	3500	B	INTEGRAL	ELECTRONIC	0.94	MARLIN - NM0081HF-N1 (R3 EMER.)
H	COMPACT FLUOR.	1	18	WHITE	3500			ELECTRONIC	0.94	MARLIN - L7133
K	COMPACT FLUOR.	2	26	WHITE	3500	C		ELECTRONIC	0.94	IGUZZINI - 7068
L	COMPACT FLUOR.	2	18	WHITE	3500	B	INTEGRAL	ELECTRONIC	0.94	CONCORD - 2905
M	LINEAR FLUOR.	1	36	WHITE	3500			LL + ESS	0.94	CONCORD - HILINE 2452770
N	COMPACT FLUOR.	1	13	WHITE	3500	B	ADJACENT	ELECTRONIC	0.94	MARLIN LXH113TF3HF (R3 EM.)
O	COMPACT FLUOR.	2	26	WHITE	3500	B	ADJACENT	ELECTRONIC	0.94	LIMBURG - L7477
P	TUNGSTEN H.	1	50	WHITE	3000			MULTILOAD VM300	0.94	OUTDOOR LTG. - BU-02/S/St
Q	TUNGSTEN H.	1	50	WHITE	3000			MULTILOAD VM300	0.94	D.A.L. - A2966
T	2-D	1	28	WHITE	3500	A	INTEGRAL	ELECTRONIC	0.94	ENVIER - SQPS
U	METAL HALIDE	1	150	WHITE	3500			ELECTRONIC	0.94	SILL - 490 5 015 35

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SCHEDULE OF LUMINAIRES (Cont.)

REF.	LAMP DETAILS					EMERGENCY TYPE		CONTROL GEAR		MANUFACTURER CAT. REF.
	TYPE	NO.	WATTS	COLOUR	TEMP.	TYPE	LED	TYPE	pf	
V	METAL HALIDE	1	150	WHITE	3500			ELECTRONIC	0.94	SILL - 491 2 015 36
W1	COMPACT FLUOR.	1	10	WHITE	3500			ELECTRONIC	0.94	OUTDOOR LTG. - BU-04/S/S1
X	METAL HALIDE	1	70	WHITE	3500			ELECTRONIC	0.94	BEGA - 6903
Y	METAL HALIDE	1	70	WHITE	3500			ELECTRONIC	0.94	SILL - 491 1 007 36
Z	COMPACT FLUOR.	1	36	WHITE	3500			ELECTRONIC	0.94	BEGA - 2189
EXIT	MINI FLUOR.	1	8	WHITE	3500	A	INTEGRAL	INTEGRAL	0.94	ENVIER - WEATHERWAY WWM
EX01	MINI FLUOR.	1	8	WHITE	3500	A	INTEGRAL	INTEGRAL	0.94	EMERGILITE - SILVER-LITE AE3311
EX02	MINI FLUOR.	1	8	WHITE	3500	A	INTEGRAL	INTEGRAL	0.94	EMERGILITE - SILVER-LITE AE3311
EX03	MINI FLUOR.	1	8	WHITE	3500	A	INTEGRAL	INTEGRAL	0.94	EMERGILITE - SILVER-LITE AE3311
EX04	MINI FLUOR.	1	8	WHITE	3500	A	INTEGRAL	INTEGRAL	0.94	EMERGLITE - SILVER-LITE AE3311
AA	TUNGSTEN H.	1	35	WHITE	3000			MULTILOAD VM300	0.94	CONCORD - 3021330
AB	COMPACT FLUOR.	1	13	WHITE	3500	B	INTEGRAL	ELECTRONIC	0.94	CONCORD - 2010425
AC	TUNGSTEN H.	1	35	WHITE	3000			MULTILOAD VM300	0.94	CONCORD 3021330
AD	TUNGSTEN H.	1	50	WHITE	3000			MULTILOAD VM300	0.94	O.L.S. NIMBUS 1 ASTRIS BU-02/S/St
AE	TUNGSTEN H.	1	50	WHITE	3000			MULTILOAD VM300	0.94	CONCORD 3021530
AF	LINEAR FLUOR.	1	18	WHITE	TBC			LL + ESS	0.94	CONCORD - HILINE 2452730

C.4 SCHEDULE OF LUMINAIRES (Cont.)

REF.	LAMP DETAILS					EMERGENCY TYPE		CONTROL GEAR		MANUFACTURER CAT. REF.
	TYPE	NO.	WATTS	COLOUR	TEMP.	TYPE	LED	TYPE	pf	
AG	COMPACT FLUOR.	1	13	WHITE	3500	B	INTEGRAL	ELECTRONIC	0.94	CONCORD-2010425 + Special trim finish
AH	TUNGSTEN H.	1	50	WHITE	3000			MULTILOAD VM400	0.94	KREON - KR972353 (50W) + KR702360
AJ	LINEAR FLUOR.	1	36	WHITE	TBC			LL + ESS	0.94	CONCORD - HILINE 2452770
AK	TUNGSTEN H.	1	50	WHITE	3000			MULTILOAD VM300	0.94	MARLIN - APQ 50D6
AL	COMPACT FLUOR.	1	TBC	WHITE	TBC			LL + ESS	0.94	AVANTI - KOVE LITE FLEXO

NOTES:

1. LL = LOW LOSS / ESS = ELECTRONIC SOFT START / IT = INDIVIDUAL TRANSFORMER
 2. ALL EMERGENCY LIGHTING BATTERIES ARE 3 HOUR (INCLUDING CENTRAL BATTERY INVERETERS)
MINIMUM BALLAST LUMEN FACTOR OF 0.25 FOR ALL EMERGENCY LUMINAIRES
- A = INTEGRAL CHANGEOVER/BATTERY/INVERTER UNIT
B = REMOTE (ADJACENT) CHANGEOVER/BATTERY/INVERTER UNIT
C = CENTRAL BATTERY AND INVERTER SUPPLYING MAINTAINED LUMINAIRES IN STAIRS (WITH COMMON FAULT ALARM TO BMS)
D = REMOTE BATTERY UNIT AS EXISTALITE XLV/N.12 RANGE

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SCHEDULE OF DISTRIBUTION CABLES

Nominal Phase Voltage 230V

Cable No.	From	To	Protective Device Type (A)	Cable Conductor			Prot. Conductor	
				Type	CSA (mm ²)	Core	Type	CSA (mm ²)
100	SB01	SB02	ACB/M-Pack 2000	LSF	240	16x1c	SEP.LSF	70.0
101	SB01	SPRINK	FUSE-BS88 200	DH/MICC(LSF)NE	50.0	4x1c	ARMR/SHTH	22.0
102	SB01	HOSE P.	FUSE-BS88 25	HS/MICC(LSF)NE	4.0	1x4c	ARMR/SHTH	20.0
103	SB01	HCP1	FUSE-BS88 100	HS/MICC(LSF)NE	25.0	4x1c	ARMR/SHTH	15.0
104	SB01	LIFT 4.F	FUSE-BS88 63	HS/MICC(LSF)NE	10.0	4x1c	ARMR/SHTH	9.50
105	SB01	MCP2	FUSE-BS88 50	HS/MICC(LSF)NE	10.0	4x1c	ARMR/SHTH	9.50
106	SB01	MCP3	FUSE-BS88 63	HS/MICC(LSF)NE	16.0	4x1c	ARMR/SHTH	12.0
107	SB01	MCP4	FUSE-BS88 125	HS/MICC(LSF)NE	25.0	4x1c	ARMR/SHTH	15.0
109	SB01	G/EL2	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
110	SB01	B/BL5	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
111	SB01	LIFT 1.P1	FUSE-BS88 63	XLPE/SWA/LSF	10.0	1x4c	ARMR/SHTH	49.0
112	SB01	LIFT 2.P2	FUSE-BS88 63	XLPE/SWA/LSF	10.0	1x4c	ARMR/SHTH	49.0
113	SB01	LIFT 3.P3	FUSE-BS88 63	XLPE/SWA/LSF	10.0	1x4c	ARMR/SHTH	49.0
114	SB01	LIFT 8.C2	FUSE-BS88 250	XLPE/SWA/LSF	95.0	1x4c	ARMR/SHTH	149
115	SB01	LIFT 6.R	FUSE-BS88 63	XLPE/SWA/LSF	10.0	1x4c	ARMR/SHTH	49.0
116	SB01	LIFT 7.C1	FUSE-BS88 250	XLPE/SWA/LSF	95.0	1x4c	ARMR/SHTH	149
117	SB01	FA/VA	FUSE-BS88 32	XLPE/SWA/LSF	4.0	1x4c	ARMR/SHTH	36.0
118	SB01	BMS-B/EL3	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
119	SB01	LIFT 5.G2	FUSE-BS88 80	XLPE/SWA/LSF	16.0	1x4c	ARMR/SHTH	60.0
120	SB01	B/L1&EL1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
121	SB01	B/L2&EL2	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
122	SB01	LG/L1&EL1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
123	SB01	G/L1&EL1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
124	SB01	1/L1&EL1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
125	SB01	2/L1&EL1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
126	SB01	3/L1&EL1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
127	SB01	4/L1&EL1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
128	SB01	5/L1&EL1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
129	SB01	6/L1&EL1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
130	SB01	7/L1&EL1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0

C.5

SCHEDULE OF DISTRIBUTION CABLES (Cont.)

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SCHEDULE OF DISTRIBUTION CABLES

Nominal Phase Voltage 230V

Cable No.	From	To	Protective Device Type (A)	Cable Conductor			Prot. Conductor CSA	
				Type	(mm ²)	Core	Type	(mm ²)
10A	RYE-A	DB6/R3	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
10B	RYE-B	DB7/R7	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
11A	RYE-A	DB7/R5	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
11B	RYE-B	DB7/R8	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
12A	RYE-A	DB7/R6	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
12B	RYE-B	DB7/R9	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
1A	RYE-A	DBLG/T1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
1B	RYE-B	DBLG/T2	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
2A	RYE-A	DBG/T1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
2B	RYE-B	DBG/T2	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
3A	RYE-A	DB1/T1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
3B	RYE-B	DB1/T2	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
4A	RYE-A	DB2/T1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
4B	RYE-B	DB2/T2	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
5A	RYE-A	DB3/T1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
5B	RYE-B	DB3/T2	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
6A	RYE-A	DB4/T1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
6B	RYE-B	DB4/T2	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
7A	RYE-A	DB5/T1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
7B	RYE-B	DB5/T2	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
8A	RYE-A	DB6/R1	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
8B	RYE-B	DB6/R4	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
9A	RYE-A	DB6/R2	FUSE-BS88 100	XLPE/SWA/LSF	25.0	1x4c	ARMR/SHTH	71.0
LEA	TX	RYE-A	FUSE-BS88 400	PVC	185	4x1c	SEP.PVC	240
LEB	TX	RYE-B	FUSE-BS88 400	PVC	185	4x1c	SEP.PVC	240

SPARES

12 OCT 1998



Anord Electric Controls Limited

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FACSIMILE

MESSAGE NO. 121098

Attn of: Mr. Robin Aves

From: Michael O'Connor

Company: T.Clark

Date: 12/10/98

Fax No: 0044 171 8938502

No. of Pages: 1+2

Project Ref: Carlton Gardens

Our Ref: JN 558

Subject: Parts List

Robin,

Please find attached a print out of the Parts list associated with the LV Switchgear for the above Project. All parts are identified by Type, Manufacturer & Code, your Client can determine from this list what spares he would like to hold from the list attached.

Best Regards

M.O'Connor

M.O'Connor
Project Manager

CC: Jerome McEvoy

(filename)



Anord: Job No. 558
Project: CARLTON GARDENS
Client: T CLARKE

CARLTON GARDENS
SPARES LIST

COMPONENT	TYPE	MANUFACTURER	QTY	UNIT PRICE
ACB	E2N 2000 4P WD PR112 LSIG	ABB	N/A	N/A
ACB	E2N 2000 4P WD NON AUTO	ABB	N/A	N/A
ACB	S5H 400A 4P PR212 LSIG	ABB		
ACB AUX	ISDAO 38327 R1	ABB		£548.38
ACB AUX	ISDAO 43467R1	ABB		£8.08
ACB CHASSIS	E2 4P	ABB		£57.65
AUX CON	ISDAO 43475 15 WAY	ABB		£678.46
AUX CONT	ISDAO 13575 S3	ABB		£13.60
CLOS COIL	ISDAO 38287R1	ABB		£13.60
CONTACTOR	UB30-30-10R	ABB		£48.49
CONTACTOR	CA5-700	ABB		£62.45
COUNTER	ISDAO 38346 OP	ABB		£47.46
E MAX MOTOR	ISDAO 38324 R1	ABB		£52.71
GUARD	ISDAO 38343 R1 PB	ABB		£275.91
MCCB	ISDAO 13846R1 230V UVR	ABB		£11.20
MCCB	S5H 400A N/CT	ABB		£33.25
MCCB	S3/4/5 AD R/H ISDAO13869 R1	ABB		£31.15
MCCB	S5H 600A 3P FXD PR211 PLI	ABB		£8.08
MOTOR MECH	ISDAO 13876	ABB		£558.14
POS/LOCK	ISDAO 38357 R1	ABB		£177.46
SHUT/LOCK	ISDAO 38363 R1	ABB		£23.18
TRIP CONTACT	ISDAO 38338R1	ABB		£19.98
TRIP CONTACT	ISDAO 38337R1	ABB		£17.29
LOCK STOP	V50 N/O	BRETER		£17.29
CONTACT BLOCK	V40 N/C	BRETER		£4.92
GREEN LENS	RM600	BRETER		£1.00
RED LENS	RM600	BRETER		£0.26
AMBER LENS	RM600	BRETER		£0.26
BLACK PLATE	RT010	BRETER		£0.28
SPRING RETURN	RM480N 3POS	BRETER		£0.12
MOMENTARY P/BUTTON	RT010	BRETER		£4.15
TRAFO	570 220/6V	BRETER		£1.72
BACK STUD	32 BS	BUSSMANN		£3.31
BACK STUD	63/100 BS	BUSSMANN		£1.00
BLACK FUSE BASE	CM20FW	BUSSMANN		£1.72
BS88 FUSE	NIT 10A NITD10	BUSSMANN		£3.31
BS88 FUSE	NIT 2A NITD2	BUSSMANN		£0.31
BS88 FUSE	NIT 4A NITD4	BUSSMANN		£0.51
BS88 FUSE	NIT 6A NITD6	BUSSMANN		£0.49
BS88 FUSE	TCP 100A CEO100	BUSSMANN		£0.51
BS88 FUSE	TCP 63A CEO63	BUSSMANN		£2.31
BS88 FUSE	TCP 80A CEO80	BUSSMANN		£2.06
BS88 FUSE	TF 160A DD160	BUSSMANN		£2.31
BS88 FUSE	TF 200A DD200	BUSSMANN		£3.94
BS88 FUSE	TIA 25A AAO25	BUSSMANN		£0.43
BS88 FUSE	TIA 32A AAO32	BUSSMANN		£0.85
BS88 FUSE	TIS 63A BAO63	BUSSMANN		£0.86
BS88 FUSE	TKF 250A ED250	BUSSMANN		£1.38
BS88 FUSE	TMP 400A ED400	BUSSMANN		£5.48
				£6.92

Anord: Job No. 558
 Project: CARLTON GARDENS
 Client: T CLARKE

CARLTON GARDENS
 SPARES LIST

BUSBAR SUPPORT	01-495	BUSSMANN	£3.57
WHITE FUSE BASE	CM10FW	BUSSMANN	£3.91
WHITE FUSE BASE	CM32FW	BUSSMANN	£4.77
WHITE FUSE BASE	CM63F	BUSSMANN	£7.35
FUSE	6A 10X38 420006	DF	£0.15
FUSE	NHOO 100A 300100	DF	£1.29
FUSE	NHOO 63A 300063	DF	£1.29
FUSE BASE	10X38 450032	DF	£0.98
NEUTRAL	10X38 450032N	DF	£1.20
TIMER	BA 9043/002 3P4W C/W	DOLD	£86.26
PF RELAY	CR2000 8STAGE PFC	ELECTRONICON	£290.51
MFB TIMER	2.550.029.81	ENTRELEC	£21.48
BLANKS	F/029000-072	GE	£0.26
DIST BD + KEY	8 WAY TP	GE	£79.91
ELCB	25A DP V/304-022030	GE	£18.58
ELCB	40A DP V/304-024030	GE	£18.58
EXT PLAIN/KEY	1 ROW 18MOD	GE	£51.34
ISOLATOR	200A 3P+N DILOS	GE	£51.34
MCB	1C10-6-6K V/0099-004110	GE	£3.03
MCB	1C16-6-6K V/0099-004116	GE	£3.03
MCB	1C20-6-6K V/0099-004120	GE	£3.03
MCB	1C2-6-6K V/099-004120	GE	£3.03
MCB	1C32-6-6K V/0099-004132	GE	£3.03
MCB	1C40-6-6K V/0099-004140	GE	£3.03
MCB	3C16-6-6K V/099-004316	GE	£9.82
MCB	3C20-10-10K V/0099-007320	GE	£16.77
MCB	3C20-6-6K V/0099-004320	GE	£9.82
MCB	3C32-10 10K V/0099-007332	GE	£21.92
MCB	3C40-6-6K V/0099-004340	GE	£9.82
RELAY	SIZE 2 MVAA 13 CASE	GEC	£15.38
RELAY	SIZE 4 MCGG 22 CASE	GEC	£15.38
PROT COVER	1319.429	HOLEC	£16.54
PROT COVER	1319.423	HOLEC	£16.14
SWITCH FUSE	QSA100N1-A1/3N 1230.736	HOLEC	£158.86
SWITCH FUSE	QSA100N1-A1/3N 1320.737	HOLEC	£110.57
SWITCH FUSE	QSA200N1-B2/3NCTPR1320.808	HOLEC	£146.66
SWITCH FUSE	QSA200N1-B2/3NCTPR1320.809	HOLEC	£141.71
SWITCH FUSE	QSA400N-B4/3N CTPR1320.876	HOLEC	£158.86
SWITCH FUSE	QSA400N-B4/3N CTPR1320.881	HOLEC	£212.98
SWITCH FUSE	QSA400N-B4/3N CTRL1320.880	HOLEC	£212.98
CT	2000/5 TAS 84	IME	£18.72
CT	100/5 TAI 200	IME	£8.38
VENT	SK 3326.200	RITTAL	£26.91
CONTACTOR	100-C09-10	ROCKWELL	£10.43
CONTACTOR	100-C85-00	ROCKWELL	£95.43
RELAY	700HA32A03-3 8PIN 230V	ROCKWELL	£3.57
RELAY BASE	700HN100 8PIN	ROCKWELL	£1.55
SURGE PROT DEV	WSP EMTP	WALSUR	£553.92

Distribution Schedule

Area Ref.	1st Floor				Sheet No.:	1 OF 1
Board Ref.:	1/T2				TC No.:	10802
Service:	Lighting & Power		Serving Area:	1ST FLOOR		
No. of Ways	8		TP & N Rating:	100A TP&N		
Way No.	Cable Size	Cable Type	Fuse/MCB Rating	MCB Type	Description	Comments
1 R	1.50	LSF	16	C	LIGHTING	RADIAL
1 Y	1.50	LSF	16	C	LIGHTING	RADIAL
1 B	1.50	LSF	16	C	LIGHTING	RADIAL
2 R	1.50	LSF	16	C	LIGHTING	RADIAL
2 Y	1.50	LSF	16	C	LIGHTING	RADIAL
2 B	1.50	LSF	16	C	LIGHTING	RADIAL
3 R	1.50	LSF	16	C	LIGHTING	RADIAL
3 Y	1.50	LSF	16	C	LIGHTING	RADIAL
3 B	2.50	LSF	16	C	LIGHTING	RADIAL
4 R	2.50	LSF	16	C	LIGHTING	RADIAL
4 Y	2.50	LSF	16	C	LIGHTING	RADIAL
4 B						
5 R	4.00	LSF	32	C	FCU	RADIAL
5 Y	4.00	LSF	32	C	FCU	RADIAL
5 B	6.00	LSF	32	C	FCU	RADIAL
6 R	4.00	LSF	32	C	FCU	RADIAL
6 Y	4.00	LSE	32	C	FCU	
6 B	1.50	LSF	10	C	RISER LIGHTING	RADIAL
7 R	6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
7 Y	6.00	LSF	32	RCD	SOCKETS SMALL POWER	RADIAL RCD
7 B	1.50	LSF	15	C	FCU CONTROL	RADIAL
8 R						
8 Y						
8 B						
9 R						
9 Y						
9 B						
10 R						
10 Y						
10 B						
11 R						
11 Y						
11 B						
12 R						
12 Y						
12 B						
13 R						
13 Y						
13 B						

C.4

SCHEDULE OF LUMINAIRES

REF.	LAMP DETAILS					EMERGENCY TYPE		CONTROL GEAR		MANUFACTURER CAT. REF.
	TYPE	NO.	WATTS	COLOUR	TEMP.	TYPE	LED	TYPE	pf	
A1	LINEAR FLUOR.	2	50	WHITE	3500	A	INTEGRAL	HF	0.94	ZUMTOBEL - FT 2/50W
A2	LINEAR FLUOR.	1	50	WHITE	3500	A	INTEGRAL	HF	0.94	ZUMTOBEL - FT 1/50W
A3	COMPACT FLUOR.	2	24	WHITE	3500	A	INTEGRAL	HF	0.94	
A4	LINEAR FLUOR.	1	32	WHITE	3500	A	INTEGRAL	HF	0.94	ZUMTOBEL - REL 1/32W
A5	COMPACT FLUOR.	1	18	WHITE	3500	B	INTEGRAL	ELECTRONIC	0.94	CONCORD - 2151500
A6	LINEAR FLUOR.	1	32	WHITE	3500	A	INTEGRAL	HF DIMMABLE	0.94	ZUMTOBEL - RED 1/32W LME (LMT)
B1	COMPACT FLUOR.	1	26	WHITE	3500	A	INTEGRAL	ELECTRONIC	0.94	MARLIN - SDGR 266
D	COMPACT FLUOR.	1	32	WHITE	3500	B	INTEGRAL	ELECTRONIC	0.94	MARLIN - LXH132TF3HF
E	LINEAR FLUOR.	1	36/58	WHITE	TBC			LL + ESS	0.94	AVANTI - KOVE LITE LINEAR
G	COMPACT FLUOR.	1	26	WHITE	3500	B	INTEGRAL	ELECTRONIC	0.94	MARLIN - NM0081HF-N1 (R3 EMER.)
H	COMPACT FLUOR.	1	18	WHITE	3500			ELECTRONIC	0.94	MARLIN - L7133
K	COMPACT FLUOR.	2	26	WHITE	3500	C		ELECTRONIC	0.94	IGUZZINI - 7068
L	COMPACT FLUOR.	2	18	WHITE	3500	B	INTEGRAL	ELECTRONIC	0.94	CONCORD - 2905
M	LINEAR FLUOR.	1	36	WHITE	3500			LL + ESS	0.94	CONCORD - HILINE 2452770
N	COMPACT FLUOR.	1	13	WHITE	3500	B	ADJACENT	ELECTRONIC	0.94	MARLIN LXH113TF3HF (R3 EM.)
O	COMPACT FLUOR.	2	26	WHITE	3500	B	ADJACENT	ELECTRONIC	0.94	LIMBURG - L7477
P	TUNGSTEN H.	1	50	WHITE	3000			MULTILOAD VM300	0.94	OUTDOOR LTG. - BU-02/S/St
Q	TUNGSTEN H.	1	50	WHITE	3000			MULTILOAD VM300	0.94	D.A.L. - A2966
T	2-D	1	28	WHITE	3500	A	INTEGRAL	ELECTRONIC	0.94	MENVIER - SQPS
U	METAL HALIDE	1	150	WHITE	3500			ELECTRONIC	0.94	SILL - 490 5 015 35

C.4

SCHEDULE OF LUMINAIRES (Cont.)

REF.	LAMP DETAILS					EMERGENCY TYPE		CONTROL GEAR		MANUFACTURER CAT. REF.
	TYPE	NO.	WATTS	COLOUR	TEMP.	TYPE	LED	TYPE	pf	
V	METAL HALIDE	1	150	WHITE	3500			ELECTRONIC	0.94	SILL - 491 2 015 36
W1	COMPACT FLUOR.	1	10	WHITE	3500			ELECTRONIC	0.94	OUTDOOR LTG. - BU-04/S/S1
X	METAL HALIDE	1	70	WHITE	3500			ELECTRONIC	0.94	BEGA - 6903
Y	METAL HALIDE	1	70	WHITE	3500			ELECTRONIC	0.94	SILL - 491 1 007 36
Z	COMPACT FLUOR.	1	36	WHITE	3500			ELECTRONIC	0.94	BEGA - 2189
EXIT	MINI FLUOR.	1	8	WHITE	3500	A	INTEGRAL	INTEGRAL	0.94	ENVIER - WEATHERWAY WWM
EX01	MINI FLUOR.	1	8	WHITE	3500	A	INTEGRAL	INTEGRAL	0.94	EMERGILITE - SILVER-LITE AE3311
EX02	MINI FLUOR.	1	8	WHITE	3500	A	INTEGRAL	INTEGRAL	0.94	EMERGILITE - SILVER-LITE AE3311
EX03	MINI FLUOR.	1	8	WHITE	3500	A	INTEGRAL	INTEGRAL	0.94	EMERGILITE - SILVER-LITE AE3311
EX04	MINI FLUOR.	1	8	WHITE	3500	A	INTEGRAL	INTEGRAL	0.94	EMERGLITE - SILVER-LITE AE3311
AA	TUNGSTEN H.	1	35	WHITE	3000			MULTILOAD VM300	0.94	CONCORD - 3021330
AB	COMPACT FLUOR.	1	13	WHITE	3500	B	INTEGRAL	ELECTRONIC	0.94	CONCORD - 2010425
AC	TUNGSTEN H.	1	35	WHITE	3000			MULTILOAD VM300	0.94	CONCORD 3021330
AD	TUNGSTEN H.	1	50	WHITE	3000			MULTILOAD VM300	0.94	O.L.S. NIMBUS 1 ASTRIS BU-02/S/St
AE	TUNGSTEN H.	1	50	WHITE	3000			MULTILOAD VM300	0.94	CONCORD 3021530
AF	LINEAR FLUOR.	1	18	WHITE	TBC			LL + ESS	0.94	CONCORD - HILINE 2452730

C.4

SCHEDULE OF LUMINAIRES (Cont.)

REF.	LAMP DETAILS					EMERGENCY TYPE		CONTROL GEAR		MANUFACTURER CAT. REF.
	TYPE	NO.	WATTS	COLOUR	TEMP.	TYPE	LED	TYPE	pf	
AG	COMPACT FLUOR.	1	13	WHITE	3500	B	INTEGRAL	ELECTRONIC	0.94	CONCORD-2010425 + Special trim finish
AH	TUNGSTEN H.	1	50	WHITE	3000			MULTILOAD VM400	0.94	KREON - KR972353 (50W) + KR702360
AJ	LINEAR. FLUOR.	1	36	WHITE	TBC			LL + ESS	0.94	CONCORD - HILINE 2452770
AK	TUNGSTEN H.	1	50	WHITE	3000			MULTILOAD VM300	0.94	MARLIN - APQ 50D6
AL	COMPACT FLUOR.	1	TBC	WHITE	TBC			LL + ESS	0.94	AVANTI - KOVE LITE FLEXO

NOTES:

1. LL = LOW LOSS / ESS = ELECTRONIC SOFT START / IT = INDIVIDUAL TRANSFORMER
 2. ALL EMERGENCY LIGHTING BATTERIES ARE 3 HOUR (INCLUDING CENTRAL BATTERY INVERETERS)
 MINIMUM BALLAST LUMEN FACTOR OF 0.25 FOR ALL EMERGENCY LUMINAIRES
- A = INTEGRAL CHANGEOVER/BATTERY/INVERTER UNIT
- B = REMOTE (ADJACENT) CHANGEOVER/BATTERY/INVERTER UNIT
- C = CENTRAL BATTERY AND INVERTER SUPPLYING MAINTAINED LUMINAIRES IN STAIRS (WITH COMMON FAULT ALARM TO BMS)
- D = REMOTE BATTERY UNIT AS EXISTALITE XLV/N.12 RANGE

D

D

OPERATION OF THE INSTALLATION

NOTE: The Operation Procedures Description as given below, should be read in conjunction with the main L.V. Distribution Schematic Drg. No. TC10802/E/400

D.1 NORMAL OPERATION

D.1.1 L.V. Distribution Switchgear - Anord Control Systems Ltd.

The system consists of two switchboards, Main switchboard SB.01, Life Safety switchboard SB.02 and a Generator control panel.

SB.01 contains two main ACBs,

ACB M1 controls the incoming L.E. supply.

ACB M2 controls the supply from SB.01 to SB.02.

SB.02 contains two main ACBs,

ACB G1 controls the incoming Generator supply.

ACB G2 controls the supply from SB.02 to SB.01.

The control system is controlled primarily by the generator control panel. An Auto / Manual / Test switch is located on the generator control panel which controls the change over system.

Electrical interlocking is provided to prevent inadvertent manual closing of ACBs M1 and M2 when not synchronised.

If an under voltage condition is detected at ACB M1, the generator start up sequence is initiated. However if ACB M2 has tripped on over current or earth fault, the start up sequence will be inhibited. If ACB M1 trip on over current or earth fault then it shall trip ACB M2 and the generator will start.

If the control switch is moved from Auto to Manual or Test to Manual no ACB operation will take place as a result. If it is moved from Manual to Auto or Manual to Test then the ACBs will switch to the dictates of the under voltage relay and availability of the ACBs in relation to their protection status and carriage position. When the system is in Auto or Test mode, change over from mains supply to generator and back again will happen automatically by temporarily synchronising and paralleling the supplies thus re transferring load to the mains without interruption of supply.

Operation in Auto Mode

- a) Normal Operation
 - i) ACB M1, M2 and G2 closed. ACB MG1 open.
 - ii) The generator control panel will prevent inadvertent closure of the ACBs.
 - iii) The manual close switch on each ACB is disabled.
 - iv) The manual trip switch on each ACB is enabled.
 - v) The generator stop button located on the generator control panel is enabled.
- b) Mains Failure
 - i) Mains failure is detected by PFR on the incoming mains supply.
 - ii) A start signal is given to the generator control panel which after an adjustable time delay will
 - a) If the generator is not running, start the generator. When it is up to speed and within voltage and frequency limits, open ACB M1 and close ACB G1.
 - b) If the generator is already running and the voltage is within voltage and frequency limits, open ACB M1 and close ACB G1.
 - iii) The PFC is switched out of circuit when ACB G1 closes.
 - iv) If the mains supply returns before the generator start time delay period has expired, the change over will be aborted. However once the sequence has been initiated, it shall proceed without interruption until the mains restoration sequence occurs.
- c) Mains Restoration
 - i) When the mains voltage is detected by PFR at ACB M1 and is steady for a time period (adjustable 0-30 min), a stop signal will be sent to the generator control panel. The generator control panel will synchronise with the mains supply and then close ACB M1. The generator shall continue to run in parallel with the mains for a specified minimum time.
 - ii) On successful load re transfer confirmed by ACB M1 being in service and closed and ACB G1 being in services and open, the generator control panel will stop the generator after the required cooling run.

Operation in Manual Mode

- a) Normal Operation
 - i) ACB M1, M2 and G2 closed. ACB MG1 open.
 - ii) Hard wired interlocking will prevent inadvertent closure of the ACBs.
 - iii) The manual close switch on each ACB is enabled.
 - iv) The manual trip switch on each ACB is enabled.
 - v) The generator control buttons located n the generator control panel are enabled. The start button will start the generator if it is not already running. The stop button will initiate the stop sequence.
- b) Mains Failure
 - i) Mains failure is detected by PFR on the incoming mains supply. However the generator will not start automatically. The generator can be started manually via the start button on the generator control panel.
 - ii) If the generator is started manually no auto change over will take place. ACB M1 is opened manually via the trip switch on SB.01 and ACB G1 is then closed via the close switch on SB.02. However if the mains has failed and the generator started manually and the control switch is then turned from Manual to Auto, auto change over will occur.
- c) Mains Restoration
 - i) If a manual change over has been carried out and the mains supply is restored then the ACB switching procedure must be reversed to change over to mains supply.
 - ii) If a manual change over has been carried out and the mains supply is restored and then the control switch is switched to Auto, then an automatic no break soft load re transfer will take place as detailed in the auto mode above.

Operation in Test Mode

- a) Normal Operation
 - i) ACB M1, M2 and G2 closed. ACB MG1 open.
 - ii) The generator control panel will prevent inadvertent closure of the ACBs.
 - iii) The manual close switch on each ACB is disabled.
 - iv) The manual trip switch on each ACB is enabled.
 - v) The generator stop button located on the generator control panel is enabled.

- b) Testing
 - i) When the generator start button is pressed the generator will start and synchronise with the mains supply. After an adjustable time period (adjustable 0-10 min) the generator control panel will close ACB G1 and the generator will run in parallel with the mains. The reverse power relay MWTU 11 located at ACB M1 will monitor the system and signal the generator control panel to reduce the generator output to ensure that power is not exported to L.E.
 - ii) The generator will run in parallel with the mains supply for a set test period. During the parallel operation period the MRN2-24D relay located at ACB M1 shall provide full G5/9 protection as required by L.E. and signal the generator control panel accordingly.
 - iii) If the mains supply fails during the test period the generator control panel will receive a signal from the MRN2-24D relay and open ACB M1.
 - iv) Returning the control switch to the Auto position will return the system to auto control and allow the automatic no break soft load re transfer to take place as detailed in the auto mode above once mains supply is restored.

Protection and Monitoring Relays

ACB M1

- i) PR112 LSIG Inverse time delay over current and earth fault protection (integral ACB trip unit)Trips ACB M1 & M2
Signals generator to start and signals to BMS

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5-7 Carlton Gardens, London SW1

ii) PFR Under voltage relay	Signal generator control panel to start and signals to BMS
iii) MAVS 01 Check sync relay	Inhibits the auto control system from closing ACB M1 when not in sync.
iv) MWTU 11 Reverse power relay	Signals generator control panel when system is about to export power to L.E.
v) MRN2-24D G5/9 production relays	Signals generator control panel for under/over voltage and under/over voltage. Rate of change of frequency signal is used to detect mains failure and signals the generator control panel that mains supply is lost during parallel operation.

ACB M2 & G2

i) KCEG 142 Directional overcurrent and earth fault relay	Trips ACB.
ii) MVAA 13 Lockout relay	Locks out ACB following a trip. Signals BMS, ACB M2 sends an inhibit signal to the Generator control panel.
iii) MVAX 31 Trip supervision relay	Supervises trip circuit. Signals BMS.

ACB G1

- | | |
|---|--|
| i) MCGG 22 Earth fault relay | Trips ACB. |
| ii) MCAG 14 Restricted earth fault relay. | Trips ACB. |
| iii) MVAA 13 Lockout relay | Locks out ACB following a trip. Signals BMS. Sends a stop signal to the Generator control panel. |
| iv) MVAX 31 Trip supervision relay. | Supervises trip circuit.
Signals BMS. |
| v) MAVS 01 Check sync relay. | Inhibits the auto control system from closing ACB G1 when not in sync. |

Note: Generator over current protection is provided by the MCCB mounted on the generator.

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D.1.2 Standby-by Generation - AVK/SEG (UK) Ltd.

Refer to Section H.3 of this O & M Manual for details.

Also refer to attached letter from AVK/SEG (UK) Ltd. dated 18/9/98

FACSIMILE

MINISTRY WHARF, SAUNDERTON
HIGH WYCOMBE, BUCKS HP14 4HW
TELE : 01494 564541
FAX : 01491 564543

AVK SEC (UK) LTD

"The Power People"

FACSIMILE

Company :	T CLARKE PLC	Fax No :	0171 701 6265
F.A.O :	G W Novy	From :	Alan Fisher
Date :	18/9/98	Mobile No	07775 631500
Your Ref. :		Pages :	1
Our Ref. :	FAJF-TCLARKE-22	Job No :	JN98255
Copy :	Robin Aves		

Subject 5-7 CARLTON GARDENS - GENERATOR INFORMATION

Dear Sir,

The O & M Manual information requested is not available at present as we are still at the design stage and equipment is to be custom manufactured. In the programme issued to T. Clarke on 24/7/98 it showed O&M manuals would be provided in week 45.

The situation on specific issues raised in your letter is as follows:-

- | | | |
|----|---|---|
| a) | System normal and general operations procedures | To be included in O & M Manual |
| b) | Starting up procedures | To be included in O & M Manual |
| c) | Shut down procedures | To be included in O & M Manual |
| d) | Emergency procedures | To be included in O & M Manual |
| e) | Recommended spare parts list | List to be provided 21/9/98, based on specific annual usage rate |
| f) | Tools list | No special tools required |
| g) | Expected life of equipment | MTBFs etc cannot be quantified as failure rates are a function of frequency of operation, maintenance etc |
| h) | Guarantees/Warranties | Twelve months from commissioning and setting to use. |

Please do not hesitate to contact me if you have any further queries.

Regards

Alan Fisher

Alan Fisher
Project Manager

GENERATOR CONTROL OVERVIEW

GENERATOR SYSTEM	GENERATOR CONTROL MASTER SWITCH	SWITCHBOARD
GENERATOR OFF SYSTEM NOT AVAILABLE	STOP	PERMITS MANUAL OPENING AND CLOSING OF M1, M2, G2 CLOSING/OPENING OF G1 NOT ALLOWED
GENERATOR CONTROLLER CONTROLS ACB M1 & G1. WITH MAINS AVAILABLE THE CONTROLLER SYNCHRONISES WITH MAINS & CLOSES G1 THEN MATCHES DEMAND UP TO PRE-SET kVA VALVE NOT POWER IS EXPORTED	TEST (PEAK LOPPING TO TEST GENERATOR)	GENERATOR CONTROLLER CLOSES ACB M1 & G1 AND DISABLES CLOSING OF M2 & G2
GENERATOR CONTROLLER CONTROLS ACB M1 & G1. ON MAINS FAILURE THE CONTROLLER SYNCHRONISES WITH MAINS & CLOSES G1 WHEN MAINS IS AVAILABLE AT M1 THE GENERATOR CONTROLLER SYNCHRONISES & CLOSES M1 FOR A SHORT TERM PARALLEL. THE GENERATOR CONTROLLER OPENS G1	AUTO (MAINS FAILURE AUTO START, AUTO NO BREAK RETURN TO MAINS)	GENERATOR CONTROLLER CONTROLS ACB M1 & G1 AND DISABLES CLOSING OF M2 & G2. CHECK SYNCHRONISED RELAY ACTION AT M1 INHIBITS PARALLELING UNTIL IN SYNC
GENERATOR CONTROLLER ALLOWS MANUAL STARTING OF GENERATOR GENERATOR ONLY RUNS OFF LOAD NO CLOSING OF ACB's IS ALLOWED	MANUAL (NO LOAD TEST)	GENERATOR CONTROLLER CONTROLS ACB M1 & G1 AND DISABLES CLOSING OF M2 & G2 NO AUTO SWITCHING UNLESS SWITCH MOVED TO AUTO OR TEST

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5-7 Carlton Gardens, London SW1

D.1.3 Fire Detection and Voice Alarm System - I.A.T. (Europe) Ltd.

Refer to Section H.8, sub-section 1 & 2 of this O & M Manual for details.

2 OPERATION

Power input to the rack is 24V DC. Derived from 230V AC/ 24V DC uninterruptable power supply unit. Isolation of the incoming supply at the rack is by miniature circuit breakers, mounted on terminal rails within the rack. The supply is distributed to equipment requiring the supply voltage and to equipment requiring other voltages, via power supply units with suitable outputs. (Drg 72819020). Circuits fed from the power supply units are fused and can be isolated at the terminal blocks +24V, +5V, +12V, -12V. (Drg 72819020) by lifting the isolating blades in the terminal blocks.

Inputs from devices external to the rack, e.g. Alarms, are fed to the rack. The control system in turn sends out functional signals for visual, and audible communication.

The system is controlled from the panel mount Security Microphone panel Drg. 72819201 and the Fireman's microphone control panel Drg. 72819101.

The system is shown in block diagram form on drg. 72819020 and 7281901.

2.1 Security Microphone Panel

The general arrangement of the panel is shown on Drg.72819201.

The panel is split into seven sections. A microphone is fitted to the Announcement section for making announcements over the P.A. system.

The unit is cabled back to the main control rack, the operation of the push buttons and the control of the LED indications, are digitised and read by the access panel part of the Single Board Apcams control system.

These units have provision for, Alarm Control, System Status, Routine and Emergency Announcements, Music, Zone Control, System Status, Lamp Test.

2.1.1 Music Section

Led indicators show when illuminated, the selected function.

2.1.2 General

LED indicators when lit, give indications for power availability, and the existence of, general and microphone fault.

Lamp Test

When selected, (Press and Hold) all the LEDs on the panel will light, hold the button whilst the condition of the lamps are determined. Releasing the button will terminate the test.

Tick Tone

When selected, (Press LED illuminates) produces a tone which can be heard from all loudspeakers. Press the tick tone button again to deselect the function.

2.1.3 Bomb & Test

Bomb Alert

To activate press the Bomb Alert Button, a pre-recorded message will be broadcast to all zones. Deselect the function press the button again.

The alarm can be interrupted by an Emergency Speech function.

Test Alarm

Operation of the Test Alarm is by pressing the test alarm button; a pre-recorded message will be broadcast to all zones. To terminate the test, press the button again.

2.1.4 Music Zone

Allows music to be broadcast to specific areas.

To select press the appropriate button, to deselect press the selected button again.

2.1.5 PTT Zones

Allows speech to be broadcast to specific areas, used in conjunction with the talk button and microphone.

First select the zone or zones where speech is to be directed to, by pressing the appropriate zone button. Press and hold the Talk button whilst speaking into the microphone, releasing the Talk button will terminate the broadcast. Press the selected P.T.T buttons (Led lit), to deselect the function.

The All Call button will broadcast speech to all zones.

Emergency Message

This will allow urgent speech messages to be broadcast to all areas, overriding alarms, speech and music.

Press and hold the button whilst speaking into the microphone, releasing the button will terminate the broadcast.

2.1.6 Music Source

Allows the music source to selected and in conjunction with the music zone section the music source can be broadcast to selected zones.

Press the desired music source button the LED will light and the required music zone button the LED light.

2.2 AUTOMATIC ALARMS

These are signals received by the control panel, from the Fireman's Panel, which result in pre recorded alarm messages being broadcast over the system in accordance with the Cause and Effect chart

Illuminated Indicator shows the operating functions.

When an evacuation or alert message is being broadcast, emergency speech is still possible, the active messages are suspended for the duration of the emergency speech.

2.3 Fireman's Microphone Panel**2.3.1 Manual Operation of alarms**

Manual operation of all evacuation alarms is performed by pressing the appropriate button on the panel. The LED will light on the selected function.

The alarm is cancelled by pressing the Evacuate All button

2.3.2 Zone Selection Speech

Speech can be broadcast to specific zones by pressing the appropriate button, the corresponding LED will light.

Pressing the All Call button will broadcast speech to all zones.

Alert All

Pressing the Alert All push button will broadcast an alarm to all zones.

EVAC a pre-recorded evacuation message can be broadcast to that level; LED indicators are lit when a function is operating.

PROGRAM A inputs are automatically received from the Fire and Gas panel; LED indicators are lit when a function is operating.

ALERT - Pre recorded message is automatically broadcast to a specific level. During this event a voice call all alert floors broadcast will suspend the alert message for the duration of the broadcast.

With alert broadcast active pressing the silence alert push-button the broadcast will stop.

2.4 AUDIO MATRIX Board

The purpose of the Audio Matrix board, is to receive multiple audio inputs, configure these to give multiple outputs, by using a number of boards various input/output arrangements in multiples of eight can be achieved 72819007. The audio inputs are balanced and each input is fed through a transformer. The signal level can be attenuated or amplified, by a volume control knob mounted on the board and final adjustments can be made on site, to ensure that all the inputs can be adjusted to the same level.

2.5 ALARM PRIORITIES

Alarms are prioritised as follows.

1. EMERGENCY PTT FIREMANS PANEL
2. EMERGENCY PTT SECURITY PANEL
3. EVACUATE
4. ALERT
5. BOMB
6. BOMB TEST
7. FIREMANS SPEECH
8. SECURITY SPEECH
9. CASSETTE
10. C.D
11. TUNER
12. TICK TONE

The priorities are factory set as above, but may be changed by via the P.C. Mimic.

2.6 Pre recorded voice message

The evacuate, alert, bomb alarms are pre-recorded message announcements. In normal operation, the messages are initiated from alarm inputs coming into the fireman's Panel and switch the message stored on the voice storage modules installed in the amplifier racks.

2.7 Automatic Monitoring

A microprocessor on the Single Board Apcams, monitors the Control Panel signals, Fire inputs, the audio signals path to the power amplifiers. Amplifier and speaker lines are also monitored for power failure, short circuit, and open circuit and earth faults.

Limited indication of system faults are indicated on the S.B. Apcams L.C.D. display, installed on the control panel rack.

2.8 Status Indication

System status information can be seen on the Apcams panel, (mounted on the control rack) LED indicators and the L.C.D. display.

Comprehensive System information can be obtained by use of the optional PC Mimic. The mimic software runs on a P.C. by connecting a P.C. to the 'D' connector on the Apcams front panel.

2.9 Amplifiers

Amplifiers are used to amplify audio signals and are programmed for selected zones, each floor has two amplifiers, with the exception of the ground and lower ground floor which share an amplifier. Temperature controlled fans are mounted at the rear of the amplifiers for cooling.

2.10 Speaker & Amplifier Monitoring

Amplifiers are continuously monitored for faults, and the speaker loops are monitored for earthleaks and high or low impedance faults. These faults are reported on the access panel or the P.C. Mimic.

2.11 Audio Fault Monitoring

When the system is not making a broadcast, or monitoring the amplifiers and speakers, the internal and external audio paths of the system are monitored. Any failure is reported on the PC-Mimic

3 ApCAMS

Apcams is a printed circuit board on the front panel, located in the control rack. It contains a microprocessor and other electronic components and is mounted as shown in figure 1 below.

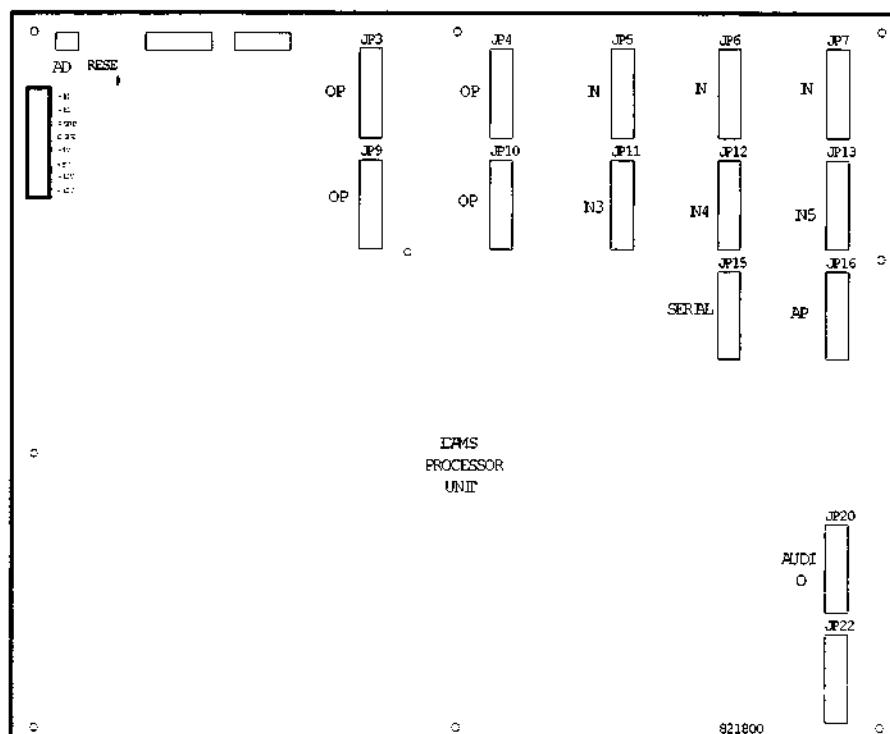


Figure 1: Apcams board G.A.

Connections made to the board are via terminal blocks for power and multipin connectors for input and output signals. Each of the multipin connection leads is identified with a label indicating the destination of the lead., e.g.

ApCAMS JP7	meaning:	Connector JP7 on the ApCAMS board
IN2		is cabled to Termination Card IN2
OPTO-INPUT		
CARD		

The board accepts one AUDIO IN announcement or tone and matches the signal to the input level of the mixer. A test tone is injected into the signal conditioning path and is later received, rectified and measured by an analogue to digital converter (ADC) as a measure of the integrity of the audio path. After further signal conditioning the mixer output is suitable for driving the power amplifiers and a second P.A. rack where applicable.

The CPU controls the ADC output for speaker monitoring, and controls the amplifier selection. In addition the CPU performs the following functions:

- Holds the system parameters and priorities in non-volatile memory
- Reads digital status signals from the four 16-bit input ports, typically from fire and gas alarm inputs
- Writes digital control signals to the six 16-bit output ports, typically alarm indications to a supervisory system
- Communicates with a PC-based mimic display via an RS232 port
- Communicates with a remote PA system via the RS 422 port (in the case of a duplicated system)
- Accepts announcement commands from an Audicom or access unit
- Controls the access units to provide LED indications

3.1 Input and output cards

To enable the Apcams board to interface correctly with inputs and outputs, and to detect speaker faults, the board connects to other printed circuit boards located in the termination chamber area of the rack. These cards are:

- Audio termination card
- Opto-isolated input card
- Relay termination card
- Amplifier select and monitoring cards
- Access Panel interface card
- Relay termination card
- Voltage Monitor card
- Ribbon interface card
- Apcams expansion card
- Bell Tone generator card
- Speaker / amplifier monitor card

Depending on which application the Apcams unit is used, will determine which cards are used.

4 MIMIC/MAINTENANCE TERMINAL

4.1 Introduction

The PC mimic program supplied with the system has three main purposes

- To display and record the state of the PA system
 - To allow the modification of operational parameters
 - To support fault finding and maintenance procedures

4.2 System Requirements

The PC Mimic program is designed to run on an IBM PC compatible computer, which meets or exceeds the following specification:

- Intel 386 SX processor
 - 2Mb Ram
 - MS-DOS 5
 - Colour VGA screen
 - 9600 baud RS232 serial port

4.3 Installation

The program is supplied on a 3.5" disk.

4.4 Execution

To execute the program type mimic 1. A count down is displayed, during which the operator can abort the running of the mimic and exit to the DOS prompt before the program starts to execute. A blue screen with the message "Asking for Host" will be displayed for a few seconds while communications are established. The main mimic screen will then be displayed

4.5 Main Screen - Status Message Area

4.5.1 Operation

The status message area occupies the top of the screen. When a fault in the system is detected, or an alarm is raised, an appropriate message is displayed in this area in red text. When the fault or alarm condition is subsequently cleared, the message is displayed as blue text. There is space only to display 3 such messages on the screen. If more than three occur then the messages may be scrolled up and down by using the + and - keys. Cleared fault or alarm conditions (i.e. those displayed in blue text) can be acknowledged, and removed from the display by moving the message to the centre line of the display using the + and - keys and then pressing the 8 key.

Raised, Cleared and Acknowledged fault and alarm conditions are recorded with a timestamp in a file EVENT.LOG, which is an ASCII-format file, and thus may be read, printed, searched etc. using standard PC/DOS programs and tools.

4.5.2 Messages

The following alarm and fault messages are typical of those, which can be displayed. They are not specific to any contract.

Alarm input fail Aucams configuration corrupt Aucams program memory fail

Aucams data memory fail

Aucuns configuration corrunt

Aucams program memory fail

Aucams Internal Audio Fault

Access panel audio fail

Fan Fuse Fail

Amplifier Fail

Speaker Loop Low
Impedance

Amplifier Earth Fault

Speaker Loop High
Impedance Fault

4.6 Main Screen - System Mimic Area

The system mimic area is an animated block schematic of the system, indicating faults and operation of all major inputs, outputs and monitoring results. The screen is arranged as five columns, each column containing a number of blocks or pictograms representing different system components. For the purposes of the following description, the columns will be referred to by number, column 1 being the left hand side column.

4.6.1 Audio Inputs.

The top block of column 1 represents the control panels and other audio sources, the state of which is represented by both the colour and the text displayed within the boxes;

Colour	Text	Meaning
Green	Ready	The station is powered up, reports no faults and is ready to make announcements
White	Active	The station is making an announcement or has raised an alarm
Light Red	Failed	The station has failed. A fuller description of the fault will be displayed in the status message window above

4.6.2 External Alarm Inputs

The inputs from the external alarm systems are represented in column 1, second block.

Colour	Meaning
Green	Alarm input is healthy, and reports no faults or alarm requests
White	Alarm input reports alarm request

4.6.3 Main Rack

The enclosure in the third and fourth of the main screen represents the controlling rack. It contains elements representing equipment within the rack

4.6.3.1 Fans

Fans are used to ventilate the system when an amplifier is operating. These are represented by boxes at the top and bottom of the screen. The state of the fans is portrayed by the colour of the box and the enclosed text message, column four.

Colour	Text	Meaning
Green	Ready	Fans are ready to operate
White	Active	Fans are operational
Light Red	Failed	Fans have failed

4.6.3.2 Apcams CPU

The Apcams CPU (control section of motherboard) is represented by a coloured box on the screen. The state of the CPU is portrayed by the colour of the box, and the enclosed text message, column three.

Colour	Text	Meaning
Green	Ready	Operational
Light Red	Failed	Either the ROM (program), RAM (data) or NVRAM (configuration data) memory has been corrupted. More information will be displayed in the status text window

4.6.3.3 Apcams Audio

The Apcams Audio (analogue section of motherboard) is represented by a coloured box on the screen. The state of the audio is portrayed by the colour of the box and enclosed text message, column three.

Colour	Text	Meaning
White	Active	Processing broadcast
Green	Ready	Inactive
Light Red	Failed	Internal test tone not detected at output stage or alarm tone generator failed

4.6.3.4 Speaker Monitoring

The speaker monitoring equipment is represented by a coloured box. The state of the audio is portrayed by the colour of the box and the enclosed text message, column three.

Colour	Text	Meaning
Green	Ready	Ready for operation
White	Active	Monitoring speakers

4.6.3.5 Amplifiers

The operational state of the amplifiers are represented by coloured blocks. The status of each amp is represented by the colour of the blocks, column 4.

Colour	Meaning
Green	Powered up and ready to operate
White	Active, performing broadcast or speaker monitoring operation
Light Red	Failed, due to fuse, power or earth fault. More information will be available in the text status window

4.6.4 Status of Alarm

Column 2. Bottom block, identifies which alarms are active. When used in conjunction with External Alarm indications and Access Panel indications, the type and location of the alarm can be determined.

4.6.5 Zones Served

Column 2. Top block, Identifies Zones selected for any broadcast being made. Each zone is represented by a green bar which turns from green to white when that zone is active.

4.6.6 Speaker Loops

Column 4. Identifies the state of each speaker loop, this is portrayed by the colour of the pictogram and associated text.

Colour	Text	Meaning
Green	Ready	Inactive, ready for operation
White	Active	Activated for broadcast
Light Red	Failed	Low impedance, high impedance or earth leak fault on the speaker loop. The status text window will contain further information
Blue	Absent	Speaker loop disabled by operator

4.7 Mimic Main Menu

The mimic main menu is reached by pressing the 0 key from the main mimic screen. The following options are available:

Option 1: Mimic

Return to main mimic screen.

Option 2: Terminal

Allows direct communication with the Apcams CPU operating system. For use only by, or under the instruction of, Akusta technical staff.

Option 3: Set-up

Enters set-up menu (see below).

Option 4: Select Comms Port

Allows the user to change which comms port of the PC is used to communicate with the Apcams.

Option 5: System Monitor

Displays in real time the state of key variables and I/O state of the Apcams software. For use only by, or under the instruction of, Federal Signal technical staff.

Option 6: Mailbox Monitor

Option 7: Matrix Monitor

Option 0: Return To DOS

Exits from the Mimic program.

The required option may be selected by either pressing the associated number key, or using the up and down arrow keys to highlight selected option, and then pressing the return key.

4.8 Set Up Menu

The set up menu is reached from the main menu as described above. The required option may be selected by pressing the associated number or letter key, or using the up and down arrow keys to highlight the selected option, and then pressing return key.

4.8.1 Rack Name

Allows editing of the rack name, which is displayed at the top of the main mimic screen.

The left and right arrow keys move the yellow cursor along the name. Typed characters overwrite existing characters. When editing is complete press the escape key. The program will prompt you to save the changes. Selecting 'Y' will send the changes to the Apcams CPU and return you to the set-up menu. Selecting 'N' will return you to the set-up menu without saving changes.

4.8.2 Alarm Tone(Not Applicable)

Alarm tones can be user set. The tones are generated by the Apcams internal tone generator. See section Alarm Tone Programming.

4.8.3 Alarm Tone Programming(Not Applicable)

4.8.3.1 Introduction

The alarm tone programming screens allow the operator to set up a sequence of five different settings (know as slices) for the tone generator registers, plus timing and sequencing information. When an alarm is first initiated, the tone generator will be set up according to the values in the first slice. These settings will be used for the time defined in the slice, and then the tone generator will be set up according to the values in the second and subsequent slices. A 'repeat slice' allows the sequence of tones thus generated to be repeated from any point in the sequence.

4.8.3.2 Moving Around the screen

Each slice is represented by a panel containing 'Knobs' for setting the Base, LFO, Offset & Time for that slice, and a set of 'Push Buttons' for selecting the modulation envelopes.

On entering the screen, the cursor (indicated by yellow text) is at the Base knob for the first slice. The right arrow key moves the cursor from the Base knob to the LFO, then to the Offset, Time, Envelope push buttons and then Base knob for the next slice, and so on. The left arrow key will move the cursor back. Pressing the Control and Right arrow keys simultaneously will move the cursor to the Base knob of the next slice. Pressing the Control and Left arrow keys simultaneously will move the cursor to the Envelope buttons of the previous slice

4.8.3.3 Changing Values

With the cursor on one of the knobs, the Up arrow key will increment, and the Down arrow key will decrement the knob value by one. The Control and Up arrow, and Control and Down arrow will increment or decrement the knob by 10.

With the cursor in the Envelope push buttons, the Up arrow will select the previous button, the down arrow the next. Note that only one button may be selected.

4.8.3.4 Sweep Envelope

The sweep envelope allows the selection of swept frequency tones with a period of up to 25.5 seconds. The sweep may be of increasing or decreasing frequency.

When the sweep envelope is selected, the BASE, OFFSET, and LFO knobs become START, END and PERIOD.

The START and END knobs select the initial and final frequency of the sweep (using the same formula for base frequency above). PERIOD selects the period of the sweep in 1/10ths of a second.

For example, a sweep down from 1200 Hz to 500Hz over 1 second:

- START = 48
- END = 0
- PERIOD = 10

or a tone sweeping up from 1000 to 1700 Hz over 10 seconds

- START = 32
- END = 83
- PERIOD = 100

4.8.3.5 Time and Repeat Settings

The Time knob defines how long the settings within the slice should be used before going on to the next slice and using those settings. The units are in 10ths of a second. A setting of 0 means that that slice shall never time out.

If, instead of an envelope, the 'Rpt' button is selected, the meaning of the knobs change. The Base, Time, and LFO knobs no longer apply and the offset knob becomes the 'From' knob, selecting which slice the sequence should repeat.

4.8.3.6 Examples**A constant 800 Hz tone:**

Slice 1

Base	20
Offset	0
Lfo	0
Time	0
Envelope	Const

Slice 2

Base	Don't Care
Offset	Don't Care
Lfo	Don't Care
Time	Don't Care
Envelope	Don't Care

Slice 3

Base	Don't Care
Offset	Don't Care
Lfo	Don't Care
Time	Don't Care
Envelope	Don't Care

Slice 4

Base	Don't Care
Offset	Don't Care
Lfo	Don't Care
Time	Don't Care
Envelope	Don't Care

Slice 5

Base	Don't Care
Offset	Don't Care
Lfo	Don't Care
Time	Don't Care
Envelope	Don't Care

An Amplitude and frequency modulated 1200 Hz tone for 20 seconds, followed by a constant 800 Hz tone for 5 second alternating with a constant 1200 Hz tone for 2 seconds

Slice 1

Base	48
Offset	20
Lfo	7
Time	200
Envelope	MdTri

Slice 2

Base	20
Offset	0
Lfo	0
Time	50
Envelope	Const

Slice 3

Base	48
Offset	0
Lfo	0
Time	20
Envelope	Const

Slice 4

	Don't Care
From	2
	Don't Care
	Don't Care
Envelope	Rpt

Slice 5

Base	Don't Care
Offset	Don't Care
Lfo	Don't Care
Time	Don't Care
Envelope	Don't Care

4.8.3.7 Saving And Exiting

The programmed alarm tone is saved to the Apcams CPU by pressing the F1 key. The Escape key returns you to the set-up menu

4.8.4 Audio Mutes (Not applicable)

Loudspeakers may be muted, this screen allows the selection of loudspeakers to be muted. defaults.

Down the left hand side of the screen is a list of all the different broadcasts available on the system. To the right of each broadcast are boxes, one for each zone.

The Up, Down, Left and Right arrow keys are used to move the cursor (yellow highlight) around the boxes. The space bar toggles between selected (ticked) and deselected (no tick). When editing is complete press the escape key. The program will prompt you to save the changes. Selecting 'Y' will send the changes to the Apcams CPU and return you to the set-up menu. Selecting 'N' will return you to the set-up menu without sending changes

4.8.5 Audio Zones

Each broadcast has a default set of zones. These may be overridden by operator actions (i.e. during zoned speech from access panels). This screen allows the editing of these defaults.

Down the left hand side of the screen is a list of all the different broadcasts available on the system. To the right of each broadcast are boxes, one for each zone.

The Up, Down, Left and Right arrow keys are used to move the cursor (yellow highlight) around the boxes. The space bar toggles between selected (ticked) and deselected (no tick). When editing is complete press the escape key. The program will prompt you to save the changes. Selecting 'Y' will send the changes to the Apcams CPU and return you to the set-up menu. Selecting 'N' will return you to the set-up menu without sending changes

Care should be taken when using this screen that alarms and emergency speech have the appropriate zones set up.

4.8.6 Audio Priorities

All broadcasts have different priority levels. A request for a high priority broadcast will override that for a lower priority broadcast.

The screen will display a list of all possible broadcast types down the left hand side of the screen. To the right of each broadcast name is its priority number. The higher the number, the higher the priority.

The Up and Down arrow keys are used to select the priority to edit. The new priority number (between 0 and 255) should be typed in directly, and terminated with a carriage return. When editing is complete press the escape key. The program will prompt you to save the changes. Selecting 'Y' will send the changes to the Apcams CPU and return you to the set-up menu. Selecting 'N' will return you to the set-up menu without sending changes

4.8.7 Audio Time-outs

To prevent a high - priority announcement blocking any other broadcasts, it is recommended that any announcement with priority greater than an alarm is given a time-out. This forces the announcement to end after a programmed number of seconds.

The audio time-out screen allows the operator to program these times. The layout and use of the screen is identical to audio priorities above. The units are seconds. A value of 0 indicates no time-out. A value of about 30 seconds is recommended for those announcements requiring time-outs

4.8.8 Speaker Monitoring (1-8)

The loudspeakers are monitored by measuring the current that is drawn from each amplifier by its speakers for a fixed voltage 20KHz test tone. The speaker monitoring screen allows the setting of maximum and minimum current values. If the current goes outside of these settings an error will be reported.

This screen should be activated when all speakers have been installed and tested, and the system is quiescent (not in use). It should be noted that it will only give accurate results when no broadcast is being made. It should also be noted that speakers in quiet areas are activated by this screen, therefore some (minor) disturbance of the occupants may result.

For each amplifier there is a graphical display of the current being drawn by the speakers. This consists of four lines. The upper and lower yellow lines represent running minimum and maximum values recorded of the sample period. The green line represents a running mean over the sample period, and the white line represents the last sample. If the current is stable, then these lines may completely coincide.

Each amplifier has a MAX and MIN slider. Upon entry, the cursor (yellow highlighted text) is on the MIN slider for amp 1. The left and right arrow keys move the cursor from slider to slider. The up and down arrow keys move a slider up and down by one unit. By holding the control and up or down arrow keys the slider may be moved 10 units.

For each active amplifier, the MIN slider should be moved to just below the lower yellow current line. The MAX slider should be moved to just above the upper yellow current line.

When all amplifiers have been calibrated, the F1 key sends the new calibration data to the Aucams CPU.

The ESC key returns to set-up menu.

F2 Test - Indicates if the test tone is active.

4.8.9 Speaker Monitoring (9-12)

As above

4.8.10 Audio Monitoring

The control modules internal tone generators and internal audio paths are tested when the system is quiescent, and is not monitoring the loudspeakers.

The test is performed by setting up the audio path through the system for each device in turn, and monitoring the level of a test tone at the output stage of the Aucams audio processor. If the level falls below a pre-set, then a fault is reported.

The setting up of the pre-sets is done in the audio monitoring screen.

This screen should only be activated when the racks audio monitoring process is active, otherwise unreliable results may occur. This process can be seen by the cycling of selections on the analogue switch card in the rack.

On the screen, for each monitored device, there is a window showing the last detected levels of the test tone, and a slider to pre-set the trigger level.

Upon entry the cursor (yellow highlighted text) will be at the slider for the first monitored device. The left and right arrow keys move the cursor from device to device. The up and down arrow keys move the selected slider up and down by 1. Control Up and Control Down move it by 10.

When all samples have been collected, the sliders should be moved to be a little below the recorded values.

When calibration is complete, the trigger levels are transmitted to the Apcams CPU by pressing the F1 key. The ESC key returns to set-up menu.

4.8.11 Select Comms Port

From the Mimic Main Menu screen select 4 'Select Comms Port' - Select port 1. Returns to Main screen.

4.8.12 Restore Default

This option restores all above set-up items to their factory default values. It prompts before continuing.

4.8.13 Save Set Up

All the above set-up values can be stored to a file. Upon entry to this screen, the name of the file for the set-up values should be entered. Only valid DOS file names are allowed. The file is always saved with the extension .ISU (**Icams Set Up**). When the file name is complete, press the ESC key to leave the screen. You will be asked if you wish to save the set-up in this file. Press Y to continue with saving. If a file with the same name already exists in the directory, you will be asked if you want to overwrite the existing file. Press Y to continue.

4.8.14 Load Set-up

This screen allows the loading of a previously saved set-up file. A list of all .ISU files in the directory appears on the screen. The currently selected .ISU file is highlighted in yellow, and is also displayed at the top of the list. The up and down arrow keys are used to select the required file. Having selected the required file, the return key transmits it to the Apcams CPU. The ESC key returns to the set-up menu.

4.8.15 Rack Monitor

4.8.16 Return To Main Menu

Returns to main menu.

13 CAUSE & EFFECT CHART

Doc. Ref. E1512 Rev : C1

Notes.		Legend	Cause and Effect Matrix									
		o immediate effect • effect after 180 seconds										
B	1, 2, 15, 16. Core, car park, staff area & planrooms	1st smoke/heat detector 2nd smoke/heat detector Break glass unit Sprinkler flow switch Evacuate button (B)	Office lifts (L1, L2, L3) home to G/F or park at nearest floor if fire is at G/F	Office lifts (L1, L2, L3) home to G/F or park at nearest floor if fire is at G/F	Firefighting lift (L4) change to firefighting mode	Signal to security system to release doors						
LG	17, 18, 19, 40, 54. Core, office, sprinkler valveroom & storage	1st smoke/heat detector 2nd smoke/heat detector Break glass unit Sprinkler flow switch Evacuate button (LG)										
G	21, 22, 23, 24. Core, office & Entrances	1st smoke/heat detector 2nd smoke/heat detector Break glass unit Sprinkler flow switch Evacuate buttons (3 No.) (Residential Entrance) (Offices) (Office Entrance & Core)										
1	25, 26, 27. Core & office	1st smoke/heat detector 2nd smoke/heat detector Break glass unit Sprinkler flow switch Evacuate button (1st)										
2	28, 29, 30. Core & office	1st smoke/heat detector 2nd smoke/heat detector Break glass unit Sprinkler flow switch Evacuate button (2nd)										
3	31, 32, 33. Core & office	1st smoke/heat detector 2nd smoke/heat detector Break glass unit Sprinkler flow switch Evacuate button (3rd)										
4	34, 35, 36. Core & office	1st smoke/heat detector 2nd smoke/heat detector Break glass unit Sprinkler flow switch Evacuate button (4th)										
5	37, 38, 39. Core & office	1st smoke/heat detector 2nd smoke/heat detector Break glass unit Sprinkler flow switch Evacuate button (5th)										
6	41 Lobby	1st smoke/heat detector 2nd smoke/heat detector Break glass unit Sprinkler flow switch Evacuate button (6&7)										
7	41, 52. Lobby & plantroom	1st smoke/heat detector 2nd smoke/heat detector Break glass unit Sprinkler flow switch Evacuate button (6&7)										
6	42, 43, 44, 45, 46. Plats & maisonette	1st smoke/heat detector 2nd smoke/heat detector Break glass unit Sprinkler flow switch Evacuate button (1 per flat)										
7	47, 48, 49, 50. Plats	1st smoke/heat detector 2nd smoke/heat detector Break glass unit Sprinkler flow switch Evacuate button (1 per flat)										
Pool	53 Plant area	Break glass unit Evacuate button (Pool)										
B to 5 or 7	13, 4, 5. Stairs	No detection										
B or LG to 5	6 (L1, L2, L3)	1st smoke/heat detector										
B to 7	7 (L6)	1st smoke/heat detector										
B to 6	8 (L5)	1st smoke/heat detector										
LG to 7	20 (L4) Lift Wells	1st smoke/heat detector										
B(HL) to 5	9, 10, 11. Elec. risers	1st smoke/heat detector 2nd smoke/heat detector										
B(HL) to 5(7)	12 Mech. riser	1st smoke/heat detector										
B(HL) to 5(7)	13, 14. Mech. risers	No detection										

- 1) Smoke/heat detectors 1 to 6 are 2 Person zones
2) Smoke/heat detectors 7 to 12 are 1 Person zones
3) Smoke/heat detectors 13 to 14 are 3 Person zones

Doc. Ref. E1512 Rev : C1

Notes.

1. Stair lobby detection and alarm devices shall be adopted into the adjacent floor zone and not staircase zone.
2. Detectors in lift wells and risers shall be adopted into the adjacent floor fire zone to facilitate effects at the given level.
3. Floors are covered by multiple sprinkler flow switches.
4. Refer to layout drawing Nos. E-1201 through to E-1211 and schematic drawing Nos. E-1510 and E-1511.
5. Cancel or reset at the main or FCC FAP's at any time after alarm initiation cancels the current alarm and automatically resets all input and output devices.

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5-7 Carlton Gardens, London SW1

D.1.4 Security System - Blenheim Security Systems Ltd.

Refer to Section H.6 of this O & M Manual for details.

6 ELECTRONICS

A full description of the operation of the electronic circuits is beyond the scope of this document. A brief description of each circuit board and its principle components is provided for information only.

6.1 1821 800 Apcams Control Module

The circuit board is split into various sections as follows:-

CPU and memory
Input/Output, LCD, Keypad ports and link field
RS422 port and access panel port
RS232 serial ports
Tone generator
Chime generator
Mixer and audio input/output
Watchdog
ADC
Test tones

The power connections into TB3 feed both digital and analogue circuits on the board: the analogue and digital grounds are commoned at the terminals.

6.1.1 CPU and Memory

Microprocessor U49, type R65C02P2, operating with a 2 MHz clock connected at pin 00. Pin connections on the microprocessor may be summarised as follows:

OUTPUT Ø1	(C0) clock in antiphase with 00 above
OUTPUT Ø2	(C1) clock in phase with 00 above
SYNC	(C7) goes high during operating code fetch
R/W	(C4) Goes high when reading data from memory or I/O bus. Low when the data bus has valid data from the microprocessor to be stored at the addressed memory location.
A0-A15	16-bit address bus
INPUTS SO	(C3) A negative transition on this line sets the overflow bit (V) in the processor status register.
IRQ	(C2) Taking this low requests an interrupt sequence to begin within the microprocessor.
NMI	(C8) Taking this low generates a non-maskable interrupt.
RDY	(C6) Taking this high halts the microprocessor with the output address lines reflecting the current address.
RESET	(C5) Taking this low resets the microprocessor.
INPUTS/OUTPUTS	8-bit bi-directional data bus used for data exchanges to and from the microprocessor D0-D7 and peripherals.

C0 - C7 are I/O CONTROL lines for the CPU. From C1 and C4 write (WR) and read (RD) lines are derived at gates U48 A/C/D for enabling other devices on the board. RN15 is an array of pull-up resistors.

The CPU operates with three memory chips, U52, U53 and U54

U52 is an EPROM of 32K X 8 bits which has permanently stored the default parameters of the system (corresponding to the customer system operating requirements) in its memory locations. It is selected by chip select.

Input ROM_CS. Memory locations are addressed by the A inputs, and a high on RD reads data onto D0-D7 from the addressed location to the CPU.

U53 is a battery backed RAM of 8K X 8 bits which stores vital temporary data in its memory locations. This data includes changes to the system made after the EPROM has been blown, e.g. on-site, and which if permanent could be incorporated into a replacement EPROM.

It is selected by chip select input RAM_CS. Memory locations are addressed by the A inputs, and the data to be read into or out of the locations is carried on the D0-D7 lines. A high on WR writes data present on D0-D7 to the addressed location. A high on RD reads data onto D0-D7 from the addressed location.

U54 is a type 6264 non-volatile RAM with battery back-up (the battery is mounted above the chip) for temporary data storage with a basic capacity of 64K organised as 8192 X 8-bit words. The socket will also accommodate type GR881 non-volatile RAM with integral memory and type 2816 EEPROM (electrically erasable programmable read-only memory). It is selected by chip select input EE_CS. Memory locations are addressed by the A inputs, and the data to be read into or out of the locations is carried on the D0-D7 lines.

JP14 is a 40-way connector providing an extension bus for optional Apcams enhancement cards. The other components are decoders and latches deriving chip select and serial port controls from the address lines.

Capacitors C30 - C41 provide power supply decoupling.

6.1.2 I/O Read and Write Controls, LCD, Keypad Ports and Link Field

The U39 3 to 8 line multiplexer provides 8 write signals for 4 parallel output ports: the signals are buffered by the octal buffer U38.

The U40 and U40 3-8 line multiplexers provide read signals for 6 input ports.

Switch SW1, resistor array RN19 and octal buffer U55 are a means of providing data inputs to the CPU for software maintenance.

The remaining circuits are for optional external 240 X 64 dot liquid crystal display module, Toshiba type TLX-711A, and keypad.

6.1.3 Output Ports

The circuits accept 8-bit parallel data from the CPU and write it at higher power levels to four 16-bit parallel output ports, OUTPUT 0, 1, 2 and 3, when enabled by write signals WR0, 1, 2 and 3. U1, 2, 3, 4, 22, 23, 24, and 25 are octal transparent latches. The data D0-D7 presented by the CPU at the inputs are latched onto the outputs Q1-Q8 by the write command (IO-WR) for the latch.

U11, 12, 13, 14, 32, 33, 34 and 35 are octal darlington driver ICs. They accept the latched outputs Q1-Q8 and drive capability of 50 V max, 500 mA max (power dissipation 2.2W up to 25°C, 1W above). The drive signals exit to the output termination cards via the four 20-way connectors JP3, JP4, JP9 and JP10.

C15-C53 provides power supply decoupling.

6.1.4 Input Ports

The circuits accept 16-bit parallel data from the parallel input ports, INPUT 0, 1, 2 and 3, and when enabled by read signals RD0, 1, 2 and 3, pass the parallel input data as parallel 8-bit data blocks to the CPU on the D0-D7 lines.

U5-10, 26-31 are the 8-bit transceivers passing the 8-bit blocks to the CPU when enabled by the read (RD) signals. RN1-12 are resistor arrays. C1-C5 provide power supply decoupling.

6.1.5 RS422 Port and Access Panel Port

U61, a 65C22 Versatile Interface Adapter (VIA), and ICs U45, 46 and 47 are used for the access panel interface. The U61/U45/U47 combination provides an 8-bit parallel output port with drivers: U61/U46/RN14 provide an 8-bit parallel input port. Where communication between two systems is required, an RS422 interface is provided by the U21 (65C51) Asynchronous Communications Interface Adapter (ACIA) and line driver U16A. The baud rate is derived from a 1.843 MHz crystal clock and can be selected using software. Word length and parity are also software controlled. MOVs and T-filters are used to protect the input and output ports from spikes which may be present on the links.

C35-C37 provide power supply decoupling.

6.1.6 RS232 Serial Ports

Two serial communication links are implemented using the 65C51 Asynchronous Communications Interface Adapter (ACIA) and RS232 line drivers. All handshaking signals are provided for asynchronous operation. The baud rate is derived from a 1.843 MHz crystal clock and can be selected using software. Word length and parity are also software controlled. C44-C45 provide power supply decoupling.

6.1.7 Tone Generator

The circuits on this sheet are designed to generate a wide range of tones to meet as many customer required tones as possible. These include warbles, wails, continuous tones and chimes. The card delivers the tones when addressed and instructed by the CPU.

Two LF oscillators are shown, U86 and U67 each selectable for sine, triangular and square waveforms. The main oscillator is U67 which delivers its tone output via U77B. This tone is modulated by the output of U86 which generates tones at the point LF0-OP in the frequency range 0.1 to 8Hz. These typically produce the wailing and other modulation effects.

Both of the oscillators are voltage controlled. The frequencies generated by U86 are controlled by the voltage at the output of the digital to analogue converter (DAC) U83, which is set by the CPU via the data lines D0-D7. The reference voltage for the DAC is 1.25 volts derived from Vcc by the zener REF 12Z. A monostable circuit U81A damps the rate of rise of the oscillations from U86.

The basic frequency generated by U67 is controlled by the voltage at the output of the digital to analogue converter (DAC) U85, which is set by the CPU via the data lines D0-D7. The reference voltage for the DAC is the modulating signal LF0-OP from U86. Another DAC, U84, provides a voltage output to set the offset frequency of U67.

Selection of the type of waveform, sine, triangular or square, and switching of the tone path etc. is by data from the CPU acting via the octal latch U62 and relay driven by the U62 outputs SL0-SL7.

6.1.8 Chime Generator

The chime generator is a DAC / LF oscillator / monostable combination similar to that described for the tone generator, has its chime frequency set by the CPU via the data lines and its decay time set by capacitor C60.

6.1.9 Audio Mixer and Audio Input / Output

Audio signals for announcement are brought to the board at connector JP20, which can also receive audio announcements from remote systems and carries conditioned audio and tones out to the power amplifiers. Signals I/P-A and I/P-B from JP20 are made to audio transformer T2, and are conditioned by tone control circuits before entering the mixer U78C via capacitor C85. The other inputs to the mixer are the tones and the chime. The audio and or tones are then fed too, two destinations:-

- The power amplifier inputs via T3, relays, and Amps-A / Amps-B connections.
- An optional duplicate system via T1 and T-RM-A / T-RM-B connections

Facilities are provided in the audio paths to inject test tones at the points 1K-TT and 20K-TT, and to monitor them at the detector points marked, 20KDET, LOCDET, RODET and RIDET. The monitoring is carried out by an ADC. A jack socket is also provide to enable an engineer to listen to the output of the mixer. Relay RL2A selects local or remote audio for announcement.

6.1.10 Watchdog

The system uses a supervisory IC to check the power supply and microprocessor. The MAX690A provides two main functions. It provides a reset pulse during power up, power down and brown-out conditions. It also provides a reset pulse if the watchdog timer has not been toggled within 1.6 seconds. The reset pulse is clocked into a counter and after three reset pulses the system locks in a reset condition until a manual reset is made. The watchdog timer function is optional and can be disabled using a jumper link.

6.1.11 ADC

U72 is an analogue to digital converter (ADC) which accepts an analogue voltage at Vin and delivers the value as an 8-bit binary output at D0-D7. The analogue input is a rectified version of one of the test tones monitored in the audio path (see sheet 10). These tones are LOCDET, RODET, RIDET, 20KDET and are selected in turn by the CPU via data lines D0-D7 via octal latch U63. Rectifier D2/D3 converts the tones to DC and the DC values are filtered and amplified before passing to the ADC for measurement. The binary value of each is compared by the CPU with an acceptable window of values. A circuit is also provided, TB1 / U75A, to accept a 4-20mA analogue signal directly (typically an analogue fire and gas measurement) and to measure it in the ADC for comparison by the CPU within acceptable limits. If the CPU concludes that there is a fault in the normal values it generates an alarm for the external supervisory system.

6.1.12 Test Tones

The two test tones are produced by two separate waveform generators and buffered. They are both sine waves, one at 1KHz and one at 20KHz. They are injected into the audio circuits, for audio path monitoring. The ADC can be used to measure the level of the 1kHz tone at the mixer output, thereby confirming the integrity of the audio pathway within Apcams. The 20kHz test tone can be fed out to the amplifiers for loudspeaker monitoring purposes. A reference voltage is fed back from each amplifier, proportional to the power drawn by the load, and Apcams can compare this with the measured level of the 20kHz tone itself to determine the load impedance for each amplifier.

6.1.13 Amplifier/Speaker Monitor Card

These cards are connected to the output ports on the Apcams control board and under software control select each zone amplifier as required for broadcasts. The amplifiers are assigned to zones by fitting jumpers onto a zone/amplifier patching matrix on the board. The control system also checks each amplifier, and its speaker loop in turn, by selecting all the

amplifiers and passing a 20Khz signal from the Apcams board through each of the amplifiers and speakers.

A signal is sent to the monitor card multiplexor U1 from the ADC output on the Apcams board which reads the current taken by each speaker loop in turn, This is then reported to the P.C. mimic which compares the figure to the window parameters that have been set up on commissioning for that loop, if it is outside the settings then a fault is reported for that loop.

Each amplifier in turn also sends back a signal if its monitor detects any connection of the loop to earth and this again is read through multiplexer U2 to give a signal which is read via the Apcams opto-input board and is then flagged as a fault on the mimic.

Each amplifier in turn also sends back a signal if its monitor detects its internal voltage on part of its circuit dropping below 7 volts (which means the amplifier has failed) and this again is read through multiplexer U3 to give a signal which is read via the Apcams opto-input board, and is then flagged as a fault on the mimic.

The card also has an audio select matrix which can be used in some systems if multiply audio paths are required to be active at the same time.

The audio comes from the Apcams board via a pre-amp and into JP44 on the monitor board.

6.1.14 821565 Opto Isolated Input Card

The opto-isolated input card provides galvanic isolation for 16 external status inputs to the system. The status signals are typically from the Audicom system to read the zone selects, fire initiation, speaker monitor and UPS status

Connection for digital signals between the interface card and Apcams input port are made by ribbon cable from the 20-pin connector CON1 to one of the 20-pin connectors on the Apcams motherboard JP5.

Input connections from the digital signals to be monitored are connected at the terminal blocks T1 - T16, these are typically +24V on one side of the opto and a switched 0v on the other. Terminal block TB17 is unused in Apcams-based systems.

6.1.15 Relay Output Termination Card

This relay card provides 16 isolated relay change-over contacts for controlling external elements such as alarm inputs on fire and gas systems, supervisory systems and in this instance the Audicom system

Connection for digital signals between the interface card and Apcams output port are made by ribbon cable from the 20-pin connector JP1 to one of the 20-pin connectors on the Apcams motherboard JP4.

As the relay contacts are isolated power may be switched either from an external or internal source depending on the system that is been controlled.

Connections are made on TB1 to TB16 with each TB having three connections:- Normally closed, common, normally open.

7 SOFTWARE UPGRADES

7.1 Rack Operating System

Rack operating system upgrades are supplied on 27C256 Eproms. The new Eprom should be inserted with the system powered down. The device is static sensitive, so precautions should be taken before handling.

- Remove power from rack.
- The knife switches integral to the rack terminals, the fused terminals, amplifier feed fuses and MCB's should all be opened.
- Put on a suitable earth wristband, and connect it to earth via the rack metalwork
- Using a suitable IC extraction tool, or by gently prising at each end with a screwdriver, remove the 27C256 EPROM (U52 on the 821800 motherboard) from it's socket. Note orientation of IC before removal.
- Place the IC in some suitable anti-static container and retain
- Remove the upgrade EPROM from it's packaging
- Insert the upgrade IC into the vacated socket, ensuring correct orientation of the IC.
- Remove wristband & earthstrap
- Apply power to the rack.
- The amplifier fuses should be closed, the amplifier LED display will indicate power on.
- The control system MCB's are to be closed, followed by the Apcams supply fuses and the remainder of the control system fuses.
- Energise the system and check the operation of the system.
- It may be necessary to initialise a replacement chip, or if a new Apcams board has been fitted. Set the dil switch 8 (on switch 1) to the RHS (On position) press the reset button on the front of the Apcams panel. Return dil switch 8 to the LHS.

IT IS THE RESPONSIBILITY OF THE OPERATING AUTHORITY TO ENSURE THAT THE SYSTEM IS FULLY TESTED AFTER AN UPGRADE TO THE RACK OPERATING SYSTEM

8 AMPLIFIER (DUAL)

A2500M 24V. DC 120Watt

8.1 The dual 120w Power Amplifier Overview.

This is a 120-Watt amplifier, which incorporates various forms of protection and has several LEDs on the front panel. The power amplifier front panel is shown in Figure 1



Figure 1: Dual 120watt Power Amplifier

The Amplifier is designed for installation into a 19" standard rack and occupies 1U height of space. It has built in 'Speaker monitoring' circuit which works in conjunction with the Apcams P.A. control system via a 10 way ribbon connector, or may be used in simple systems by ignoring the monitoring connections or using another version fitted with a 5 pin XLR connector.

The SUPPLY ON LED illuminates when 24 VDC is applied.

As announcements are made the MONITORING LEDS indicate an amplifier output voltage between 10-100V RMS.

AMP SELECT illuminates as the amplifier is selected during a broadcast: if it selects at any other time this indicates a fault.

A voltage of 24 V DC is applied to DE-SELECT the amplifier

If the amplifier is overloaded the OVER LOAD LED illuminates.

The LED marked CUT OUT illuminates if the amplifier cuts out. This will occur if a short circuit is applied to the output, or if a serious overload is experienced. After approximately six seconds the amplifier cuts in again.

The HIGH TEMP LED indicates that the temperature sensor on the amplifier output transistors has caused the output to be disconnected. It reconnects automatically when the transistor heat sink cools.

The Amplifier board has built in circuitry for Selecting the Amplifier on, and a monitoring circuit for the detection of earth faults and changes in resistance of the 100-Volt line output to the speakers.

The select signal, monitoring signals and Audio input are connected to the amplifier via a 10 way

IDC ribbon from the Speaker/Amplifier monitoring board, or via a 5 pin XLR plug for unmonitored versions.

The amplifier gain is factory set so that a 0.775 V RMS input signal will give a 100V RMS output. This audio level should never require adjustment.

8.2 Power Amplifier Specification

	1U 19" rackmount, 45(H) x 483(W) x 426(D)	
Size (mm)		
Weight	7Kg.	
Supply voltage	24Volts DC,	
Power output	2 x 120 watts RMS	
Power Consumption	300 VA. Total (Both Channels)	
Rear connections		
10 way IDC ribbon connector.	Pin 1 Earth-0V monitoring, Pin 3 0 to 20mA output to ADC Pin 5 Supply Monitoring >7V O/P Pin 7 0V Pin 9 Audio -	Pin 2 +12V Monitoring Pin 4 Earth Fault O/P Pin 6 Amp Select I/P Pin 8 Audio + Pin 10 Not used
5 pin XLR connector	Pin 1 Audio + Pin 3 0V/Screen Pin 5 Audio -	Pin 2 Amp select Pin 4 Fuse Fail
3-pin XLR 100 Volt line output connector	Pin 1 100 V line output Pin 2 100 V line output	
3-pin Power Con Power connector DC	Pin 1 +24VDC Pin 2 0V Pin 3 Earth	

8.3 Amplifier Performance Specification

Audio input sensitivity	0 dBm (775 mV RMS into 600 ohms) for 100 volt RMS line output
Frequency response	80 Hz - 18 KHz (-3 dB points).
Signal/noise ratio	Better than 75 dB
Total harmonic distortion	Better than 1% at full power
Electronic protection	Open and short circuit protection.

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D.2 STARTING UP

D.2.1 Stand-by Generation

Refer to Section H.3 of this O & M Manual for details.

Also refer to attached letter from AVK/SEG (UK) Ltd. dated 18/9/98.

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D.3 SHUT DOWN PROCEDURE

D.3.1 Stand-by Generation

Refer to Section H.3 of this O & M Manual for details.

Also refer to attached letter from AVK/SEG (UK) Ltd. dated 18/9/98

D.4 EMERGENCY PROCEDURES

D.4.1 Stand-by Generation

Refer to Section H.3 of this O & M Manual for details.

Also refer to attached letter from AVK/SEG (UK) Ltd. dated 18/9/98

FACSIMILE

MINISTRY WHARF, SAUNDERTON
HIGH WYCOMBE, BUCKS HP14 4HW
TELE : 01494 564541
FAX : 01491 564543

AVK  (UK) LTD

"The Power People"

FAX

Company :	T CLARKE PLC	Fax No :	0171 701 6265
F.A.O :	G W Navy	From :	Alan Fisher
Date :	18/9/98	Mobile No	07775 631500
Your Ref. :		Pages :	1
Our Ref. :	FAJF-TCLARKE-22	Job No :	JN98255
Copy :	Robin Aves		

Subject 5-7 CARLTON GARDENS - GENERATOR INFORMATION

Dear Sir,

The O & M Manual information requested is not available at present as we are still at the design stage and equipment is to be custom manufactured. In the programme issued to T.Clarke on 24/7/98 it showed O&M manuals would be provided in week 45.

The situation on specific issues raised in your letter is as follows:-

- | | | |
|----|---|---|
| a) | System normal and general operations procedures | To be included in O & M Manual |
| b) | Starting up procedures | To be included in O & M Manual |
| c) | Shut down procedures | To be included in O & M Manual |
| d) | Emergency procedures | To be included in O & M Manual |
| e) | Recommended spare parts list | List to be provided 21/9/98, based on specific annual usage rate |
| f) | Tools list | No special tools required |
| g) | Expected life of equipment | MTBFs etc cannot be quantified as failure rates are a function of frequency of operation, maintenance etc |
| h) | Guarantees/Warranties | Twelve months from commissioning and setting to use. |

Please do not hesitate to contact me if you have any further queries.

Regards

Alan Fisher

Alan Fisher
Project Manager

E

E

MAINTENANCE OF THE INSTALLATION

TESTING AND MAINTENANCE - OVERVIEW AND GENERAL RECOMMENDATIONS

INDEX

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E.1

INTRODUCTION

This section provides general notes and schedules to assist in the testing and maintenance of the electrical installation. It must be emphasised however, that no work should be carried out to any part of the system except by a fully competent and qualified person.

E.1.1

PANELS, DUCT CUPBOARDS AND PLANT ROOMS

It must be noted that electrical panels, riser duct cupboards and areas of plant rooms adjacent to panels, switchgear and electrically driven machinery must in no circumstances be used for the convenient storage of materials or cleaners equipment, etc. This is strictly contrary to regulations and constitutes a fire hazard as well as obstructing access to isolating devices in an emergency.

E.1.2

ALTERATIONS TO INSTALLATION

The installation comprising this sub-contract has been fully tested in accordance with the 16th Edition of the I.E.E. Wiring Regulations. Any subsequent modification or extension to the various system should also be tested fully as should all parts of the existing system which may be affected by the new work.

E.1.2.1

PERIODIC INSPECTION AND TESTING

The results of a periodic inspection and test of an installation, or any part thereof, shall be recorded on an inspection certificate and given by the contractor or by an authorised person acting on his behalf, to the person ordering the inspection and test.

The method of inspection and test shall be in accordance with the relevant requirements and the certificate shall be in the form set out in the current Edition of the I.E.E. Wiring Regulations.

E.1.3

PLANNED MAINTENANCE

It is recommended that a planned system of preventive maintenance is adopted to ensure maximum economy with minimum disruption. Such a system should include planned programmed routines to ensure that all equipment receives regular attention under the following headings:-

- a) Inspection
- b) Lubrication
- c) Adjustment
- d) Replacement
- e) Overhaul

All work carried out should be dated, recorded, evaluated and costed.

The system adopted should satisfy the following objectives:-

- a) Maximum utilisation of resources
- b) Well defined channels of communication
- c) Continuously updated costs and records system
- d) Flexibility in routines to enable emergencies to be handled with minimum disruption
- e) Continuous cost control
- f) Facility for accurate cost forecasting
- g) Comprehensive historical record of plant
- h) Preventive maintenance
- i) Built-in feedback and warning system

E.1.4

LOG BOOK

A log book should be kept in regular daily use and all matters appertaining to the equipment and its operation should be recorded daily therein.

Typical items to be noted could be as follows:-

- 1) Main switchpanel meter readings
- 2) Equipment condition (operational, standby, repair, overhaul, etc.)
- 3) Any special report items (malfunctions, breakdowns, etc.)

The keeping of an up-to-date and detailed log book promotes good supervision and maintenance of the equipment, as well as giving a good historical record. The log book should be regularly inspected to ensure that it is up-to-date, entries have been made correctly and if any trends occur which could indicate future trouble. Old log books should be safely kept for record purposes.

E.1.5

MAINTENANCE SCHEDULES

Explanations

The schedules show the routine maintenance required to ensure that the plant and systems will operate with minimum trouble and maximum efficiency. The maintenance shown against each item of plant on the schedule, generally falls under one or more of five categories, namely, inspection, lubrication, adjustment, replacement and overhaul, these categories being described as follows:-

a) General Notes

INSPECTION

Inspection forms the foundation of good maintenance. Its purpose is to anticipate trouble and faults before they occur so that the necessary action can be taken to prevent a system breakdown.

As well as the specific items listed on the schedules, inspection should also include as a matter of course the noting of any changes in the equipment, both visible, audible and tactile. Any changes in the normal state of the plant should be noted, no matter how trivial it might appear at the time.

One should look for such things as changes in noise levels (up or down), new noises, changes in vibrations, temperature variations, new accumulations of dirt or staining, etc.

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When such items have been noted, further frequent inspections should be carried out to check if the point noted is worsening, in the event of which action should be taken to ascertain the cause.

b) Lubrication

Regular lubrication should be carried out to ensure that the equipment operates satisfactorily for the maximum period. Neglect of lubrication could lead to equipment failure and the subsequent ensuing dangers. Always ensure that the right lubricants are used for the job they have to do and that they are suitable for the temperature and loads to which they will be subjected. Always use fresh lubricants, and never re-use old lubricants, even for general purpose light oiling.

c) Adjustment

With constant usage, tolerances are bound to vary outside their normal limits. Belts will stretch, bearings will wear, springs will weaken, etc. It is therefore necessary to make periodic adjustments to compensate for wear and ageing factors.

d) Replacement

Any working part has a limited life. As its age increases, so does the probability that it will fail. A failure caused through age and fatigue is usually a sudden occurrence, with no warning signs prior to the failure. Therefore, to ensure that the maintenance is preventative, a policy should be adopted to replace parts before they fail due to age and fatigue, even though on inspection they appear acceptable and functional. This policy will prevent, to a large extent, sudden failures and the damage and inconvenience they can cause.

e) Overhaul

The prime purpose of an overhaul is to return the equipment to an 'as new' condition. Care should be taken when stripping down and re-assembling, and any suspect parts should be replaced.

f) Frequencies

The frequencies shown on the schedule at which the various items of maintenance should be carried out are for guidance only. They very much depend on the usage, condition, age, etc., of the plant or equipment.

g) Cleanliness

Good maintenance can only prevail in clean conditions. All equipment and the areas in which they are housed should be kept clean.

h) Remote Control

WARNING

IT SHOULD BE REMEMBERED THAT WITH REMOTE CONTROLLED SYSTEMS VARIOUS ITEMS OF EQUIPMENT MAY BECOME ENERGISED WITHOUT WARNING. IT IS THEREFORE IMPERATIVE TO ENSURE THAT ANY ITEM OF EQUIPMENT IS FULLY ISOLATED BEFORE ANY MAINTENANCE WORK IS CARRIED OUT.

E.1.6 EMERGENCY LIGHTING

LEGISLATION

The principal legislation covering various types of premises where emergency lighting may need to be installed are -

Fire Precautions Act 1971

Health and Safety at Work Act 1974.

Other statutory documents cover requirements for sports grounds, cinemas, theatres, gaming clubs and places of entertainment. Local enforcing authorities may also have particular requirements for the installation of emergency lighting and for its type, mode and duration. Close liaison should be maintained with the enforcing authority throughout the design process and approval of the proposed design scheme obtained prior to installation.

SYSTEM REQUIREMENTS

Guidance on the requirements of an emergency lighting installation is given in BS 5266: Part 1 1988, the code of practice for emergency lighting. The standard requires that when the normal lighting or parts of the normal lighting fails the emergency lighting should fulfil the following functions:

- To indicate clearly and unambiguously the escape routes.
- To provide illumination along such routes to allow safe movement towards and through all exits.
- To ensure that fire alarm call points and fire fighting equipment provided along escape routes can be located.

E.1.7

FIRE ALARMS

SYSTEM DESIGN

There are two reasons for installing fire alarm systems, the protection of life and the protection of property. To achieve either it is vital that the control system operates quickly, either to warn people, allowing them to escape in safety, or to enable effective fire fighting to be undertaken.

BS 5839 : Part 1 sets out the recommendations for the installation and servicing of such fire detection and alarm systems and forms the accepted code of practice for systems installed in the UK.

The information contained within this leaflet is intended for guidance only. As the circumstances for each installation can vary greatly it is recommended that your local Fire Prevention Officer be consulted at each stage of the project design and installation.

In general, if an alarm system is required to protect life in a building housing normally active persons a manual system may be sufficient, but automatic detection will ensure that an alarm is raised in good time to enable all occupants to be safely evacuated. When installing a system to protect property automatic fire detection devices must be used to ensure that an alarm is raised with minimum delay.

5 MAINTENANCE AND FAULT FINDING/TROUBLE SHOOTING

5.1 Maintenance

Routine maintenance is minimal. Fault isolation is largely automatic and is enunciated on the Apcams LCD, PC mimic display (if fitted), and the individual fault LED's of the access panels.

5.1.1 General System Maintenance

- Inspect the system visually for any sign of damage to the hardware.
- Check the system rack and access panel for any fault indication.
- Check the PC mimic display for any fault indication. (Optional)
- Clean the surface of the equipment with a slightly damp cloth.
- Check the operation of all the speakers by initiating the tick tone at the access panel.
- Check the operation of all the alarm tones at convenient regular intervals. I.e. during official emergency muster evacuation practices.

5.1.2 Adjustment of the Audio Levels

The audio levels are pre-set during factory tests and should rarely require adjustment. However, levels can be adjusted to accommodate site conditions where necessary.

5.1.2.1 Access Panels

The access panel audio output is factory set to deliver 0.775 Vrms. The adjustment of this level is achieved by a 25-turn potentiometer, VR1.

5.1.2.2 Interface Cards

No adjustments are available on the interface cards

5.1.2.3 Amplifiers

The amplifier gain is factory set so that a 0.775 V RMS. input signal will give a 100V RMS. output. This audio level should never require adjustment.

5.1.3 Other Adjustments

5.1.3.1 Single Board Apcams

The Single Board Apcams motherboard is fitted with other potentiometers for various adjustments.

VR2 - Bass adjustment of the speech only.

VR4 - Treble adjustment of the speech only.

N.B. Care must be taken if these tone controls are adjusted as adjustment can lead to the filtering of important internal monitoring signals.

VR6 - ADC reference voltage adjustment.

VR8 - LCD mimic contrast adjustment. (not fitted to these systems).

5.1.4 Definition of Jumpers and Switches

The various hardware items are fitted with jumpers and switches to make them flexible in their function to meet various requirements.

5.1.4.1 Single Board Apcams

Single Board Apcams is fitted with the following jumpers:-
JP8 - Watchdog timer enable/disable.
JP18/ JP19 - Selects the alarm tone fundamental shape. There are three selections Sine, Triangular and Square wave shapes.
JP17 - Selects between a 2 Kbytes and an 8 Kbytes EPROM.
JP23 - Selecting different fonts for the LCD mimic display (not fitted on this system).
Single Board Apcams is also fitted with an 8 way dip switch used for two functions.
Switch 1 on - Forces the rack to become master.
Switch 8 on - Resets the user configurable parameters back to the factory default values.

5.1.4.2 Analogue Switch Card

This card is used for selecting an audio source to be directed into the Single Board Apcams input. The 16 jumpers on this board are used to connect up to 8 balanced line audio sources onto a single common audio bus.

5.1.4.3 Monitor and Configuration Board

This card has various functions

- Distribute audio signals to amplifiers
- Selects amplifiers for broadcasts and monitoring. Maximum of 16 amplifiers into 8 zones.
- Multiplexing amplifier monitoring signals into Single Board Apcams

This PCB has many jumper settings offering great flexibility to the system:-

- JP43, JP45 - Selecting these jumpers power to the card is taken directly from the Single Board Apcams motherboard down the ribbon cable. The jumpers select -12V and +12V respectively.
- JP46 - Rack select. When using systems with multiple Monitor and configuration PCB's this jumper is used to identify each card. There are four settings for allowing up to four cards to be used in a system.
- JP35 - JP42 - Selecting these jumpers selects which of the system amplifiers are active in which of the zones. JP35 being zone 0 through to JP42 being zone 7.
- JP9,10,12-19,21-26 - These jumpers are used to select the balanced line audio into the amplifiers. The jumpers Au+16 and Au-16 must be selected when using a single audio source from terminals JP44. This system uses zone 7 jumpers to direct the single source audio into the amplifiers.
Amplifier one using lines Au+0 and Au-0
Amplifier two using lines Au+1 and Au-1 etc.

5.2 Troubleshooting

Troubleshooting would be largely dictated by the fault indications on the controlling rack, control panel and also the (optional)PC mimic.

The P.C. mimic will show faults both graphically and also in text, in the information box at the top of the display.

The Single Board Apcams system has comprehensive fault detection and recording facilities. Additional information about active faults is only available through the PC mimic program.

The principle classification of faults is as Major and Minor. A fault is classed as Major if it compromises the operation of all or part of the system. A fault is classed as Minor if the system will continue to operate.

5.2.1 Fault List

The following is a list of faults detected as reportable on the mimic. They are classified as;

- 1: Major
- 3: Semi Major
- 2: Minor

Fault Message	Class	Cause & Notes
Rack Audio Fail	2	<p>20KHz pilot tone from named audio source not detected. Generally one of</p> <ul style="list-style-type: none"> • Power failure at source • Wiring fault to rack • Incorrect calibration <p>Due to the number of audio paths monitored it may take over three minutes to report a fault, or the clearing of the fault.</p> <p>It should also be noted that audio fault detection only operates when no broadcasts are active and speaker monitoring is not active.</p>
Alarm Tone Audio Fail	2	Internal fault on Single Board Apcams card
Internal Audio Fail	2	Internal fault on the Single board Apcams card
SINGLE BOARD A μ CAMS Program Memory Fail	1	<p>The Single Board Apcams program ROM checksum is constantly checked. This fault is raised if the checksum is incorrect. Can be caused by:-</p> <ul style="list-style-type: none"> • Incorrect programming of ROM • Exposure of ROM to light without window being covered • Physical or electrical damage to ROM or Single Board Apcams board
SINGLE BOARD A μ CAMS Data Memory Fail	1	The Single Board Apcams data RAM is constantly checked. The fault can be caused by physical or electrical damage to RAM on Single Board Apcams board
SINGLE BOARD A μ CAMS Configuration Corrupted	1	<p>The Single Board Apcams configuration is stored on a non-volatile memory IC (NVRAM) on the Single Board Apcams board. The checksum of the configuration is constantly checked. The fault can be caused by</p> <ul style="list-style-type: none"> • Illegal modification to NVRAM contents by operator or program • Electrical or physical damage to NVRAM or Single Board Apcams board • Failure of NVRAM backup power
Fan Fuse Fail	3	Power to the fans is monitored during fan operation. A failure of this power will raise the fault

Comms Link Fail (Not applicable)	1	Raised if communications cannot be established with other rack. Possible causes: <ul style="list-style-type: none">• Break in inter-rack wiring/cabling• Power failure on other rack• Incorrect installation or shielding of inter-rack wiring/cabling
Audio Link Fail (Not applicable)	1	Raised if the pilot tone from the other rack cannot be detected. Possible causes: <ul style="list-style-type: none">• Break in inter-rack wiring• Power failure on other rack

5.2.2 Single Board Apcams Troubleshooting

5.2.2.1 LED's

The Single Board Apcams motherboard 821800 rev 2 is fitted with 5 red LED's for assessing the status of the system. These are identified as LD1,LD2,LD3,LD4, and LD5. Their functions are as follows:-

LD1 - Watchdog timer running.

LD2 - Reset enabled

LD3 - Healthy

LD4 - Healthy with one previous system reset

LD5 - Healthy with two previous system resets.

When a healthy system is running LD1 and LD3 should be illuminated

5.2.2.2 Jumpers

There are 3 jumpers which must be fitted to the Single Board Apcams for it to operate correctly:-

JP8 - Watchdog timer enable/disable

JP18,JP19 - Only 1 of 3 settings should be jumpered. This selects the shape of the fundamental alarm tone frequency between sine, triangle or square.

JP17 - Selects between two types of ROM (8K)

5.2.2.3 Test Points

Single Board Apcams is fitted with 13 test points as follows:-

TP1 - Analogue ground

TP2 - Digital ground (linked to TP13)

TP3 - Chime output

TP4 - 0.775V rms Audio out to remote amplifiers

TP5 - Audio detection signal. DC level between 0 and 2.5V for input into the analogue to digital converters (ADC)

TP6 - Buffered fire and gas signal between 0 and 2.5V DC for input into the ADC

TP7 - 1Khz Internal test tone

TP8 - Alarm tones signal

TP9 - 20Khz test tone used for speaker monitor

TP10 - Audio

TP11 - 0.775V rms Audio out to local amplifiers

TP12 - 1.26V DC voltage reference for digital to analogue converters (DAC)

TP13 - Analogue ground (linked to TP2)

5.2.2.4 Potentiometers

The potentiometers are all factory set and should not require adjustment during troubleshooting.

5.2.2.5 Troubleshooting

A fault in the Single Board Apcams system would be automatically identified on the P.C. mimic and on the major fault indicator of the access panel. This could take the form of total system loss caused by power loss or the system crashing.

All power supplies and fuses should be checked carefully. Also all terminations on to the motherboard and onto other cards should be checked carefully. If the system has crashed then rebooting the system using the reset switch is recommended.

Due to the complexity of the board any repair, or maintenance required, at component level should be done by qualified experienced personnel.

E.2

SAFETY PROCEDURES

Careful attention must be given to securing the safety of personnel and equipment while maintenance or repair work is in progress. A code of safety rules based on a system of 'Permits to Work', similar to that which is detailed in British Standards Code of Practice CP 1008 (1958) Section 12, is recommended.

Where maintenance work is in progress, a 'DANGER' notice must always be attached to any 'LIVE' apparatus calling attention to the danger of approach. A 'CAUTION' notice must always be attached to plant or its associated control equipment warning of possible damage to equipment which may be caused by interference.

Before any work commenced on any item of equipment the supply and ancillary circuits must be made 'dead' and locked off.

When working on low voltage switchgear, it is recommended that caution notices and adequate screens are used and voltage indicators are used to prove that the apparatus is dead before any work is commenced. Where it is necessary to work on 'live' low voltage switchgear, steps should be taken to guard against shock and short-circuit by the use of insulating standards, screens, boots, gloves and tools may be necessary; these should be maintained in sound condition and checked immediately before use.

Only fully-insulated handlamps with non metallic guards should be used. Danger and caution notices in the vicinity of 'live' conductors should be non metallic. Any automatic fire-extinguishing equipment should be rendered temporarily inoperative.

Any plates, fitted to switching devices, giving operating instruction, should be maintained in a legible condition.

Precautions should be taken to ensure that control circuits to automatic equipment are disconnected from the supply before work is commenced on such equipment. It should not be assumed that the isolation of the main supply to the equipment isolates auxiliary circuits. For example, a voltage transformer may be 'live' back from another source. In isolation auxiliary circuits to automatic equipment, care should be taken that the tripping supplies to other units are not affected.

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Before any maintenance work is undertaken the maintenance engineer or contractor should obtain from the competent person responsible for the electrical supply an authorization to commence the work. This should be in the form of a 'Permit to Work' ensuring that equipment in question is isolated from the system and that supply ancillary circuits are isolated and locked off. Danger and caution notices must be displayed and must be firmly attached to supply and control switchgear.

E.3

PERMIT TO WORK

A suitable 'Permit to Work' document in 4 parts is described in CP 1008, parts 1 and 2 of which are given here as an example:-

PERMIT-TO-WORK ON ELECTRICAL APPARATUS

SERIAL NO.....

- Part 1.**
- A) Authorization for work. This permit is issued for the following work
-
By
To
authorised person in charge of switching and earthing operations.
- B) Switching and isolating. The apparatus is to be disconnected from all live conductors by the following operations.....
.....
.....
- C) Potential Tests and Earthing. Potential Indicator test to be applied before fixing earths at the following points
-
Number of portable earth lead applied
- D) Danger Notices are to be posted at
-
- E) Caution Notices are to be posted at
-

Time Date Signed

Rank

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Part 2.

Declaration

I hereby declare that the operations detailed in Part 1. B, C and D have been completed and the apparatus detailed in Part 1. A is safe to work on and any adjacent live equipment is securely padlocked. It will not again be made 'live' until the Clearance Certificate in Part 4 is completed.

Permits-to-work should be issued by persons specially authorised in writing by the occupier to do so.

The permits should be numbered serially for references and should be in duplicate. One copy should be retained by the issuer and one copy handed to and signed as an acknowledgement of its terms, by the person carrying out or in charge of the work; he should retain it until the work is completed or stopped.

When work is completed or stopped, the appropriate section of the permit should be signed by the person to whom it was issued and the permit returned to the issuer for cancellation. In those cases where the permit is returned prior to the completion of the work, a note to that effect should appear on the permit and work should not be recommenced until a fresh permit is issued.

The apparatus in the permit or permits ordered to be made 'dead' must not again be made 'live' until every permit covering that apparatus has been cleared by the person to whom it was issued and returned and cancelled by the issuer.

When a person authorised to issue permits-to-work intends to do work on the apparatus himself, he should complete a permit-to-work form to ensure that he is taking the same precautions as he would when authorising work by others.

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E.4

EMERGENCY MAINTENANCE

NOT APPLICABLE

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E.5

SYSTEM TESTING

INDEX

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E.5.1

INSULATION RESISTANCE TEST

This describes the procedure for testing the insulation resistance of a sub-main and the apparatus served by it.

NOTES

1. This procedure should be carried out before a sub-main, on which major alteration or work has been carried out, is permanently connected to the supply.
2. This procedure should only be carried out by a qualified electrician.
3. Reference should be made to the I.E.E. Regulations.
4. Adequate precautions should be taken to prevent accidents, should the insulation being tested be faulty.

STEP ACTION

NOTES

1. Switch off isolator covering the main to be tested and withdraw fuses. Check with mains tester that sub-main is dead.
2. Disconnect all current-carrying apparatus and/or remove all lamps served by the main to be tested.

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STEP	ACTION	NOTES
3.	Test insulation resistance with a constant voltage test set with a D.C. voltage of not less than twice the working voltage being applied (up to 500 volts) between each pair of poles or phases, and also between the neutral conductor and each pair or phase.	Check that in each case the insulation resistance is not less than 1 megohm. Where earth concentric wiring is installed see I.E.E. Regulations.
4.	Connect together all poles (except where earth concentric wiring is installed) or phases and test insulation resistance to earth using the test meter in the same manner as step 3.	Check the insulation resistance to earth is not less than 1 megohm.
5.	Test insulation resistance of all disconnected apparatus by applying the test set between the framework of the apparatus and all live parts, and also between poles or phases.	Check that in each case the insulation resistance is not less than 0.5 megohms.
6.	When the tests have been satisfactorily completed re-instate the sub-mains to its operational condition.	Check that all conductors are reconnected correctly and securely, and the correct rating of fuses replaced.

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E.5.2 EARTH CONTINUITY TEST

This procedure describes testing the earth continuity of a sub-main with a mains test set.

NOTES

1. This procedure should be carried out before a sub-main on which major alteration or work has been carried out, is permanently connected to the supply.
2. This procedure should only be carried out by a qualified electrician.
3. Reference should be made to the I.E.E. Regulations.

STEP	ACTION	NOTES
1.	Switch off isolator covering the sub main to be tested and withdrawn fuses.	Check with mans tester that sub main is dead.
2.	Connect together two of the conductors at the 'distribution' end of the sub main.	
3.	Measure the impedance of the two conductors in series testing between them at the 'supply' end with the secondary windings of a mains test set.	The impedance of one conductor will be half the measured value.

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STEP	ACTION	NOTES
4.	Disconnect two conductors connected together in step 2.	
5.	Connect either of the two circuit conductors in step 4 to the earth continuity conductor at the 'distribution' end.	
6.	Measure the impedance of the earth continuity conductor by testing between them at the 'supply' end by passing a current of up to $1\frac{1}{2}$ times the rated current of the circuit (with a maximum test current of 25 amps.) from the secondary windings of a mains operated test set.	The impedance of the earth continuity circuit can be obtained by subtracting the value of the conductor circuit utilised (obtained in step 3) from the measured value. Check the impedance of the earth continuity circuit does not exceed 1 ohm (the value should not exceed 4/3rds the protective fuse current rating of $1\frac{1}{2}$ times the overload setting of the protective circuit breaker as applicable).
7.	When the test has been completed satisfactorily re-instate the sub main to its operational condition.	Check that all conductors are reconnected correctly and securely, and the correct rating of fuses replaced.

E.5.3

EARTH LOOP IMPEDANCE TEST

This procedure describes testing of the phase to earth of a sub main protected by fuses or excess current circuit breakers.

NOTES

1. This procedure should be carried out before a sub main on which major alterations or work has been carried out, is permanently connected to the supply.
2. This procedure should only be carried out by a qualified electrician.
3. Reference should be made to the I.E.E. Regulations.
4. Adequate precautions should be taken to prevent accidents, should the earthing circuit be defective.

STEP	ACTION	NOTES
1.	Isolate sub main to be tested.	Check with mains tester that sub main is dead.
2.	Connect phase-earth loop test set between earth continuity and a phase conductor of the sub main under test.	
3.	Select rating value on test set corresponding to the rating of the circuit fuse or overload trip.	

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STEP	ACTION	NOTES
4.	Switch on sub main and conduct phase-earth loop test noting readings.	Check that the reading does not exceed the current rating of the protective device protecting the circuit by the following amounts:-
		a) Semi-enclosed fuse, or cartridge fuse having a fuse factor exceeding 1.5-3 times the current rating.
		b) Cartridge fuse having a fuse factor not exceeding 1.5-2.4 times current rating.
		c) Excess current circuit breaker - 1.5 times tripping current.
5.	Isolate sub main being tested.	
6.	Reconnect phase connection of test set on to next phase conductor.	
7.	Repeat steps 3 to 5 for each phase conductor.	
8.	Disconnect test set and on a satisfactory result, leave sub main operational.	

E.5.4

OPERATION OF RESIDUAL CURRENT DEVICES

**RESIDUAL CURRENT OPERATED CIRCUIT BREAKERS TO
BS 4293**

The test is made on the load side of the circuit breaker, between the phase conductor of the circuit protected and the associated circuit protective conductor, so that a suitable residual current flows. All loads normally supplied through the circuit breaker are disconnected during the test.

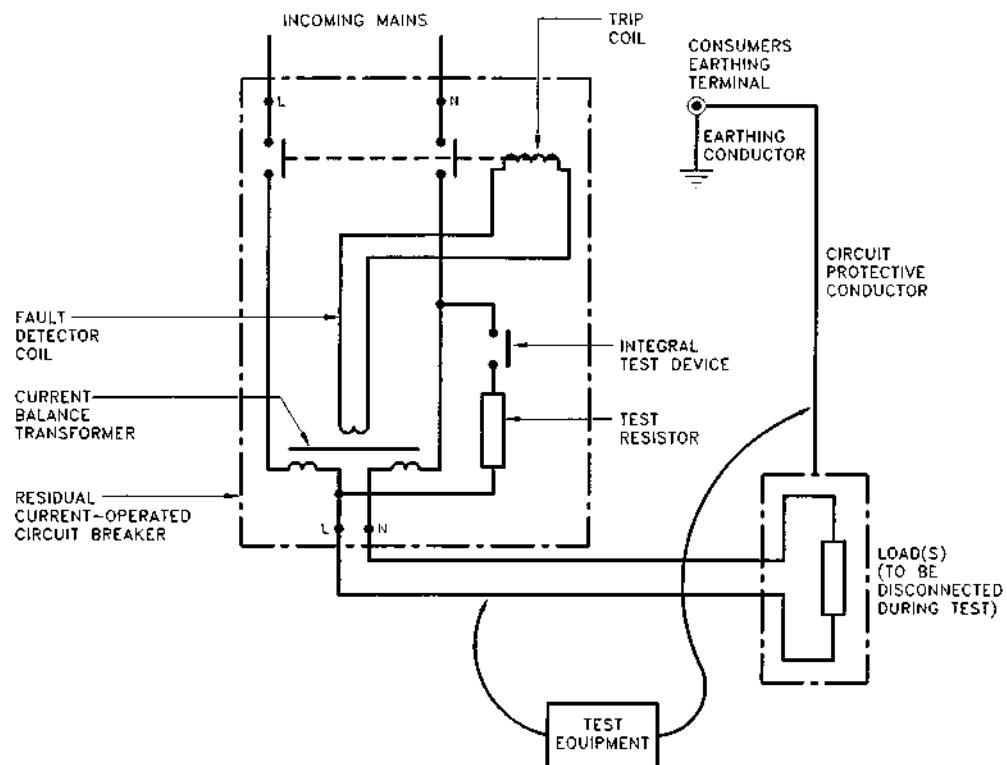
The rated tripping current shall cause the circuit breaker to open within 0.2s or at any delay time declared by the manufacturer of the device.

Note: Where the circuit breaker has a rated tripping current not exceeding 30mA and has been installed to reduce the risk associated with direct contact as indicated in Regulations 412-14 (ii), a residual current of 150mA should cause the circuit breaker to open within 40ms.

In no event should the test current be applied for a period exceeding one second.

The effectiveness of the test button or other test facility integral with the circuit breaker is also to be tested, preferably after application of the externally applied tests described above.

RESIDUAL CURRENT OPERATED CIRCUIT BREAKER TEST

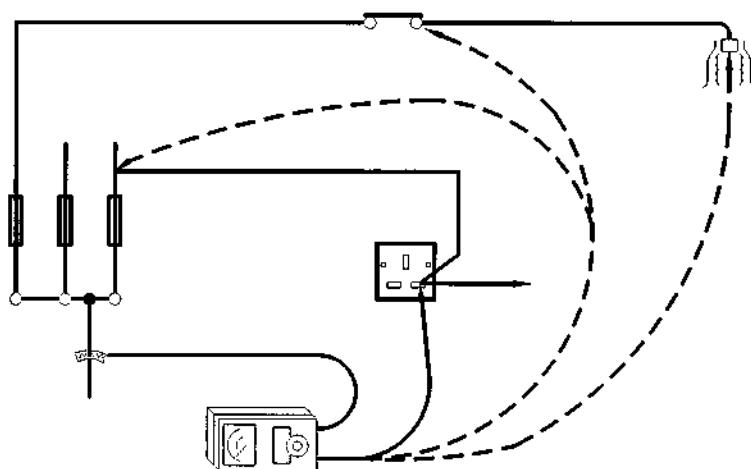


Method of test for compliance with Regulation 613-16 for a residual current operated circuit breaker to BS 4293.

E.5.5

POLARITY TEST

It is important that single-pole switches, fuses and circuit breakers are connected in the phase and not in the neutral, and that the earthed neutral, and not the phase conductor, is connected to the outer contacts of single-contact bayonet or edition screw lampholders. If portable appliances are to be safe, their polarity also must be correct, which involves testing each socket outlet for correct connection. The polarity test may be carried out with a continuity tester connected to the phase conductor at the mains position (before connection of the supply), with its other contact taken in turn to phase conductors throughout the installation as shown below:



Polarity test of an installation.

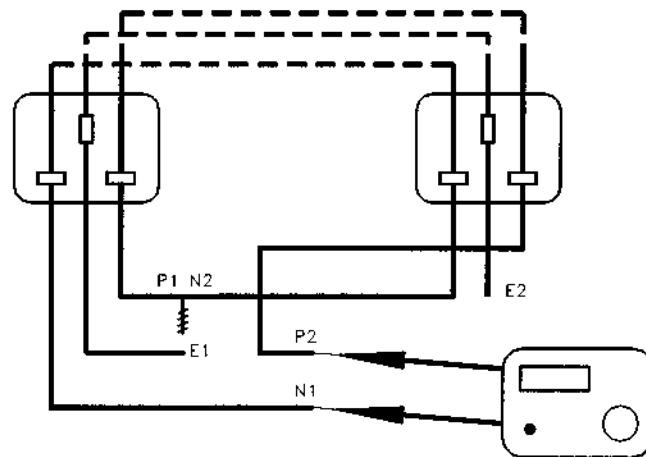
E.5.6

CONTINUITY OF RING FINAL CIRCUIT CONDUCTORS

It is important that the conductors - phase, neutral and protective - within the ring final circuit are continuous and not disrupted. Should this happen, the load will not be shared correctly and the conductors could become dangerously overloaded. It is also important to establish the ring has not been bridged - for example, if two spurs from different points were connected - as this too could cause an imbalance of current. The tests for the final ring circuit will confirm the continuity of the conductors and the absence of bridges.

TEST 1 - RING CONTINUITY

The conductors should be disconnected at the distribution board. The phase conductor and neutral from opposite sides of the ring are then connected. Using a low resistance ohmmeter, the reading is taken between the remaining phase and neutral conductors to confirm continuity. Continuity of the circuit protective conductor (CPC) can be checked by connecting the phase conductor and CPC from opposite sides of the ring and measuring the resistance between the remaining phase conductor and CPC.

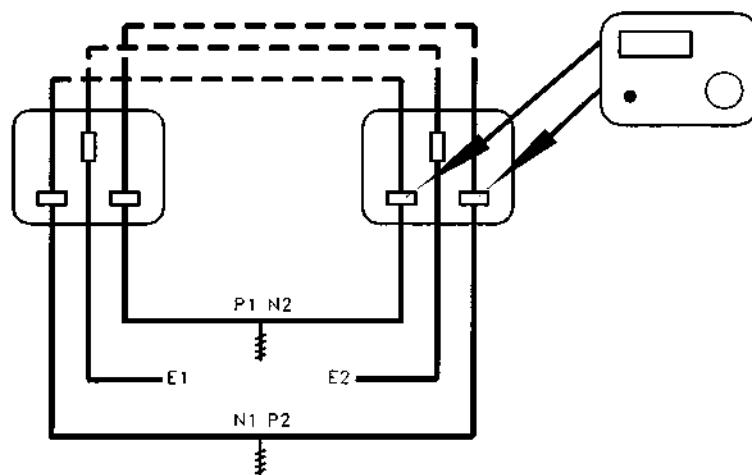


CONTINUITY OF RING FINAL CONDUCTORS

TEST 2 - ABSENCE OF BRIDGES

The phase conductors and neutrals from opposite sides of the ring are connected and a resistance measurement is recorded between phase and neutral at each of the sockets in the ring.

The value of each measurement recorded should be virtually the same, thus confirming the absence of a bridge. If different values are detected it suggests that a bridge is present or that there is an incorrect connection at the ends of the conductors.



CONFIRM ABSENCE OF BRIDGES

MINIMUM INSTRUMENT REQUIREMENT

Accuracy	+/- 2%
Test Voltage	3-24V AC or DC
Test Current	not less than 20mA
Able to measure to within	0.01

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E.6

FAILURE OF ELECTRICAL SUPPLY

London Electricity

261 City Road

London EC1V 1LE

Tel: 0171 733 5611

Fax: 0171 250 7313

E.7

MAINTENANCE SCHEDULES

**NOTE: FOR OPERATING AND MAINTENANCE
PROCEDURES, RELATED TO SPECIFIC
SYSTEMS INSTALLED, REFER TO
MANUFACTURERS LITERATURE IN
VOLUME 3.3 OF THIS O & M MANUAL**

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NOTE: 1) Asterisk given under frequency column denotes recommended maintenance period.

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E.7.1

ELECTRICAL SUPPLY AND DISTRIBUTION

E.7.1.1

MAIN AND SUB MAIN DISTRIBUTION SWITCHBOARDS & PANELS

FREQUENCY

DESCRIPTION OF MAINTENANCE

1 WEEK *..... **GENERAL INSPECTION**

- 1) Check location for general cleanliness and switchboard for any sign of overheating.
- 2) Check for any electrical discharge noises indicating loose components.
- 3) Check to ensure that special tools and isolating equipment are serviceable and in their proper storage position.

1 YEAR *..... **OVERHAUL**

- 1) Isolate board from supply, remove all loose covers and clean out the interior of the panel. Check that all electrical connections are clean and tight.
- 2) Carry out normal electrical insulation and continuity tests between phase neutral and earth conductor.
- 3) Thoroughly clean out the interior removing all loose dirt, etc. Wipe clean all mouldings and contacts. Examine contacts for signs of burning, overheating or other damage and recondition or renew as necessary.
- 4) Clean out and inspect insulation and renew where necessary. Insulation resistance tests are recommended after any work is carried out.

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FREQUENCY	DESCRIPTION OF MAINTENANCE
	5) Check that roller contact springs are in good condition and have not lost their tension through overheating. If contacts show slight signs of arcing, they may be cleaned carefully with a very fine file.
	6) When re-assembling, check that all connections are tight.
	7) Lubricate all moving parts and check operating before returning switches to services.

Note:

- 1) Do not use cotton waste for cleaning.
- 2) Any brushed and blower nozzles used should not contain metallic material.
Cloths used should be free from loose fibres, metallic threads or similar.

E.7.1.2 MAIN AND SUB-MAIN CABLES

FREQUENCY	DESCRIPTION OF MAINTENANCE
------------------	-----------------------------------

1 YEAR *..... INSPECTION

Test insulation, earth loop impedance and earth continuity in accordance with I.E.E. Regulations.

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E.7.1.3

DISTRIBUTION EQUIPMENT

FREQUENCY DESCRIPTION OF MAINTENANCE

a) Fuseboards

1 WEEK *..... INSPECTION

- 1) Make a general inspection for cleanliness.
- 2) Remove all combustible materials from proximity.
- 3) Examine interior for any signs of overheating.
- 4) Check for temporary wire bridges and replace with correctly rated H.R.C. fuse.
Check fuse carriers and replace if any sign of burning are apparent.

1 YEAR *..... OVERHAUL

- 1) Isolate board from supply, clean out with a brush or dry cloth. Check all electrical connections are clean and tight.
- 2) Carry out normal insulation and continuity test between all phases. Neutral and earth conductor.

b) Contactors

1 WEEK *..... INSPECTION

Check for any electrical discharge noise indicating loose components.

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FREQUENCY	DESCRIPTION OF MAINTENANCE
1 YEAR *.....	<u>OVERHAUL</u>
	Inspect and clean contactors in accordance with the manufacturers recommendations.
c) <u>Switches and Fuseswitches</u>	
	<u>INSPECTION AND OVERHAUL</u>
	See manufacturers recommendations
E.7.2 <u>SMALL POWER AND LIGHTING</u>	
E.7.2.1 <u>SUB CIRCUIT WIRING</u>	
FREQUENCY	DESCRIPTION OF MAINTENANCE
1 YEAR *.....	<u>INSPECTION</u>
	Test in accordance with I.E.E. Regulations for insulation resistance, earth continuity and ring circuit continuity.
E.7.2.2 <u>GENERAL LIGHTING & LUMINAIRES</u>	
FREQUENCY	DESCRIPTION OF MAINTENANCE
1 WEEK *.....	<u>INSPECTION/OVERHAUL</u>
	1) Make a general examination of light fittings or cleanliness.

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FREQUENCY	DESCRIPTION OF MAINTENANCE
6 MONTHS *.....1)	<p>2) Check fluorescent tubes, tungsten lamps and lamp holders for signs of deterioration and discolouration and renew as necessary.</p>
6 MONTHS *.....1)	<p>2) Inspect all light fittings and clean as necessary checking to ensure that all fixings are secure and that there is no evidence of arcing or burning due to loose contacts or cable connections.</p> <p>2) Opal and Prismatic diffusers should be removed from the fitting and washed externally in warm soapy water.</p> <p>3) Fluorescent tubes in open fittings should be removed and wiped clean with a damp cloth.</p>

REPLACEMENT

It is recommended that fluorescent tubes should be replaced on a planned maintenance system over a 2 year period.

1 WEEK *.....NOTE:

If there is a large number of tubes in a building it is suggested that an agreement is negotiated with a lamp manufacturers to supply an additional quantity of tubes, in order to replace tubes which fail under the nominated life. These tubes to be replaced on a weekly basis.

CLEANING

DIFFUSERS AND PLASTIC CONTROLLERS

Cleaning should be undertaken when necessary or at the time of general maintenance and follow the procedure below.

- a) Clean using a solution of water and domestic detergent.
- b) Rinse after cleaning.
- c) Allow to dry.
- d) For prolonged protection against dust apply anti-static solution.

REFLECTORS

Reflectors require little or no maintenance when installed under normal environmental conditions. Correct handling of reflectors during installation is paramount to their effectiveness as an efficient light controller and to this end reflectors should *always* be handled using cotton gloves, thus avoiding greasy finger marks on the reflector surface.

Where finger marks are present, they can be removed by using methylated spirits and a soft clean cotton cloth.

Reflectors can become contaminated with dust and dirt particles as a result of a site cleaning-up operation. If at all possible, it is advisable to avoid this occurrence by ensuring that the reflectors are installed after the clean-up operation and before the building is handed over to the Client.

We appreciate that this may not always be possible and under such circumstances we recommend that the following cleaning operation is performed in order that the reflector be restored to a satisfactory condition.

- 1) Prepare bath/dip tank and fill with hot water containing a good quality domestic detergent. The dimensions of the tank should be at least twice the size of the reflector in width and height, and 300mm longer.

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- 2) Using gloves, immerse reflector in solution and thoroughly, but carefully agitate, ensuring all parts of the reflector are treated.
- 3) Remove reflector from solution and hose down using cold clean water. It is absolutely essential that all soap residue is removed. The use of a rinse tank would not be effective since this would quickly become contaminated by the detergent.
- 4) Spray reflector thoroughly using a solution of 600 parts of cold clean water to 1 part of "Kodak Photo-Flo 600" solution. This reduces the surface tension of the water and eliminates drop marks. The mix ratio of water to Photo-flo 600 is important and care should be taken to ensure correct measurements. It is best to apply this using a napsack and sprayer as used for weed killer application and preferably with an adjustable nozzle from a mist spray to a jet. Any similar arrangement would be quite satisfactory.
- 5) Allow to dry in clear air in a horizontal position with the back of the reflector nearest to the floor.
- 6) When dry, replace reflector in luminaire using cotton gloves.

This cleaning operation is engineered with labour costs in mind around large installations where it is envisaged that the reflectors would be removed in batches of 50 or so, to a basement room or otherwise where effective treatment can be carried out. For smaller installations, space may inhibit such a cleaning operation, in which case the individual would devise his own cleaning system which would probably consist of localised cleaning with the reflector in position. labour costs not being too influential on this type of installation.

WARNING NOTE

The operatives given the task of this cleaning operation should be well instructed and supervised to ensure continuing awareness of the relative fragility of the louvre optic. This awareness should extend from the actual cleaning when they are most susceptible to damage, to handling and stacking.

PAINT FINISHED SURFACES

These should be cleaned using a cotton cloth to apply a solution of domestic detergent and water, then all surfaces must be wiped clean. Care must be taken not to scratch paint finish.

SATIN ANODISED ALUMINIUM SURFACES

Care must be taken as this is only a surface finish and may be scratched if abrasive materials contact it.

To clean use a soft cotton cloth and a solution of domestic detergent and water. This will remove most stains.

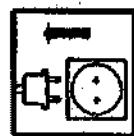
REPLACEMENT OF COMPONENTS

- i) *Lamps* - these must be of the type originally specified.
- ii) *Starter Switches* (Where applicable)
These must be of the type recommended by the luminaire manufacturer in the case of ballasts with integral starter. A complete ballast unit will be required.
- iii) *Control Gear Components*
Only use components of equivalent values to those supplied by luminaire manufacturer.
- iv) *Internal Wiring*
Fluorescent - 0.5mm² single core copper conductor. Only wire which meets with the manufacturers approval should be used. In the case of special requirements, refer to the manufacturing works drawing for details.
- v) *Terminal Block/Lampholder*
Only those of equivalent specification to the type originally fitted must be used.
- vi) *Emergency Packs*
Ensure that units of equivalent specification to those supplied by the luminaire manufacturer are to be used. See spares list for details.

Recommendation for safe handling of low voltage tungsten halogen lamps



When replacing the lamp, ensure that lamp voltage and wattage conform to the transformer and the fixture. The use of lamps of excessive wattage can result in overheating of the transformer or the luminaire. Using lamps of too low a wattage for the transformer can lead to shortening the lamp life due to overheating.



Disconnect power supply before replacing a lamp.



Do not touch the lamp with bare fingers. If touched accidentally, wipe clean with a soft cloth moistened with methylated spirits.



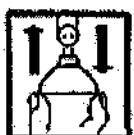
In operation the bulb can reach temperatures in excess of 350°C. Therefore do not touch the lamp before it has cooled down



Lamp should be protected from high humidity or direct contact with water.



The grip cap in aluminium reflector lamps makes it easier to insert or remove the lamp.



When replacing dichroic reflector lamps do not grip the bulb hold by the reflector edge.

NOTE:

Always ensure that the lamp holder is correct for the given lamp. Avoid bending the contact pins this can damage the lamp and result in early failure.

E.7.2.3

EMERGENCY AND ESCAPE LIGHTING

FREQUENCY	DESCRIPTION OF MAINTENANCE
1 WEEK *	Carry out test procedures as detailed by manufacturer.
a) <u>Standard Fittings with Inverter Units</u>	
1 YEAR *	Check inverter unit internally, generally as described previously for distribution boards and other equipment
b) <u>Self Contained Units</u>	
1 WEEK *	<u>LIGHTING FITTING INSPECTION</u>
	Check for satisfactory operation.

EMERGENCY LIGHTING SERVICING

1. Supervision

Regular servicing is essential. The occupier/owner of the premises shall appoint a competent person to supervise the system. This person should be given sufficient authority to ensure any work necessary to maintain the system in correct operation is carried out.

2. Batteries

In all cases the manufacturer's instructions should be followed. It is particularly important that where applicable:-

- a) The tops of batteries and their terminals are kept clean and unobstructed and that battery cases are periodically checked for leaks.

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- b) Any replacement battery should be compatible with the battery charger.
- c) Any replacement battery should be compatible with the existing battery.
- d) Any replacement battery charger should be compatible with the battery.

3. Routine Inspection and Tests

General:

Because of the possibility of a failure of the normal lighting supply occurring shortly after a period of testing of the emergency lighting system or during the subsequent recharge period, all tests should, wherever possible, be undertaken at time of minimum risk. Alternatively, suitable arrangements should be made until the batteries have been recharged.

Inspection and tests should be carried out at the following intervals as recommended in BS.5266: Part 1: 1988.

- a) Daily
- b) Monthly
- c) Six Monthly
- d) Annually

Daily:

An inspection shall be made every day to ascertain that:-

- a) Any fault recorded in the log book has been given urgent attention and the action noted.
- b) Every lamp in a maintained system is lit.
- c) The main control or indicating panel of each central battery system or engine driven generator plant indicates normal operation.
- d) Any fault found is recorded in the log book and the action taken noted.

Monthly:

An inspection shall be made at monthly intervals in accordance with the Schedule in Appendix A. Tests should be carried out as follows:

Each 3 hour conversion unit, self-contained luminaire, and internally illuminated exit sign shall be energized from its battery for simulation of a failure of the supply to the normal lighting for a period sufficient only to ensure that each lamp is illuminated.

The period of simulated failure should not exceed one quarter of the rated duration of the luminaire or sign. During this period all luminaires and/or signs shall be examined visually to ensure that they are functioning correctly.

At the end of this test period the supply to the normal lighting should be restored and any indicator lamp or device checked to ensure that it is showing the normal supply has been restored.

At the completion of each monthly test a Certificate shall be completed and attached to the aforementioned schedule.

Six Monthly:

The monthly inspection shall be carried out and the following tests made:-

Each 3 hour conversion unit, self-contained luminaire, and internally illuminated sign shall be energized from its battery for a continuous period of 1 hour, by simulation of a failure of the supply to the normal lighting.

During this period all luminaires and/or signs shall be examined visually to ensure that they are functioning correctly.

At the end of this period, the supply to the normal lighting should be restored and any indicator lamp or device checked to ensure that it is showing that the normal supply has been restored.

Annually:

The monthly inspection shall be carried out and the following additional tests made:-

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- a) Each emergency lighting installation should be tested and inspected to ascertain compliance with this code.

- b) Each 3 hour conversion unit, self-contained luminaire, and/or internally illuminated sign should be tested for its full duration.

At the end of the test period the supply to the normal lighting should be restored and any indicator lamp or device checked to ensure that it is showing that normal supply has been restored.

Records

A detailed Log Book shall be kept detailing all fault reports, scheduled and unscheduled maintenance, replacement parts and any specific works carried out directly or indirectly on the emergency lighting system.

Copies of all monthly Maintenance Schedules and the monthly Inspection and Test certificates shall be kept in the Log Book as a record.

Appendix A

Emergency Lighting

Monthly Maintenance Schedule

Results of Inspection and Tests

1. Are correct entries made in the log book? YES/NO
2. Are record drawings available? YES/NO
3. Are record drawings correct? YES/NO
4. Signs
 - a) Are the signs correctly positioned? (5.1 and 6.1) YES/NO
 - b) Are details of the signs correct? (5.2) YES/NO
 - c) Do the self luminous signs (if any) need changing before the date of the next scheduled inspection. If so state date (see label on sign) (7.3) YES/NO
5. Luminaires
Are luminaires correctly positioned? (5.2, 6.2 and 6.3) YES/NO
6. Illumination for safe movement (Clause 5 and see record drawings) YES/NO
 - a) Are the correct lamps installed in the luminaires (Clause 8) YES/NO
 - b) Has there been any change in the decor or layout of the premises since the last inspection, which has caused any significant reduction, which has caused any significant reduction in the effectiveness of the lighting system?
(Any changes to be stated under Comment below) YES/NO
 - c) Is the installation in a generally satisfactory condition? YES/NO

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7. Marking

- a) Is the category and nominal operating voltage of the system clearly marked or readily identifiable? (Clause 8) YES/NO
- b) Are luminaires clearly marked to indicate the correct lamp for use? (Clause 8) YES/NO
- c) Is information available to ensure correct battery replacement (Clause 8) YES/NO

8. Wiring systems (Clause 9)

State the date of the last test of the wiring system YES/NO

9. Power services

- a) Are the charging arrangements for secondary batteries satisfactory? (Clause 7 and 12.4) YES/NO
- b) Do changeover devices operate satisfactorily upon simulation of failure of the normal supply (Clause 7 and 12.4) YES/NO

10. Self-contained luminaires and signs

After operation for the rated duration:

- a) Does each self-contained luminaire and sign operate? (Clause 7 and 12.4) YES/NO
- b) Following restoration of the system to normal supply is the battery charger functioning? (Clause 7 and 12.4) YES/NO

11. Further Requirements

In addition to the specific requirements listed above, the following should be carried out:-

- a) Check that defects recorded in the log book have been corrected. YES/NO
- b) Clean the exterior of luminaires and signs. YES/NO

- c) Check correct operation of luminaires and internally illuminated signs by operating the test facility. (12.4.3) YES/NO
- d) Check that all indicator lamps are functioning. YES/NO
- e) Record date in the log book. (11.3) YES/NO

Note: In addition to the above, the instruction issued by the manufacturers should be observed.

12. COMMENT (if any) and variations from the Code of Practice.

Note: 1) Because of the possibility of a failure of the supply to the normal lighting occurring shortly after a period of testing, all tests should be undertaken at times of no risk. Alternatively, suitable temporary arrangements should be made until the batteries have been recharged.

Note: 2) The figures in brackets indicated the relevant clauses in BS.5266:Part 1.

Appendix B

Emergency Lighting

Inspection and Test Certificate

Occupier/owner

Address of premise

..... Tel. No.

Date of inspection and test.....

Inspection and test carried out by

Name and address.....

..... Tel. No.

I/We hereby certify that the emergency lighting installation at the above premises has been inspected and tested in accordance with the schedule below by me/us and to the best of my/our knowledge and belief complies at the time of my/our test with the recommendations of BS.5266 "Emergency Lighting" Part 1: 1975 "Code of Practice for the emergency lighting of premises other than cinemas and certain other specified premises used for entertainment", published by the British Standard Institution, for a category* installation, except as stated below.

Signature of person responsible for inspection and test

Qualification ** Date

For and on behalf of

Details of variations from the Code of Practice (BS.5266:Part 1)

* Enter M/1,2 or 3 or NM/1 as appropriate (see BS.5266:Part 1, Clause 7.4.3)

** Qualifications: A suitably qualified electrical engineers or a member of the Electrical Contractors Association or the Electrical Contractors' Association of Scotland; or a certificate holder of the National Inspection Council for Electrical Installation Contracting; or a qualified person acting on behalf of one of these (in which case it should be stated on whose behalf he is acting). Where acceptable to the enforcing authority the authorised representative of a manufacturer of emergency lighting equipment may be deemed to be a suitably qualified person.

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EMERGENCY LIGHTING TEST RECORD CARD/LOG SHEET

LUMINAIRE LOCATION	LUMINAIRE DESCRIPTION	INSTALLATION ENGINEERS
Ref. No. Duration hours Maintained/Non Maintained	Installation Engineers Test Report Red charge indicator shows () Full charge/Discharge test ()	Tel: Date of installation:

TEST RECORD

Month	Test	First Year		Second Year		Third Year		Fourth Year		Fifth Year	
		Signed	Date	Signed	Date	Signed	Date	Signed	Date	Signed	Date
1	Functional										
2	"										
3	"										
4	"										
5	"										
6	1 hr. durat.										
7	"										
8	"										
9	"										
10	"										
11	"										
12	1 hr durat. Full durat.	//////////	//////////	//////////	//////////	//////////	//////////	//////////	//////////	//////////	//////////

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E.7.2.4

SOCKET OUTLETS, PLUG TOPS

FREQUENCY	DESCRIPTION OF MAINTENANCE
3 MONTHS *.....	<u>INSPECTION</u> Check for mechanical damage.
2 YEARS *.....	Carry out normal tests in accordance with regulations.
1 YEAR *.....	Isolate. Check & tighten all internal connections, check for arching etc. Check cord grip. Ensure correct fuse rating in plug top.

E.7.3

PROTECTION SYSTEMS

E.7.3.1

FIRE ALARM SYSTEMS

FREQUENCY	DESCRIPTION OF MAINTENANCE
1 WEEK *.....	<u>INSPECTION</u> For comprehensive requirements and details refer to Fire Alarms operation and maintenance procedures in Volume 3.3.

RECOMMENDATIONS FOR THE ROUTINE TESTING AND SERVICING OF A FIRE ALARM SYSTEM

1. General

To ensure that your fire alarm system operates correctly at all times it is essential that an agreement be reached with the manufacturer, supplier or competent contractor for regular servicing. Apart from routine servicing, a system should be established to rectify any faults which occur within 24 hours of their discovery. A suitably trained employee may undertake simple routine testing of the system but such a person should not attempt to exceed the scope of the training.

2. Daily Attention

The following checks should be carried out every day.

- a) That the panel indicates normal operation, if not that any fault indicated is recorded in the log book.
- b) That any fault warning recorded in the log book the previous day has received attention.

If the connection to the public fire brigade or other remote manned centre is a direct line not continuously monitored, it should be tested daily in accordance with the manufacturer's instruction. The time of day of the test should be agreed with the fire brigade or centre concerned.

3. Weekly Attention

The following tests should be performed each week to ensure that the system is capable of operating under alarm conditions.

- a) Operation of a trigger device or end-of-line switch on a zone circuit:

A chart of all zones should be drawn up to permit all zones to be tested in strict rotation such that each zone is tested at least quarterly for systems using monitored wiring, and at least one a week for systems using unmonitored wiring. It is preferable that each time a particular zone is tested a different trigger device is used. An entry should be made in the log book quoting the particular trigger device that has been used to initiate the test.

If the operation of the alarm sounders and/or the transmission of the alarm signal has been prevented by disconnection then a further test should be carried out to prove the final reinstatement of the sounders, and if permissible, the alarm transmission circuits.

- b) A visual examination of the battery and connections should be made to ensure that they are in good condition. Action should be taken to remedy any defect, including low electrolyte level.

Any defect should be recorded in the log book and reported to the person responsible, and action taken to correct it.

4. Quarterly Inspection and Test

It is the responsibility of the user to ensure that the following check and test sequence is carried out by the manufacturer, supplier or contractor, or by an employee who has received special training with the manufacturer, supplier or installer.

- a) Entries in the log book since the previous inspection should be checked and any necessary action taken.
- b) Batteries and their connections should be examined and tested to ensure that they are in good serviceable condition.
- c) Where applicable, secondary batteries should be examined to ensure that the specific gravity of electrolyte in each cell is correct. Necessary remedial action should be taken and an appropriate entry made in the log book.

Care should be taken to ensure that hydrometers, vessels, etc., used in the servicing of alkaline secondary cells are not contaminated by acid and vice versa. Contamination of electrolyte can ruin a cell.

- d) Primary batteries, including reserves, should be tested to verify that they are satisfactory for a further period of use by taking measurements that are indicative of the conditions of each cell, e.g. its voltage on a known and very high rate of discharge. The test conditions and the significance of the readings will depend on the type of cell and the use to which it is being put. These should be clearly specified by the supplier or commissioning company and applied with care. Primary batteries should in any case be replaced within the period of shelf-life stipulated by the battery manufacturer.
- e) The alarm function of the control and indicating equipment should be checked by the operation of a trigger device in each zone. The operation of the alarm sounders and any link to a remote manned centre should be tested. All ancillary functions of the control panel should also be tested where applicable. All fault indicators and their circuits should be checked preferably by simulation of fault conditions. The control and indicating equipment should be visually inspected for signs of moisture ingress and other deterioration.
- f) A visual inspection should be made that structural or occupancy changes have not affected the requirements for the siting of trigger devices (manual call points, smoke detectors and heat detectors). The visual inspection should also confirm that a clear space of at least 750mm radius is preserved in all directions below every detector and that the detectors are sited in accordance with clauses 12 or 13 of BS5839 : Part 1 and that all manual call points remain unobstructed and conspicuous.

Any defect should be recorded in the log book and reported to the responsible person, action should be taken to correct it.

On completion of the work a Certificate of Testing a Fire Alarm System should be issued.

5. Annual Inspection and Test

It is the responsibility of the user to ensure that the following check and test sequence is carried out by the manufacturer, supplier or contractor, or by an employee who has received special training with the manufacturer, supplier or installer.

- a) The inspection and test routines detailed in the quarterly inspection and test routine, a), b), c), d), e) and f).

- b) Each detector should be checked for correct operation in accordance with the manufacturer's recommendations, except that detectors designed to operate once only should not be subjected to routine operational test. The final test for each detector should be an 'in situ' test.
- c) Visual inspection should be made to confirm that all cable fittings and equipment are secure, undamaged and adequately protected.

On completion of the work a Certificate of Testing a Fire Alarm System should be issued.

6. Three Yearly Inspection and Test

At least once every three years at the annual inspection, the installation should be tested in accordance with the testing and inspection requirements of the 'Regulations for the Electrical Equipment of Buildings', published by the Institution of Electrical Engineers, and any defects rectified. Care should be taken that the voltages used in this testing do not cause damage to components connected to the wiring.

Any defect should be recorded in the log book and reported to the responsible person, and action should be taken to correct it.

On completion of the work a Certificate of Testing a Fire Alarm System should be issued.

7. Attention After Any Fire Whether Automatically Detected or Not

It is the responsibility of the user to ensure that the following tests are carried out as soon as possible after a fire and before normal use of the areas is resumed.

- a) A simulated test should be carried out on each trigger device that may have been affected by the fire.

- b) A visual check on the battery and charger should be carried out to ensure that all connections are sound and the level of electrolyte in the cells is adequate. If an ammeter is fitted to indicate charge rate, this should be checked. Failing either of these, every endeavour should be made to ensure that the battery is being charged and arrangements should be made for a suitably qualified person to check that the charging is satisfactory.

Any defect should be recorded in the log book and reported to the responsible person, and action should be taken to correct it.

The organization responsible for the servicing should be informed of the fire as soon as possible and should be instructed to check the extent of damage to cables, and to check the operation of the system. The extent of a fire may involve a more comprehensive check and attention to the system.

On completion of the work a Certificate of Testing a Fire Alarm System should be issued.

MAINTAINING THE LOG BOOK

The numbered pages in this section should be used to record details of any of the following occurrences:

1. Genuine or false alarms
2. System faults
3. Routine tests or attention (see Sub-sections 4 - 7)
4. Temporary disconnections
5. Component or equipment replacements
6. Notes of outstanding work

Each entry should consist of the date, time, a description of the type of event (e.g. daily test, false alarm etc.), the zone or zones affected, the action taken or required, a completion date for any work necessary and the initials of the responsible person.

When not in use the log book should be stored in a safe, preferably fireproof place.

FIRE ALARM SYSTEM – RECORD OF EVENTS

Building Services Operating and Maintenance Instructions
5-7 Carlton Gardens, London SW1

E.7.3.2 RCD's (Residual Current Devices)

FREQUENCY	DESCRIPTION OF MAINTENANCE
------------------	-----------------------------------

1 MONTH *	<u>INSPECTION</u>
-----------	-------------------

Check operation by depressing test button. Reset to normal condition after test.
--

Building Services Operating and Maintenance Instructions
5-7 Carlton Gardens, London SW1

E.8 SPARE PARTS LIST

E.8.1 L.V. SWITCHGEAR & DIST. BOARDS - Anord Control Systems Ltd.

Refer to Section H.1 of this O & M Manual for details.

Also refer to Anord Control Systems letter dated 5/10/98.

T CLARKE PLC

05 OCT 1998



Anord Electric Controls Limited

Industrial Estate, Coes Road,
Dundalk, Co. Louth, Ireland.
Tel : +353 (0)42 32268
Fax : +353 (0)42 38907

FACSIMILE

MESSAGE NO. 051098

Attn of: Mr. Robin Aves

From: Michael O'Connor

Company: T.Clarke

Date: 05/10/98

Fax No: 0044 171 8938502

No. of Pages: 1 + 5

Project Ref: Carlton Gardens

Our Ref: JN 558

Subject: Operating Procedures

Robin,

Please find attached the operating procedure for the Mains & Generator Control for the above project(5 pages including Single Line Diagram.)

Spares list will be issued under separate cover. #)

GEC relays are due into our works 3rd Nov.98 therefore we would suggest tests are scheduled for 5th and 6th Nov.98.

Can you confirm your variation order for the Plinth and Neutral /Earthing switch as per our fax dated 28/09/98.

Best Regards

Michael

M.O'Connor

Project Manager

CC: Jerome McEvoy



{filename}

TO: [REDACTED]
12 OCT 1998



Anord Electric Controls Limited

Industrial Estate, Coes Road,
Dundalk, Co. Louth, Ireland.
Tel : +353 (0)42 32268
Fax : +353 (0)42 38907

FACSIMILE

MESSAGE NO. 121098

Attn of: Mr. Robin Aves

From: Michael O'Connor

Company: T.Clarke

Date: 12/10/98

Fax No: 0044 171 8938502

No. of Pages: 1+2

Project Ref: Carlton Gardens

Our Ref: JN 558

Subject: Parts List

Robin,

Please find attached a print out of the Parts list associated with the LV Switchgear for the above Project. All parts are identified by Type, Manufacturer & Code, your Client can determine from this list what spares he would like to hold from the list attached.

Best Regards

Michael
M.O'Connor
Project Manager

CC: Jerome McEvoy

{filename}



Acord: Job No. 558
Project: CARLTON GARDENS
Client: T CLARKE

CARLTON GARDENS
SPARES LIST

COMPONENT	TYPE	MANUFACTURER	QTY	UNIT PRICE
ACB	E2N 2000 4P WD PR112 LSIG	ABB	N/A	N/A
ACB	E2N 2000 4P WD NON AUTO	ABB	N/A	N/A
ACB	SSH 400A 4P PR212 LSIG	ABB		£548.38
ACB AUX	ISDAO 38327 R1	ABB		£8.08
ACB AUX	ISDAO 43467R1	ABB		£57.65
ACB CHASSIS	E2 4P	ABB		£678.46
AUX CON	ISDAO 43475 15 WAY	ABB		£13.60
AUX CONT	ISDAO 13575 S3	ABB		£13.60
CLOS COIL	ISDAO 38287R1	ABB		£48.49
CONTACTOR	UB30-30-10R	ABB		£62.45
CONTACTOR	CA5-700	ABB		£47.46
COUNTER	ISDAO 38346 OP	ABB		£52.71
E MAX MOTOR	ISDAO 38324 R1	ABB		£275.91
GUARD	ISDAO 38343 R1 PB	ABB		£11.20
MCCB	ISDAO 13846R1 230V UVR	ABB		£33.25
MCCB	SSH 400A N/CT	ABB		£31.15
MCCB	S3/4/5 AD R/H ISDAO13869 R1	ABB		£8.08
MCCB	SSH 600A 3P FXD PR211 PLI	ABB		£558.14
MOTOR MECH	ISDAO 13876	ABB		£177.46
POS/LOCK	ISDAO 38357 R1	ABB		£23.18
SHUT/LOCK	ISDAO 38363 R1	ABB		£19.98
TRIP CONTACT	ISDAO 38338R1	ABB		£17.29
TRIP CONTACT	ISDAO 38337R1	ABB		£17.29
LOCK STOP	V50 N/O	BRETER		£4.92
CONTACT BLOCK	V40 N/C	BRETER		£1.00
GREEN LENS	RM600	BRETER		£0.26
RED LENS	RM600	BRETER		£0.26
AMBER LENS	RM600	BRETER		£0.28
BLACK PLATE	RT010	BRETER		£0.12
SPRING RETURN	RM480N 3POS	BRETER		£4.15
MOMENTARY P/BUTTON	RT010	BRETER		£1.72
TRAFO	570 220/6V	BRETER		£5.31
BACK STUD	32 BS	BUSSMANN		£1.00
BACK STUD	63/100 BS	BUSSMANN		£1.72
BLACK FUSE BASE	CM20FW	BUSSMANN		£3.31
BS88 FUSE	NIT 10A NITD10	BUSSMANN		£0.51
BS88 FUSE	NIT 2A NITD2	BUSSMANN		£0.51
BS88 FUSE	NIT 4A NITD4	BUSSMANN		£0.49
BS88 FUSE	NIT 6A NITD6	BUSSMANN		£0.51
BS88 FUSE	TCP 100A CEO100	BUSSMANN		£2.31
BS88 FUSE	TCP 63A CEO63	BUSSMANN		£2.06
BS88 FUSE	TCP 80A CEO80	BUSSMANN		£2.31
BS88 FUSE	TF 160A DD160	BUSSMANN		£3.94
BS88 FUSE	TF 200A DD200	BUSSMANN		£0.43
BS88 FUSE	TIA 25A AAO25	BUSSMANN		£0.85
BS88 FUSE	TIA 32A AAO32	BUSSMANN		£0.86
BS88 FUSE	TIS 63A BA063	BUSSMANN		£1.38
BS88 FUSE	TKF 250A ED250	BUSSMANN		£5.48
BS88 FUSE	TMP 400A ED400	BUSSMANN		£6.92

Anord: Job No. 558
 Project: CARLTON GARDENS
 Client: T CLARKE

CARLTON GARDENS
 SPARES LIST

BUSBAR SUPPORT	01-495	BUSSMANN	£3.57
WHITE FUSE BASE	CM20FW	BUSSMANN	£3.91
WHITE FUSE BASE	CM32FW	BUSSMANN	£4.77
WHITE FUSE BASE	CM63F	BUSSMANN	£7.35
FUSE	6A 10X38 420006	DF	£0.15
FUSE	NHOO 100A 300100	DF	£1.29
FUSE	NHOO 63A 300063	DF	£1.29
FUSE BASE	10X38 450032	DF	£0.98
NEUTRAL	10X38 450032N	DF	£1.20
TIMER	EA 9043/002 3P4W C/W	DOLD	£86.26
PF RELAY	CR2000 8STAGE PFC	ELECTRONICON	£290.51
MFB TIMER	2.550.029.81	ENTRELEC	£21.48
BLANKS	P/029000-072	GE	£0.26
DIST BD + KEY	8 WAY TP	GE	£79.91
ELCB	25A DP V/304-022030	GE	£18.58
ELCB	40A DP V/304-024030	GE	£18.58
EXT PLAIN/KEY	1 ROW 18MOD	GE	£51.34
ISOLATOR	200A 3P+N DILOS	GE	£51.34
MCB	1C10-6-6K V/0099-004110	GE	£3.03
MCB	1C16-6 6K V/0099-004116	GE	£3.03
MCB	1C20-6-6K V/0099-004120	GE	£3.03
MCB	1C2-6-6K V/099-004120	GE	£3.03
MCB	1C32-6-6K V/0099-004132	GE	£3.03
MCB	1C40-6-6K V/0099-004140	GE	£3.03
MCB	3C16-6-6K V/099-004316	GE	£9.82
MCB	3C20-10-10K V/0099-007320	GE	£16.77
MCB	3C20-6-6K V/0099-004320	GE	£9.82
MCB	3C32-10 30K V/0099-007332	GE	£21.92
MCB	3C40-6-6K V/0099-004340	GE	£9.82
RELAY	SIZE 2 MVAA 13 CASE	GEC	£15.38
RELAY	SIZE 4 MCGG 22 CASE	GEC	£15.38
PROT COVER	1319.429	HOLEC	£16.54
PROT COVER	1319-423	HOLEC	£16.14
SWITCH FUSE	OSA100N1-A1/3N 1230.736	HOLEC	£158.86
SWITCH FUSE	OSA100N1-A1/3N 1320.737	HOLEC	£110.57
SWITCH FUSE	OSA200N1-B2/3NCTPR1320.808	HOLEC	£146.66
SWITCH FUSE	OSA200N1-B2/3NCTPR1320.809	HOLEC	£141.71
SWITCH FUSE	OSA400N-B4/3N CTPR1320.876	HOLEC	£158.86
SWITCH FUSE	OSA400N-B4/3N CTPR1320.881	HOLEC	£212.98
SWITCH FUSE	OSA400N-B4/3N CTRL1320.880	HOLEC	£212.98
CT	2000/3 TAS 84	IME	£18.72
CT	100/5 TAI 200	IME	£8.38
VENT	SK 3326.200	RITTAL	£26.91
CONTACTOR	100-C09-10	ROCKWELL	£10.43
CONTACTOR	100-C85-00	ROCKWELL	£95.43
RELAY	700HA32A03-3 8PIN 230V	ROCKWELL	£3.57
RELAY BASE	700HN100 8PIN	ROCKWELL	£1.55
SURGE PROT DEV	WSP EMTP	WAISUR	£553.92

Building Services Operating and Maintenance Instructions
5-7 Carlton Gardens, London SW1

E.8.2

STANDBY GENERATION - AVK/SEG (UK) Ltd.

Refer to Section H.3 of this O & M Manual for details.

Also refer to AVK/SEG (UK) Ltd. letter dated 18/9/98

FACSIMILE

MINISTRY WHARF, SAUNDERTON
HIGH WYCOMBE, BUCKS HP14 4HW
TELE : 01494 564541
FAX : 01491 564543

AVK|SEG (UK) LTD

"The Power People"

FAX

Company :	T CLARKE PLC	Fax No :	0171 701 6265
F.A.O :	G W Novy	From :	Alan Fisher
Date :	18/9/98	Mobile No	07775 631500
Your Ref. :		Pages :	1
Our Ref. :	FAJF-TCLARKE-22	Job No :	JN98255
Copy :	Robin Aves		

Subject 5-7 CARLTON GARDENS - GENERATOR INFORMATION

Dear Sir,

The O & M Manual information requested is not available at present as we are still at the design stage and equipment is to be custom manufactured. In the programme issued to T.Clarke on 24/7/98 it showed O&M manuals would be provided in week 45.

The situation on specific issues raised in your letter is as follows:-

- | | | |
|----|---|---|
| a) | System normal and general operations procedures | To be included in O & M Manual |
| b) | Starting up procedures | To be included in O & M Manual |
| c) | Shut down procedures | To be included in O & M Manual |
| d) | Emergency procedures | To be included in O & M Manual |
| e) | Recommended spare parts list | List to be provided 21/9/98, based on specific annual usage rate |
| f) | Tools list | No special tools required |
| g) | Expected life of equipment | MTBFs etc cannot be quantified as failure rates are a function of frequency of operation, maintenance etc |
| h) | Guarantees/Warranties | Twelve months from commissioning and setting to use. |

Please do not hesitate to contact me if you have any further queries.

Regards

Alan Fisher

Alan Fisher
Project Manager

Building Services Operating and Maintenance Instructions
5-7 Carlton Gardens, London SW1

E.8.3

FIRE ALARM SYSTEM / VOICE ALARM - I.A.T. (Europe) Ltd.

Refer to Section H.8, sub-section 8 for details.

Building Services Operating and Maintenance Instructions
5-7 Carlton Gardens, London SW1

E.8.4

SECURITY SYSTEM - Blenheim Security Systems Ltd.

Refer to Section H.6 of this O & M Manual for details.

Also refer to Blenheim Security Systems Ltd. letter dated 10/9/98.

Specialists in all aspects of Security Installations

Mr G W Novy
T Clarke PLC
Stanhope House
116 - 118 Walworth Road
London
SE17 1JY

10th September 1998

Blenheim
SECURITY SYSTEMS LIMITED

Station Mews
Station Close,
Potters Bar,
Hertfordshire
EN6 1TL

Telephone
(01707) 646232
Facsimile
(01707) 646234

Re: 5 - 7 Charlton Gardens - Security System

Dear Mr Novy,

Further to your letter dated 27th August 1998 "operation of the installation" technical documentation the following points which are applicable are enclosed.

- a) Submitted with Blenheim O/M Manuals *OPERATION Procedures*
- b) Submitted with Blenheim O/M Manuals *Starting-up*
- c) N/A — *Shut Down Procedures*
- d) N/A — *Emergency Procedures*
- e) Spare parts list cannot be formulated until equipment has been approved by client.
- f) N/A — *TOOLS LIST*
- g) N/A — *EXPECTED service life*
- h) Enclosed

I hope this meets with your approval.

Regards,

Tom Menzies

Tom Menzies
Managing Director



Warranty

- H) All equipment supplied and installed by Blenheim comes with a minimum 12 month parts and labour warranty to cover equipment failure but not miss - use or malicious damage.

Building Services Operating and Maintenance Instructions
5-7 Carlton Gardens, London SW1

E.9

TOOLS LIST

NOT APPLICABLE

F

Building Services Operating and Maintenance Instructions
5-7 Carlton Gardens, London SW1

F SYSTEM RECORDS

F.1 EXPECTED SERVICE LIFE

F.1.1 L.V. Distribution Switchgear - Anord Control Systems Ltd.

Refer to Section H.1 of this O & M Manual for details.

Building Services Operating and Maintenance Instructions
5-7 Carlton Gardens, London SW1

F.1.2 Standby-by Generation - AVK/SEG (UK) Ltd.

Refer to attached letter from AVK/SEG (UK) Ltd dated 18/9/98

FACSIMILE

MINISTRY WHARF, SAUNDERTON
HIGH WYCOMBE, BUCKS HP14 4HW
TELE : 01494 564541
FAX : 01491 564543

AVK SEG UK LTD

"The Power People"

RECD

Company :	T CLARKE PLC	Fax No :	0171 701 6265
F.A.O :	G W Novy	From :	Alan Fisher
Date :	18/9/98	Mobile No	07775 631500
Your Ref. :		Pages :	1
Our Ref. :	FAJF-TCLARKE-22	Job No :	JN98255
Copy :	Robin Aves		

Subject 5-7 CARLTON GARDENS - GENERATOR INFORMATION

Dear Sir,

The O & M Manual information requested is not available at present as we are still at the design stage and equipment is to be custom manufactured. In the programme issued to T.Clarke on 24/7/98 it showed O&M manuals would be provided in week 45.

The situation on specific issues raised in your letter is as follows:-

- | | | |
|----|---|---|
| a) | System normal and general operations procedures | To be included in O & M Manual |
| b) | Starting up procedures | To be included in O & M Manual |
| c) | Shut down procedures | To be included in O & M Manual |
| d) | Emergency procedures | To be included in O & M Manual |
| e) | Recommended spare parts list | List to be provided 21/9/98, based on specific annual usage rate |
| f) | Tools list | No special tools required |
| g) | Expected life of equipment | MTBFs etc cannot be quantified as failure rates are a function of frequency of operation, maintenance etc |
| h) | Guarantees/Warranties | Twelve months from commissioning and setting to use. |

Please do not hesitate to contact me if you have any further queries.

Regards

Alan Fisher

Alan Fisher
Project Manager

Building Services Operating and Maintenance Instructions
5-7 Carlton Gardens, London SW1

F.1.3 Fire Detection and Voice Alarm System - I.A.T. (Europe) Ltd.

Refer to Section H.8, sub-section 9 for details

Specialists in all aspects of Security Installations

Mr G W Novy
T Clarke PLC
Stanhope House
116 - 118 Walworth Road
London
SE17 1JY

10th September 1998

Blenheim
SECURITY SYSTEMS LIMITED

3 Station Mews,
Station Close,
Potters Bar,
Hertfordshire
EN6 1TL.

Telephone
(01707) 646232
Facsimile
(01707) 646234

Re: 5 - 7 Charlton Gardens - Security System

Dear Mr Novy,

Further to your letter dated 27th August 1998 "operation of the installation" technical documentation the following points which are applicable are enclosed.

- a) Submitted with Blenheim O/M Manuals *OPERATION Procedures*
- b) Submitted with Blenheim O/M Manuals *starting-up*
- c) N/A — *shut Down Procedures*
- d) N/A — *Emergency Procedures*
- e) Spare parts list cannot be formulated until equipment has been approved by client.
- f) N/A — *TOOLS LIST*
- g) N/A — *EXPECTED service life*
- h) Enclosed

I hope this meets with your approval.

Regards,

Tom Menzies

Tom Menzies
Managing Director

BSIA
THE BRITISH SECURITY
INDUSTRY ASSOCIATION



CERTIFIED INSTALLER
BY BSIA (ISO 9000 QUALITY ASSURED)
INTRUDER ALARMS

Blenheim
SECURITY SYSTEMS LIMITED

Building Services Operating and Maintenance Instructions
5-7 Carlton Gardens, London SW1

F.1.4 Security System - Blenheim Security Systems Ltd.

Refer to attached letter from Blenheim Security Systems Ltd. dated
10/9/98

Warranty

- H) All equipment supplied and installed by Blenheim comes with a minmum 12 month parts and labour warranty to cover equipment failure but not miss - use or malicious damage.

F.2 DISPOSAL INSTRUCTIONS – LAMPS

F.2.1 DISCHARGE LAMPS

Fluorescent tubes, High Pressure Sodium and High Pressure Mercury Vapour, Mercury Xenon lamps and Metal Halide Lamps, (MCF/L, HPS/ SON/NAV, MB/MBF/HQL, HBO and MBI/MBIF/HQI lamps) all contain small amounts of Mercury and, in the latter case, halide of other metals.

Disposal should be carried out in accordance with the regulations of the Local Authority. Usually mercury-containing lamps are deposited in landfill type tips but it is the Local Authority who will advise as to the precise method in their locality.

Fluorescent Tubes (MCF/L)

When disposing of fluorescent tubes it is usual to break the tubes, taking care to avoid:

- a) The risk of cuts from flying glass. The pressure in the lamps is very low and, if broken carelessly can give rise to an implosion.
- b) Inhalation of the fluorescent powder. The powder in itself is notespecially toxic but will be contaminated with mercury and it is not advisable to inhale any type of dust. Those carrying out the work should wear suitable protection for exposed parts of the body especially for the eyes, hands and arms, A suitable mask will guard against unnecessary inhalation of dust.
- c) The work should be carried out outdoors or in a well-ventilated area.

Small or compact fluorescent (Dulux) may be broken as above or left intact, in which case they should be returned to their packing or wrapped in several layers of newspaper.

High Pressure Mercury Vapour, Metal Halide, Mercury Xenon and
High Pressure Sodium Lamps (MBF/HQL, MBI/HQI, HBO and
HPS/SON/NAV)

When disposing of MBF/HQL and the larger MBI/HQI or HPS/NAV lamps, it is usual to break the outer bulbs taking the same precautions as for fluorescent tubes. It is recommended that the disposer should not deliberately break the arc tubes. They are small and, if unbroken, will contain the mercury and other ingredients indefinitely.

High Pressure Xenon Lamps (XBO)

These do not contain toxic substances but can shatter violently if dropped. Always place the failed lamp in the protective case supplied with the new lamp. Please ask for special advice on disposal.

Low Pressure Sodium Lamps (SON/NA)

SOX lamps contain sodium metal which reacts violently with water, creating heat and the risk of fire in the process. When breaking the lamps:

- a) Take great care against flying glass and other fragments.
- b) Break the lamps carefully in a large dry container, accumulating not more than 20 in each batch.
- c) The work should be carried out in a dry atmosphere.
- d) When the container is not more than one quarter full of lamp debris the operator should fill it with water from a distance, ie by the use of a hose.
- e) The water will react with the sodium and may be disposed of as weak caustic soda solution. The debris may be disposed of as glass.

F.2.2

INCANDESCENT LAMPS

There are no problems of hazardous substances with ordinary filament lamps but tungsten halogen lamps contain small traces of one or more of the halogens. If it is necessary to break large lamps, or large quantities of these lamps during disposal, then the operation should be carried out in a well ventilated area. For small lamps, where breaking is not necessary, they should be returned to their packing or wrapped in several layers of newspaper. Care should always be taken to void injury from flying glass. In most halogen lamps the internal pressure is greater than that of the normal atmosphere. Some non halogen lamps contain a vacuum and will implode if care is not taken - (see below).

F.2.3

GENERAL

If the number of lamps to be disposed of is small, the glass may be broken carefully by tapping with a metal instrument such as an engineers file, at the part of the bulb near the cap whilst supporting the cap on a firm surface. It is usually possible to achieve a slow fracture here which allows the air to enter the lamp slowly. After the pressure has increased in the lamp to equalise with atmospheric pressure, the glass can then be broken more completely. Do not attempt this procedure with tungsten halogen or other lamps made in quartz.

If there are large numbers of lamps to be broken, machines are available on the market to break the glass whilst at the same time spraying the debris with water to prevent glass and powder flying and neutralise the sodium of low pressure sodium lamps.

Note that whenever glass is broken eye protection must be worn.

ELEMENTS OF ENVIRONMENTAL INTEREST CONTAINED IN LAMPS.

Percentage of total lamp weight (average for Europe, excluding insoluble elements contained in glass)

Lamp Element	Fluorescent (All Types)	H.P. Mercury	Halide	Metal and Low Pressure
Average weight of Lamp (g)	200	100	150	300
Mercury 4)	0.01	0.02	0.03	0.003 5)
<u>Other Elements</u>				
Antimony	0.01	-	-	-
Barium	0.03	0.002	0.002	0.04
Cadmium	- 1)	-	-	-
Indium	0.001	-	<0.001 0.02	
Lead 2)	0.005	0.5	0.3	0.3
Sodium	-	-	0.001 3)	0.1
Strontium	0.1	0.05	0.03	0.001
Thallium	-	-	0.001	-
Thorium	-	0.004	0.002	<0.001
Vanadium	-	0.07	0.005	<0.001
Yttrium	0.06	0.1	0.07	0.001

- 1) Cadmium may still exist in older lamps
- 2) Mainly in solder
- 3) As sodium salts
- 4) The mercury used in the discharge is the only substance which could be regarded as environmentally significant. It is not possible to eliminate mercury because it is the only element that fulfils a combination of essential physical functions within the gas discharge. There is no substitute
- 5) There is no mercury in low pressure sodium lamps

(See note ref. No.'s on page 4)