HEALTH AND SAFETY FILE / OPERATING AND MAINTENANCE MANUAL

For the new

MECHANICAL AND ELECTRICAL ENGINEERING SERVICES AND ASSOCIATED BULDERS WORK

within:

BECKTON ASC
HILLCROFT ROAD
BECKTON
LONDON, W5 2GB

BOOK ONE
(Sections One To Thirteen)

PRINCIPAL CONTRACTOR:

PW Building Services
Pishiobury House
Pishiobury Drive
Sawbridgeworth
Hertfordshire, CM21 0AF

Tel.: 01279 600940

DOCUMENTATION PREPARED BY:

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ISSUE: MAY 2010

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HEALTH AND SAFETY FILE / OPERATING AND MAINTENANCE MANUAL

UPS SYSTEM UPGRADE

BECKTON ASC, HILLCROFT ROAD
BECKTON, LONDON, W5 2GB

BOOK ONE
(Sections One to Thirteen)

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MANUAL AMENDMENT LOG SHEET No. 1

The following Log should be completed to record any amendments made to the Health and Safety File / Operating and Maintenance Manual. The pages upon which changes are made should also be suitable notated

REV.	DATE	DESCRIPTION OF AMENDMENT	ISSUED BY
/	May. 2010	Draft Issue For Comments / Approval	MEPA

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HEALTH AND SAFETY FILE / OPERATING AND MAINTENANCE MANUAL CONTENTS

INTRODUCTION AND SCOPE OF MANUAL

SECTION CONTENTS

1.1 INTRODUCTION

This Health and Safety File / Operating and Maintenance Manual has been compiled pursuant to obligations identified by the Construction (Design & Management) Regulations 2007 (CDM2007), and the File is based on:

- The outline of typical information that may be included in the File as detailed within the HSC Approved Code of Practice L144, Managing Health and Safety in Construction.
- Information provided by the client, project designers, principal contractor, contractors and specialist suppliers of plant, etc.

The nature of information contained in this Document is designed to alert those who are responsible for the Building of Key Health and Safety Risks that may be encountered on site and also providing as-built information and relevant operation and maintenance manuals. No existing previous Health and Safety Information has become available to be incorporated within this File. The facility has been provided, however, to enable the Client or others to insert any relevant information within Section Nine, should it become available.

This Health and Safety File / Operating and Maintenance Manual has been issued to the Client, who accepts responsibility under the Construction (Design & Management) Regulations 2007 to keep the document:

- Safe
- Up to date
- To ensure all future contractors and workmen are advised of the existence of the document and invited to inspect the same.
- To ensure all future contractors and workmen have ready access to the document at all times

This Health and Safety File / Operating and Maintenance Manual incorporates the overall general operating and maintenance requirements for the **UPS System Upgrade** installed within:

Beckton ASC
Hillcroft Road
Beckton
London, W5 2GB

by:

PW Building Services
Pishiobury House
Pishiobury Drive
Sawbridgeworth
Hertfordshire, CM21 0AF

The Works were carried out during 2010.

The Construction (Design and Management) Regulations 2007 (the CDM Regulations) require the production of a Health and Safety File on completion of a project. The File is a record of information for the end user, which focuses on health and safety during the life of the building. The information it contains will alert those who are responsible for the building and its equipment, to the significant health and safety hazards which must be addressed by persons carrying out subsequent construction, cleaning, maintenance and demolition work.

It is desirable that a copy of this File be kept on or readily accessible to the premises to which it relates. Emergency maintenance contractors may need to see the file in advance, so that they can work safely if they are called in. It should also form part of the information that the Client or the Client's successor is required to pass to the co-ordinator responsible for any future construction, maintenance or demolition work to which the Regulations apply. The Co-ordinator for any future work to which CDM applies is required to make available to Designers any relevant information contained within this file.

Where clients dispose of their entire interest in a structure, they should pass the file to the new owner and ensure that the new owner is aware of the nature and purpose of the file. Where they sell part of the structure, any relevant information in the file should be passed or copied to the new owner.

If the client leases out all or part of the structure, arrangements need to be made for the Health & Safety file to be made available to leaseholders. In some cases, the client might transfer the file to the leaseholder during the lease period.
In other cases, it may be better for the client to keep the file, but tell leaseholders that it is available. If the leaseholder acts as the client for future construction projects, the leaseholder and the original client will need to make arrangements for the file to be made available to the new co-ordinator.

1.2 COPYRIGHT OF THIS MANUAL

The following is Copyright Insurance requirement. It is intended to provide protection for the Technical Author, the Client and all those who use the Health and Safety File / Operating and Maintenance Manual.

The Copyright of this Health and Safety File / Operating and Maintenance Manual in its entirety is protected by Common Law and shall remain vested in the Author. A Licence is granted by the Author to permit the copying and reproduction of the contents of the written text for the purpose of inspecting, operating and maintaining the Mechanical Services, Electrical Services and Building Works described herein for the Works associated with the **UPS System Upgrade, only**. It should be noted that this Licence does not provide permission to copy the manufacturers' or specialists' literature. This literature may be protected by the Third Parties under the Common Copyright Law or Title of Goods Restrictions. Permission must be sought direct from these third parties should their information require to be copied. No part of this Manual shall be copied or reproduced for any purpose other than granted under the Licence.

1.3 PURPOSE OF THE MANUAL AND SAFETY WARNING

This Health and Safety File / Operating and Maintenance Manual Set addresses the particular Operating and Maintenance requirements for the Mechanical Services, Electrical Services and Building Works installed by PW Building Services associated with the **UPS System Upgrade.**

The documentation has been specifically designed and structured to assist personnel with an understanding of the Works carried out. The documentation includes descriptions and details of the Engineering Services and Building Works, procedures for the operation of equipment, maintenance requirements and intervals, recommendations regarding the development of a Spare Parts Policy, a list of recommended spares which should be kept in the stores, general Health and Safety requirements and emergency procedures. A copy of Test and Commissioning Reports, As Installed Drawings and Manufacturers' Literature are included for reference purposes.

This Health and Safety File / Operating and Maintenance Manual is for the use by maintenance personnel who have an understanding of safety requirements and methods of carrying out operation, maintenance and repair. This manual is not intended to teach un-trained and non-technical personnel in these matters.

It is potentially dangerous and a contravention of Health and Safety at Work Legislation for un-trained personnel to adjust, operate or undertake maintenance unless they have been adequately trained and are competent in these matters.

Certain maintenance activities can only correctly and safely be carried out by specifically trained technicians employed through the supplier of the equipment or through specialist maintenance companies. These activities generally require specialist tools, equipment and detailed works manuals. Detailed instructions on the methods of carrying out these specialist tasks are not included within this Manual.

It is of the utmost importance that any personnel responsible for the operation and maintenance of the installation are fully conversant with relevant Safety Standards, Regulations, the arrangement of the services installation, their purpose, their effect on the operation of other services and processes, operation procedures, maintenance procedures, this complete Health and Safety File / Operating and Maintenance Manual Set and all manufacturers’ documentation.

The Building Operator (the person overall responsible for the operation and maintenance of the Services Installation) must nominate a 'Responsible Person' to ensure that all operation and maintenance works are carried out in the safest possible manner, with minimum Risks. Risk Assessments will be required to be produced to clearly identify the 'Responsible Person's' opinions in these matters.

1.4 HEALTH & SAFETY

1.4.1 Health & Safety at Work Act 1974

There are legal requirements in connection with Health and Safety at work and in addition there are many official recommendations. For details of these references should be made to the appropriate official publications. The following paragraphs refer briefly to the more common requirements.

1. It is the duty of every employer to ensure so far as is reasonably practicable, the health, safety and welfare at work not only of all employees, but also of other people who use the premises.

2. It is the duty of every employee while at work:

   a) To take reasonable care for their health and safety also that of other people who may be affected by their acts or omissions at work.

   b) To co-operate with their employer, or any other person so far as is necessary for the provisions of the various relevant Acts to be complied with.

3. All places of work must be kept as clean as possible consistent with their use. Dirt and refuse must not be allowed to accumulate.

4. Work must never be carried out under conditions where there is any element of danger if it is reasonably practicable to eliminate the risk.

5. Safe working conditions must be provided, to give adequate protection and also safe access and egress where necessary. Access doors and panels to all areas containing mechanical or electrical plant (e.g. plant or switch rooms, electric panels, and fan chambers) must carry appropriate warning notices. Proper scaffolds, guard rails, toe boards etc., and ladders, must be provided and used. Refer to the Regulations.

6. Where appropriate to the work, protective equipment (e.g. goggles, screens, respirators, protective clothing, and safety belts) must be used.

7. Never work on moving parts of machinery. Exercise care if working on the stationary parts of machinery, which is operating; before doing so ensure that the moving parts are adequately protected by suitable guards.

8. Never lift, move or carry loads, which are liable to cause personal injury. Suitable lifting tackle must always be used.

9. Adequate lighting (permanent or temporary) must be provided.

10. Before working on electrical equipment, a ‘permit to work’ signed by a responsible person must be obtained. The equipment must be disconnected from the supply by operating the switch or starter, and also the isolator. As a further precaution, withdraw the fuses. Only competent persons must undertake any work requiring technical knowledge or experience.

11. Hand and other small power tools should be suitable for, and operated from, a 110-volt electric supply.
12. Fire precautions must be observed. 'No Smoking' notices must be displayed where necessary, and rigidly obeyed.
13. The means of escape from the building (as specified on the certificate issued by the Fire Authority) must be maintained, and at all times kept free of obstruction. Fire fighting equipment must be provided, maintained, and kept readily available.
14. Fire alarm systems must be regularly checked, and kept in working order.
15. First Aid boxes or cupboards of the prescribed standard, and containing only First Aid requisites, must be provided in accessible positions, and kept clean and in good repair.
16. All safety precautions are to be observed when using replacement products or dealing with routine maintenance, repairs to plant and ancillary equipment.
17. All labelling of packages, detailed instruction sheets, connection diagrams and labels on the equipment must be checked and used for determining the correct equipment for the specific application.
18. Any equipment used or test carried out must be in compliance with the current Code of Practice relating to such equipment, manufacturers' technical literature and specific installation instructions.
19. Where it is felt that specific test are required over that described in the manufacturers' literature this information must be obtained from, or clearance given by the manufacturer before the equipment is installed, tested and put into use.

1.4.2 Warning & Safety Notices

All warning and safety notices must be properly displayed and worded to give clear instructions.

All notices are to be the correct type and size and in the interest of personnel safety, warning and caution notices are to be strictly adhered to.

1.4.3 Fire Protection & Alarms

All employees, maintenance staff, contractors, etc., are to be made aware of the fire safety regulations for the sight. They must be aware of the location of fire fighting equipment and alarm points.

All escape routes and exits must be kept clear of obstructions at all times.

Care must be taken and adequate protection provided to prevent fire, when welding or carrying out similar operations involving the application of heat. Arc welding demands protective screens. Precautions against explosions are laid down for working on tanks or containers, which have held explosive or flammable substances.

1.4.4 Control of Substances Hazardous to Health Regulations (COSHH)

a) Statutory Obligations

On October 1st 1989, the Control of Substances Hazardous to Health Regulations 1988, (COSHH), came into effect. This has subsequently been revised and currently is in the form of 'The Control of Substances Hazardous to Health Regulations 2002 (COSHH) (amended 2004) incorporating Chemical (Hazard Information and Packaging) Regulations (CHIPS)'.

'The regulations cover products or items brought in, manufactured, or used that in a solid, gas or vapour (including micro-organisms) form where the general indication of risk is specified as very toxic, toxic harmful, corrosive or irritant. A list of these plus an indication of exposure limits are given in the Regulations.'

Relating the list to services installed is difficult, as the substances listed are in the main chemicals possibly used in manufacturing processes. This instruction manual does not cover these processes. However the reason for mentioning the Regulation is to be aware of them and apply them to products brought in for cleaning, maintenance and servicing of the installed services.

'Every employer shall ensure that the exposure of his employees to substances hazardous to health is either prevented or, where this is not reasonably practicable, adequately controlled. So far as reasonably practicable, the prevention or adequate control of exposure of employees to a substance hazardous to health shall be secured by means other than the provision of personal protective equipment.'

b) Compliance

To comply with the requirements of this act all materials and products used must comply with the following list of restricted materials and finishes:

- Calcium chloride and additives containing calcium chloride
- High alumina cement
- Backfill containing aggressive materials, particularly around services
- Flexcell - ensure that Korpak, Aerofil or other non-absorbent and non-staining materials is used
- Wood wool used for permanent shuttering
- Capillary plumbing fittings containing lead-tin solder
- Asbestos, or materials containing asbestos
- Urea formaldehyde or materials or products containing urea formaldehyde
- Materials containing fibres less than three microns diameter
- Lead or products containing lead for external use other than lead slates and flashing etc.
- Other substances generally known to be harmful

No substance specified, or unspecified, has been used unless it has been approved by a contractor's/manufacturer's safety officer in order to comply with the Control of Substances Hazardous to Health Regulations (COSHH Regulations).

Leaflets are available 'free of charge' from the Health and Safety Executive area offices.

c) Disposal Instructions

For details on disposal instructions for hazardous materials, please refer to the relevant manufacture's literature and to the current statutory laws.

If any doubt exists, consult a waste disposal specialist registered with the Environmental Protection Agency and certified to operate in accordance with the quality procedures specified in ISO 9003.

1.4.5 Permit to Work System

A `permit to work' system must be adopted to meet and satisfy the legal requirements of the present legislation.

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 commences 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. 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 hand lamps 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 instructions, 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.

Before any maintenance work is undertaken the maintenance engineer or contractor should obtain from the competent person responsible for the electrical supply an authorisation 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.

The `permit to work' system should incorporate the following:

- To give authority to maintenance staff to commence inspection of plant, or work on plant
- To explain and outline the approach required for carrying out the work in such a way that no personnel or plant hazard is created within the working environment
- The system should be devised so that maintenance may be carried out safely and starting up or running of plant presents no environmental hazard
- Co-ordination of staff, in relation to maintenance procedures and operations
- Correct shutting down of systems must be observed and no electrical work on equipment where removal of guards or housings has taken place must be undertaken without confirmation that the plant is in a safe condition for work to precede
- Members of the maintenance staff must only carry out work within their discipline and job description
- Where it is necessary to provide staging scaffolding, towers and ladders to examine or carry out replacement of components then these must comply in all respects with the latest legislation

A suitable 'Permit to Work' document in 4 parts is described in CP 1008

1.4.6 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 & First Aid

F) Clothing

G) Tools & Installing Equipment

H) Ladders, Ladder Seats, Scaffolds & Stools

A) Common Hazards

Electrical Appliances - Disconnect all electrical appliances, which are left unattended.

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 that 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:

Do not congest the working area.

Use sheets where it is necessary to protect personnel working below from falling objects such as tools, material or equipment.

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.

Broken Glass - Avoid placing broken glass or other sharp objects in waste 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 secure footing cannot be ensured.

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.

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 windowsills or frames, where they might fall out on a passer-by.

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 windowsills 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 and 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 handrails, 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:

- Second person should be present.
- Check insulation of test leads.
- Check earth leads, & mechanical / electrical connections.
- Use one hand, keep other hand away from apparatus.
- Keep fingers of active hand away from the metal end of the test probe.
- Stand on insulation material and avoid contact with ground objects.
- 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 & 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. All personnel should be aware of the location of the first aid kit. 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 wintertime.

Do use all the protective clothing supplied for specific jobs.

Do wear safety helmets on site.

G) Tools & Installation 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 the 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 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 & Steps

Ladder Hazards

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

Scaffold and Step Hazards

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

1.4.7 First Aid Principles & Practice - General

The following is only a general description of First Aid Principles and Practice.

Definition

First Aid is based on the principles of practical medicine and surgery. Knowledge of the subject in case of accident or sudden illness enables trained persons to give such skilled assistance as will preserve life, promote recovery and prevent the injury or illness becoming worse until medical aid has been obtained.

First Aid consists of simple measures that anyone can learn, but if carried out correctly, quickly, gently and as early as possible, they can be life saving, and may prevent the necessity for more complicated treatment later which may be too late to save life. It includes the necessity of giving the casualty confidence by talking to him and by reassuring him.

First Aider Responsibility

This ends when handed over to the care of a doctor, a nurse or other responsible person, but not until they have taken over the whole responsibility for the case. The First Aider should not leave until he has made his report to the doctor or other responsible persons, and has ascertained whether he could be of any further help.

First Aid, in general, is limited to the assistance rendered at the time of the emergency, with such material as is available and often extensive improvisation will be necessary.

Remember at all times the importance of COMMON SENSE in First Aid as an addition to the actual knowledge of the subject. This section (and other First Aid Manuals) usually considers for treatment only one condition at a time. However, in real life it will soon be found that serious accidents rarely produce only a single injury.

Frequently, two injuries or more occur close together so that the correct treatment of one may interfere with the correct treatment of the other. One injury may require the casualty to be put on his back, another that he should be in the coma or recovery position. In such circumstances, the First Aider must decide which injury is the most serious, or needs the most urgent treatment and treat that one in the correct way and then deal with the second injury as correctly as possible under the conflicting circumstances. Often a casualty suffers from more than two injuries at the same time, which makes matters even more difficult.

The Scope of First Aid

This consists of three parts:

- Dealing with the situation, apart from the casualty.
- Diagnosing what is the matter with the casualty and then giving the correct First Aid.
- Disposing of the casualty to Doctor, Hospital or Home and notifying those concerned about the accident.

In arriving at the diagnosis the First Aider is guided by:

The report furnished by persons present (which includes the conscious casualty) as to the cause of the injury or illness, i.e. HISTORY.

The account given by the casualty of his own sensations and feelings, i.e. SYMPTOMS.

His complete examination of the patient, i.e. SIGNS.

Priority in First Aid

Do first things first, quickly, quietly and methodically.

Reassure the casualty and those around to lessen anxiety, whilst taking in the situation.

If breathing has stopped, start resuscitation.

Control visible bleeding.

Give priority to the individual with the most important injuries.

Give priority where several are injured to those who will benefit most by prompt treatment.

Guard against shock - and look for concealed bleeding.

Immobilise fractures and larger wounds before moving the casualty - handle gently.

Do not remove clothes unnecessarily as this can be painful or awkward procedure and the casualty may get cold.

Do not allow people to crowd around - they get in the way and fresh air is essential.

Arrange early for careful conveyance of the casualty to Hospital or to a Doctor.

1.4.8 First Aid Principles & Practice - Life Saving Measures

Electrical Injuries

Even with domestic voltages if an electric current passes through a person it may in some cases produce stoppage of breathing, burns and cardiac arrest.

Breathing Stopped

If the victim stops breathing he will die, unless breathing is restored at once. First tilt his head back to open the air passage from mouth to lungs, squeeze the nostrils together then blow your own breath through his mouth into his lungs. If there is no improvement it is likely that the heart has stopped beating and must be restarted by compressing it by manual pressure on the chest wall.

Bleeding

Bleeding from injuries must be controlled as sever loss of blood may lead to death. The best way to stop bleeding is to squeeze the injured part together BY DIRECT PRESSURE of the fingers on the wound together.

Unconsciousness

The willing but untrained bystander is most helpless when confronted with the UNCONSCIOUS victim. The simplest act of turning such a victim on his side, in the COMA or RECOVERY position, so that he cannot drown in his own vomit, may save as many as 20% of such victims who would otherwise die.

Shock

Shock is likely to be present in all cases of injury and many cases of sudden illness. Its effects, which may be extremely serious, may be mitigated by the comfort, confidence and reassurance supplied by the rescuer.

Broken Bones

These are serious injuries - STOP ANY MOVEMENT OF BROKEN BONES, which may make the injury more severe. Injured limbs may be secured to the body or the other uninjured limb.

Burns and Scalds

These are common injuries and if a large part of the body is involved, death may result. Cool the affected area with cold water then cover with clean cloth or large dressing till seen by a Doctor.

Electric Shock

The severity of an electric shock will depend upon the level of the current that passes through the body and the length of time of the contact.

Other factors such as age, whether or not the casualty is wearing insulating footwear or is wet, the weather conditions and so on, all contribute to the severity of the shock. In some circumstances, 40V can be dangerous and ordinary mains voltage (240V) very dangerous indeed.

Effects of Electric Shock

At very low levels of current the effect may only be an unpleasant tingling sensation, but this in itself may be sufficient to cause someone to lose their balance and fall.

At higher levels of current the casualty may be thrown off his feet and will experience severe pain and possibly minor burns at the point of contact.

Above this level, the muscles may contract and the casualty is unable to release his grip on the conductor; he may lose consciousness and the muscles of the heart may contract spasmodically (fibrillation). This may be fatal.

What You Should Do

Break the contact either by switching off, removing the plug or wrenching the cable free. If not, stand on some insulating material such as dry wood, rubber or plastic and break the contact by pushing or pulling the person free

If the casualty is unconscious, but breathing:

Loosen the clothing about the neck, chest and waist and place the casualty in the recovery position

Keep a constant check on breathing and pulse rate

Keep the casualty warm and comfortable

Send for help

If the casualty is not breathing - ACT AT ONCE - don't waste time!

Place the casualty on his back

Make sure that the airways (nose, Mouth) are clear. Remove loose dentures or other obstructions from the mouth

Commence mouth to mouth resuscitation

When breathing has been restored the casualty should be placed in the recovery position. This position prevents the casualty inhaling fluid or vomit.

Get expert help as quickly as possible.

Mouth to Mouth Resuscitation

Lay the casualty on his back on a firm surface

Raise the casualty's shoulders on padding, e.g., folded jacket

Tilt head back and lift the jaw upwards and forwards

Open casualty's mouth. Ensure he has an open airway

Maintain head in well-back position

Pinch casualty's nostrils shut

Take a deep breath and seal lips around casualty's open mouth

Blow firmly and gently into the casualty's mouth

Watch the casualty's chest constantly; it should rise as his lungs fill with your air

Repeat this action at a steady rate until the casualty begins to breathe naturally

1.4.9 First Aid Principles & Practice – Emergency Situations

The Situation

Be calm and take charge.

Ensure safety, i.e. from the possibility of falling masonry, etc.

Ask those present to remain if considered responsible as they may be able to help; otherwise they should be requested to stand clear.

Give each one a specific job e.g.

Inform the Police.

Ask for an Ambulance or send for a Doctor.

In each case, state the place of the accident and tell what has happened.

Ask if anyone has any First Aid knowledge.

Ask for help in turning the casualty or in steadying a limb.

In each case give exact instructions and if necessary show the bystander how your request should be carried out.

The Casualty

Depending on what has happened and the degree of severity of the injuries and circumstances present, decide whether to treat the casualty where he is or whether to move him to a more suitable place.

If you decide to move him, carry out a quick preliminary examination of the head and neck, spine and four limbs. Then decide on the most suitable method of removal in view of the injuries and the amount of skilled or unskilled help available. Then complete the examination of the casualty for injuries so that you can make a complete diagnosis and carry out the necessary treatment.

The Disposal

Stay with the casualty and reassure him until Ambulance or Doctor arrives. Give your report to the Doctor and if necessary accompany the Casualty to Hospital and report there. Notify the nearest relative and any other person or organisation that should be told. In serious outdoor accidents the Police should be sent for or notified.

Most Urgent Issues

To restart the heart if it has stopped beating.

To apply resuscitation if the casualty is not breathing. If in doubt as to whether the casualty is alive or not, continue treatment until medical aid is available.

To control any bleeding.

To maintain a clear airway by correctly positioning the casualty.

Most Important Procedures to Prevent the Condition from Worsening

To dress wounds.

To immobilise fractures and large wounds.

To place the casualty in the most comfortable position, consistent with the requirements of treatment.

Most Helpful Measures in Promoting Recovery

To relieve the casualty of anxiety and promote his confidence.

To relieve him of pain and discomfort.

To protect him from the cold.

To handle gently so as to do no harm.

1.4.10 First Aid Principles & Practice - Dressings

Purpose

Dressings are used to:

Assist in controlling bleeding.

To protect a wound from further injury.

To prevent or lessen infection.

An efficient dressing should be non-adherent and have a high degree of porosity.

Types of Dressings

Adhesive Dressings The wound covering is of a non-adherent film, which is supported by several layers of absorbent gauze or cellulose held in place by a covering layer of adhesive material. Sterilised dressings are sealed in a paper or plastic envelope and should not be opened before use.

Bandages Bandages are made from flannel domett (cotton and wool), calico, elastic net or paper. They can be improvised from any of the above materials.

There are three different types:

Triangular Bandage

Roller Bandage

Elastic Net

Purpose of Bandages

To retain dressings and splints in position.

To maintain direct pressure over a dressing to control bleeding.

To reduce or prevent swelling.

To afford support in the form of a sling.

To assist in lifting or carrying casualties.

To act as padding when nothing suitable is available.

Note!

The following books, published by St. John Ambulance Association, on which the foregoing is based, are recommended for further information.

First Aid at Work Manual.

First Aid Manual.

These publications can be obtained from the Area H.Q. of the St. John Ambulance Association or leading booksellers.

1.4.11 Personnel Training Records

Details of personnel training records applicable to the systems covered by this manual should be recorded within the table below:

Name	Course/Training Module	Certificate No.	Date Completed

1.5 HEALTH AND SAFETY FILE / OPERATING AND MAINTENANCE MANUAL FORMAT

Each Section is sub-divided into various sub-sections. Each Section is preceded by a contents schedule containing details and page numbers of the sub-sections contained within that Section.

Each page of the written text is uniquely numbered in the top right hand corner. The reference includes a prefix of the Section number followed by the page number of that particular Section.

eg: SECTION ONE / 2 indicates Page Two of Section One.

In addition each page of the written text is printed with the Section Title in the top left hand corner and the Issue Date of the Manual in the bottom right hand corner.

Each Sub-Section is provided with a title preceded by a unique reference number having a prefix of the Section Number followed by the Sub-Section Number.

eg: 1.2 indicates Section One, Sub-Section Two.

Certain Sub-Sections are further divided and provided with an additional reference number.

eg: 2.3.1 indicates Section Two, Sub-Section Three, Sub, Sub-Section One.

1.6 CONTENTS OF HEALTH AND SAFETY FILE / OPERATING AND MAINTENANCE MANUAL

This Health and Safety File / Operating and Maintenance Manual contains Fifteen Sections as follows:

Section One	Introduction and Scope of Manual
Section Two	Design Philosophies, Principles and System Descriptions
Section Three	Residual Hazards and Health and Safety
Section Four	Cleaning, Maintenance and Demolition
Section Five	Plant Replacement and Safe Access
Section Six	Emergency Procedures and Fire Strategy
Section Seven	General Fault Finding Procedures
Section Eight	Operating Procedures
Section Nine	Equipment Schedules
Section Ten	Dangerous Substances
Section Eleven	Statutory Approvals, Consents and Reports
Section Twelve	Important Reference Information
Section Thirteen	Test and Commissioning Reports
Section Fourteen	As Installed Drawings
Section Fifteen	Suppliers' Documentation

1.7 COMPLETION OF THE SCHEDULE OF WORKS UNDERTAKEN

This Health & Safety File should be updated or amended by all companies undertaking construction works, as defined by the Construction (Design & Management) Regulations 2007 by:-

- Completing an entry in Section 1.8 of this File recording all construction works.
- Identifying any additional record or useful information in Section 1.10 'Schedule of Existing Information' not included within the Health and Safety File / Operating and Maintenance Manual.
- Identifying in Section 1.9 'Project Directory' all appropriate parties involved in the works.
- Providing a detailed overview of the works in Section Two of this File, drawing reference to more detailed information such as 'Operating & Maintenance Manuals' or 'Validation Reports and record drawings etc.
- Detailing any statutory approvals, consents and reports associated with the works in Section Eleven.
- Detailing any amendments to the Fire Strategy in Section Six (CDM Coordinator approval would be required).
- Identifying any appropriate test certificates and schedules in Section Thirteen.
- Modifying existing or incorporating new relevant schedules in Section Nine.
- Completing an entry in Section Three of this File highlighting any significant hazards appropriate to the identification of key Health and Safety that will need to be dealt with during maintenance, repair and subsequent construction work.
- Including any relevant details on Asbestos findings or other Hazards within Section Ten.
- Incorporating copies of any relevant additional Health and Safety information within Section Twelve.
- Including any further relevant information relating to Health and Safety which may be produced by Designers.

1.8 SCHEDULE OF WORKS UNDERTAKEN

The following Schedule should be completed to record any alterations or extensions to the Building or Works described within this Health and Safety File / Operating and Maintenance Manual.

Entry	Works Undertaken	Started	Completed

1.9 CLIENT'S STATUTORY DUTIES

1.9.1 Responsibilities of the Owner

The owner/user of the site is responsible for the safe-keeping and updating of this File, ensuring its availability to:-

- Person or persons expected to conduct maintenance activities on or within the sites perimeter.
- Person or persons expected to conduct new construction works or alterations or the sites services installations [inc. statutory utilities].
- Person or persons expected to conduct demolition works on or within the confines of the site perimeter.
- Any CDM Coordinator or design consultant involved in future works where the Construction (Design & Management) Regulations 2007 are applicable and a Health & Safety Written Plan is to be compiled prior to commencement of activity on site.

The information contained in this File or other identified information in relation to materials, substances etc. is based upon that available at the time of preparation, and will need to be checked against information available at the time of carrying out any future work as additional risks may be known and/or precautions recommended.

1.9.2 Future Works

All future work, including where there are four or less persons at work at any one time, must be:

- Arranged by competent persons e.g. who understand the nature of the work to be carried out and the risks involved;
- Carried out by competent contractors e.g. who are experienced in work of the same nature and extent and can demonstrate their ability to carry out such work safely and in compliance with all relevant statutory legislation;
- Carried out in compliance with all relevant statutory legislation, HSE guidance etc.

Guidance on the assessment of competence and provision for Health and Safety is provided in HSC Approved Code of Practice ‘Managing Health and Safety in Construction’, L144, which should be referred to.

Attention is drawn to the Clients Duties of the approved code of practice (identified above) which outlines the client’s duties with regard to the Health & Safety File under the CDM Regulations and provides guidance on the client’s other duties under CDM, including where the client carries out in-house design.

1.10 PROJECT DIRECTORY

Client	T-Mobile (UK) Ltd. Hatfield Business Park Hatfield Hertfordshire, AL10 9BW	Tel: 01707 315000 Fax: 01707 289301
Building Control Inspector	MFA Building Control Ltd 68 Ashbourne Road Derby Derbyshire, DE22 3AF	Tel: 01332 340909 Fax: 01332 340909
Contract Administrator	The Brinkfell Partnership 37A Chobham Road Woking Surrey, GU21 6JD	Tel: 01483 720732 Fax: 01483 756982
CDM Coordinator	Sage Design Services Ltd 413 Watling Street Radlett Hertfordshire, WD7 7JG	Tel: 01923 289777
Principal Contractor	PW Building Services Pishiobury House Pishiobury Drive Sawbridgeworth Hertfordshire, CM21 0AF	Tel: 01279 603300 Fax: 01279 724221
Clients Mechanical and Electrical Services Designer	The Brinkfell Partnership 37A Chobham Road Woking Surrey, GU21 6JD	Tel: 01483 720732 Fax: 01483 756982
Structural Engineering Designer	Henry Mein Partnership 12 Clarendon Street Nottingham Nottinghamshire, NG1 5HQ	Tel: 0115 947 6065 Fax: 0115 924 0136

1.11 SCHEDULE OF ADDITIONAL INFORMATION

Reference should be made to the following additional records and information which has become available and is not included within, or referred to within, this Health and Safety File.

Reference	Description	Information Location

DESIGN PHILOSOPHIES, PRINCIPLES AND SYSTEM DESCRIPTIONS

SECTION CONTENTS

DESIGN PHILOSOPHIES, PRINCIPLES AND SYSTEM DESCRIPTIONS

SECTION CONTENTS

2.1 INTRODUCTION

This Section of the Manual provides a description of the Works carried out by PW Building Services.

This Section in particular will assist with an understanding of the works carried out. It should be read in conjunction with the As Installed Drawings and also, preferably, an inspection of the installation on site.

Six specialist sub-contractors were employed by PW Building Services:

Sub-Contractor	Works Carried Out
Building Automation Solutions Ltd	BMS / Controls System Modifications
Coolair Equipment Ltd	Air Conditioning Equipment Installation and Commissioning
Drax (UK) Ltd	Fire Alarm System Alterations
Emerson Network Power Ltd	UPS System Installation and Commissioning
Fire Escape Ltd	Structural Steelwork
L & G Raised Access Floors Ltd	UPS Room Raised Floor

The Works have been carried out as part of the Building UPS Upgrade project, and as such the Building and Engineering Services Installations have been specifically designed to meet the standards required for the Clients use of the Building Area.

The Mechanical and Electrical Services Installation have generally been provided to operate continuously, twenty four hours a day. They will also operate intermittently, should this be required.

2.2 THE BUILDING

The existing Building has been modified to accommodate a new Ground Floor Battery Room and Mezzanine Floor UPS Room.

Externally, the condenser units for the new internal air conditioning units have been located to the right hand side of the building as viewed from the Reception area.

The new accommodation within the Building comprises the following:

Ground Floor

- A new Battery Room
- Space for Future Expansion

Mezzanine Floor

- A new Uninterruptible Power Supply (UPS) Room

2.3 OVERVIEW OF MECHANICAL ENGINEERING SERVICES

The new Mechanical Engineering Services comprise the following systems:-

- UPS Room Cooling
- Ground Floor Battery Room Extract Ventilation
- Ground Floor Battery Room Cooling
- Automatic Control System / BMS
- Pipework

2.4 DESIGN PARAMETERS

2.4.1 External Design Conditions

Summer:	35 °C
Winter:	-10 °C db saturated
Maximum Working Ambient:	45 °C

2.4.2 Internal Design Conditions

UPS Room:	23 °C ± 1 °C (no humidity control)
Battery Room:	20 °C ± 1 °C (no humidity control)

2.4.3 Plant Operating Periods

The Building operates 24 hours a day, 7 days a week. The air conditioning and associated equipment is intended to also operate 24 hours a day, 7 days a week.

2.4.4 External Noise Levels

Site Boundary:	No increase to current levels.

2.4.5 Internal Noise Levels

All Equipment Areas:	No increase to current levels.

2.5 UPS ROOM COOLING

Three floor mounted down flow air conditioning units, manufactured by Clivet SpA, have been installed to provide cooling within the new Mezzanine floor UPS room. The installation and commissioning of these units was carried out by a Specialist subcontractor, Coolair Equipment Ltd.

Each down flow unit is rated at 14.6kW, and discharges cooled air into the raised floor plenum. Air transfers up from the floor void via 12 centrally located 600 x 600 mm heavy duty floor grilles. Each grille is capable of handling flow rates up to 200 l/s.

The external condensers for the internal units are located to the right hand side of the building as viewed from the Reception area. The new refrigerant pipework to the condensers is run at high level from the new Mezzanine UPS room on new tray work through the existing main switch room.

Each down flow unit comprises:

- Filters
- Fans
- DX Cooling Coil
- Drip Tray
- Control Panel – including controller
- Leak Detection System

The three units are arranged for two as duty and the other as standby, with automatic changeover in the event of the duty unit failing. The motorised damper in the standby unit will normally be closed to prevent air from the duty unit from passing back through the standby unit.

Condensate from each down flow unit is discharged via a dedicated condensate drain pipework system.

Each unit is enabled / disabled by the BMS and will operate on a 24 hour, continuous basis. The BMS start / stop command is wired via a normally closed digital output, such that if the controller fails, or is powered down, the output will default to 'start'. During normal operation, the outputs will remain enabled permanently, unless overridden off via manual command at the BMS operator interfaces.

Each unit is monitored for run and common fault operational status via hard wired inputs to the BMS system. On action of the Fire Alarm System, the air conditioning units will continue to operate.

2.6 GROUND FLOOR BATTERY ROOM COOLING

Two existing Direct Expansion (DX) cooling units were relocated to provide cooling within the Ground Floor Battery Room. The removal and recommissioning of these units was carried out by a Specialist subcontractor, Coolair Equipment Ltd.

All original refrigerant was safely and correctly reclaimed in accordance with the Environmental Protection Act.

Condensate from each DX unit is discharged via a dedicated condensate drain pipework system.

Each unit is enabled / disabled by the BMS and will operate on a 24 hour, continuous basis. The BMS start / stop command is wired via a normally closed digital output, such that if the controller fails, or is powered down, the output will default to 'start'. During normal operation, the outputs will remain enabled permanently, unless overridden off via manual command at the BMS operator interfaces.

Each unit is monitored for run and common fault operational status via hard wired inputs to the BMS system. On action of the Fire Alarm System, the air conditioning units will continue to operate.

2.7 GROUND FLOOR BATTERY ROOM EXTRACT VENTILATION

A new extract mechanical ventilation system has been installed to ensure that there is no build up of fumes from the UPS batteries during both charging and operation.

The system has been designed to run continuously, and the extract fan is controlled by a wall mounted Direct-on-Line (D.O.L) motor starter unit.

The extract system comprises:

- A door mounted transfer grille with integral fire block.
- A wall mounted egg crate extract grille.
- A fire damper installed where the ductwork penetrates the Battery Room wall.
- A bifurcated axial flow fan unit.
- An extract ductwork distribution system.
- An externally wall mounted Louvre.

The system discharges 100% of the vitiated air to atmosphere.

2.8 AUTOMATIC CONTROL SYSTEM / BMS

An Automatic Control System / BMS is installed within the Building. The system is manufactured by Siemens, and is provided to generally start, stop, operate and control the Mechanical Engineering Services and certain aspects of the Electrical Engineering Services with the minimum of supervision by maintenance personnel.

The Automatic Control System / BMS must only be operated and maintained by specifically trained personnel. Un-authorised operation or adjustment of this system could result in a risk to life and property, failure or damage to the overall services installation.

Alterations were made to the existing BMS system to provide suitable control within the new and altered Mezzanine and Ground Floor areas. The works on the automatic control system / BMS was carried out by a specialist sub-contractor, Building Automation Solutions (BAS) Ltd.

A detailed self contained operating and maintenance manual has been provided by BAS Ltd for all site wide works carried out, and has been provided to the Client separately. This documentation must be referred to and studied prior to operating or adjusting set points, etc., of any plant or equipment.

2.9 PIPEWORK

2.9.1 Refrigeration Pipework

All refrigerant pipework has been installed on pipework tray, and has been carried out in refrigerant quality soft or half hard drawn copper tubing compliant with BS EN 1057.

All pipework is supported at a minimum of 2 metre centres, and is tagged with an ID number (Condensing Unit reference.) at 3 metre intervals. All pipework was pressure tested using oxygen free dry nitrogen held for 24 hours and checked for leaks prior to connecting condenser units or other equipment.

2.9.2 Condensate Pipework

Condensate pipework from the indoor units has been suitably routed to suit the new works, and to discharge externally to the Building. All condensate pipework has been installed in copper tube to BS EN 1057, and has been adequately supported to prevent distortion.

2.9.3 Thermal Insulation

All the refrigeration pipework has been insulated with slip on close cell elastomeric pipe insulation manufactured by Armaflex Ltd, and fire rated to Class ‘O’ approval, as well as complying with the requirements of the Building Regulations 1985.

2.10 OVERVIEW OF ELECTRICAL ENGINEERING SERVICES

The electrical engineering services have been installed in accordance with the 17th Edition of the 'Regulations for Electrical Installations' (BS7671:2008) issued by the Institution of Electrical Engineers. The Works also complied with:-

- British Standards Specifications and Codes of Practice.
- The Requirements of the Local Electricity Supply Authority.
- The Factory Acts and Health and Safety at Work Act.
- The Electricity at Work Act.
- The Requirements of the Authoritative Fire Officer.
- Local Authority By-Laws and Regulations.

The new Electrical Engineering Services described within this Manual comprise the following:-

- Modifications to existing Main Switch Panels LV1 & LV2.
- Installation of a new UPS distribution switch panel.
- Installation of two 400kVA UPS units complete with associated battery racks.
- Installation of power metering.
- Sub-mains cabling.
- Lighting to new UPS Room at Mezzanine level.
- Small Power to new UPS Room at Mezzanine level.
- Electrical Supplies to Mechanical Services.
- Fire Alarm System Alterations.
- Earthing and Bonding.
- Removal of redundant equipment.

2.11 INCOMING SERVICES

The existing Services Infrastructure has not been amended. The methods of isolation therefore remain as existing and as previously defined by others.

2.12 LV SWITCH PANELS

The existing LV Switch Panels are split into two sections, with both being fed by a 1 MVA Transformer via 2000A ACBs. Each section is backed up by a dedicated generator.

The existing Power Factor Correction equipment and cabling on both main switch panels (LV1 and LV2) has been disconnected and removed. The existing 630A MCCBs within each switch panel have been upgraded to suitable types with an 800A capacity.

Three 240 mm^2 4 core XLPE/SWA/LSF cables connected in parallel will provide the feed from each of the new 800Amp MCCB within the LV Switch Panels to the new UPS Input/Output panel.

2.13 UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEMS

Two new Uninterruptible Power Supply (UPS) units have been installed as part of the upgrade works. The units have been installed within the newly formed UPS Room on the Mezzanine floor above the Ground Floor UPS Battery Room.

The UPS units are manufactured by Emerson Network Power, and are from their Liebert HiPulse E series range. Each UPS unit has a rated capacity of 400kVA (320kW). The units have been installed and commissioned to operate in a parallel redundant mode of operation, with an inbuilt static bypass facility.

The UPS units have been configured to provide an N+1 facility for the system, with the input and output ratings being configured for 400V AC, 3 phase, 50Hz, 4 wire operation. The UPS units are by design capable of handling non-linear loads and have an internal harmonic filter.

The general characteristics of the UPS system are:

- 12 pulse rectifier enabled (suitable for use in conjunction with generators)
- Input current THD <5%
- Flexible power walk-in
- Capability to handle 100% unbalanced loads
- Temperature compensated battery charging
- Generator interface card
- Remote alarm indication cards

The batteries for the new UPS system have been located at Ground Floor level in the new Battery Room. Each UPS unit has a dedicated battery rack. The wall mounted circuit breakers for each battery unit have been mounted within the Ground Floor switch room adjacent to the associated battery rack.

The batteries and racks were provided by Wetac Ltd under direct contract with the UPS specialist subcontractor, Emerson Network Power Ltd.

A new UPS Input/Output Panel, manufactured by Prism Power Ltd, has been installed within the new Mezzanine level UPS Room. The panel has been mounted on a proprietary 500mm plinth off the existing concrete slab to allow cables to enter and exit the panel from below as well as from above. As directed by the Client, the new panel provides a total of 16 outgoing ways, each rated at 200A.

The new panel is rated at 800Amps and has a fault rating of 80kA. Segregation and separation is provided to Form 4.6, and has a protection rating of IP31.

The existing UPS Input/Output Panel has been retained and essentially has become an extension to the new UPS Input/Output Panel. The existing panel has been left in-situ, but now receives its supply from the new UPS Input/Output Panel via a new 250Amp MCCB. This MCCB has been set to provide a maximum supply current of 200A. All the existing outgoing ways from this panel have remained unchanged.

The installation and commissioning of the new UPS systems was carried out by a specialist sub-contractor, Emerson Network Power Ltd.

A detailed operating and maintenance manual for the UPS units has been provided by Emerson Network Power Ltd, and is included within Section 15 of this Manual Set. This documentation must be referred to and studied prior to operating, adjusting, or carrying out any maintenance activities on the UPS installations.

As the main purpose of a UPS installation is not to allow its connected load to lose power, multiple circuits are provided to connected equipment, and incorporate internal bypass feeds around the power components in the UPS and maintenance bypass feeds around the entire UPS. These alternate and bypass feeds may not allow you to isolate the UPS for the purposes of lockout. Failure to understand how the UPS is supported electrically may result in a fatal electric shock.

2.14 POWER MONITORING SYSTEM

A power monitoring system has been provided by the use of suitable equipment manufactured by Schneider Electric Inc., from their PowerLogic range. The system monitors and logs the electrical distribution system energy consumption, energy losses, power quality, sag, swells, transients and harmonics.

Meters are installed at points indicated on the As Installed Drawings. These are connected into the Building's BMS system to provide for remote access to the captured data. This monitoring system records and analyses the historical loading trends of the electrical data and raises critical alarms based on these.

Monitoring is facilitated by the use of suitably rated Current Transformers, installed in accordance with the requirements of the metering equipment manufacturer, and compliant with the requirements of BS 3938.

2.15 GENERAL SMALL POWER DISTRIBUTION

A low voltage small power supply system is provided within the new Mezzanine floor area. The small power supply system serves outlet points for connection to fixed items of equipment and for portable appliances.

Small power distribution is provided by sub-circuit wiring from the local MCB distribution boards. Separate circuit protective conductors for each sub-circuit are installed throughout, to effectively earth the outlets to their respective distribution boards. Socket outlets for portable appliances are wall mounted and are complete with RCD protection.

2.16 GENERAL LIGHTING

Additional low energy, artificial lighting system is provided within the Works area, and the fittings are indicated on the As Installed Drawings. The new luminaires are surface mounted high frequency linear fluorescent luminaires, and the details of the units are contained within the Luminaire Schedule included in Section Nine.

The circuits are fed from local distribution boards, and are protected by miniature circuit breakers (MCB's) mounted within the distribution boards. Additional circuit protective conductors for each sub-circuit are installed throughout trunking and conduit systems to effectively earth the luminaires to their respective distribution boards. The new lighting circuits are manually switched from gang switches generally located adjacent to the doorways.

2.17 EMERGENCY LIGHTING

The augmented emergency lighting system within the Works areas complies with BS EN 1838 and BS EN 50172:2004.

Emergency lighting fittings are provided to assist with evacuation should the mains power or normal lighting systems fail. The fittings are indicated on the As Installed Drawings and within the Luminaire Schedule included in Section Nine.

Surface mounted high frequency linear fluorescent luminaires with emergency conversion units have been installed on suspended galvanised lighting trunking. The emergency lamps are illuminated by the integral battery via the inverter for a minimum duration of three hours in the event of mains failure to an emergency luminaire. The batteries automatically re-charge on restoration of the circuit electrical supply.

A key test switch is provided adjacent to the manual wall switch to enable testing for the correct operation of the emergency luminaires without the need to switch off the circuit M.C.B. A separate supply is provided to the emergency luminaire battery packs via the normally closed key test switch.

2.18 FIRE DETECTION AND ALARM SYSTEM

As part of the overall Works, minor alterations were made to the fire detection coverage within the Building.

Augmentation of the existing Fire Alarm System was undertaken to provide smoke detection and fire alarm sounders within the new UPS switch room at Mezzanine level. All the equipment used for the installation was of the same design and manufacturer as the existing system.

Work on the Fire Alarm System was carried out by a specialist subcontractor, Drax (UK) Ltd.

2.19 CABLE CONTAINMENT SYSTEM

A comprehensive containment system is provided to all areas of the Works.

This comprises:

- Galvanised steel ladder rack manufactured by Legrand Electric Ltd
- Galvanised steel tray manufactured by Legrand Electric Ltd
- Galvanised steel trunking manufactured by Legrand Electric Ltd
- Galvanised steel conduits manufactured by Allied Tube and Conduit Inc

The containment system accommodates cabling for the electrical power distribution, lighting, fire alarms, security, BMS, and earthing.

New high level heavy gauge ladder rack is installed from the Mezzanine switch room to the perimeter of the main switch room, to contain any future outgoing feeds from the new UPS Input/Output panel. Smaller heavy gauge ladder rack has also been installed within the Mezzanine switch room to contain the links between the new UPS Input/Output panel and the new UPS units. Tray, trunking and conduits are provided where necessary to accommodate other cabling.

2.20 EARTHING AND BONDING

An earthing and bonding system is provided throughout the Building to facilitate the transfer of electrical current to earth in the event of an electrical fault occurring within the supply system. The system also provides protection from interference from electro-magnetic fields and electro-static forces. The system is designed and installed, to protect personnel, the Building, structure, plant and equipment.

All extraneous and exposed conductive metalclad parts, which may be reasonably expected to be in contact with earth and which at the same time may be touched by a person in contact with the earthed metalwork of the electrical installation, are provided with supplementary bonding conductors.

Final bonding connections to pipework for both equipotential and supplementary bonding conductors are electrically and mechanically secured by pipe clamps. Bonding connections to metalwork are generally installed via a sheathed or crimped lug attached to the metalwork with a non-ferrous nut and bolt.

Supplementary bonding comprising cross bonding of metallic services is provided without independent connection to the main earthing system of the Building, wherever mechanical services systems (pipework, ductwork, etc) pass through fittings which are not electrically continuous.

All new circuit protective conductors, supplementary bonding conductors, equipotential bonding conductors and other earthing system conductors have been installed, tested and commissioned to the requirements of the 17th Edition of the Institution of Electrical Engineers Wiring Regulations (BS7671:2008), The Electricity at Work Regulations 1989 and British Standard BS 7430:1991.

All earthing bars are manufactured from high conductivity, solid drawn annealed copper, mounted on shock resisting insulators. They are all provided with removable test links to facilitate maintenance and routine testing.

Each final lighting and power circuit is provided with a separate circuit protective conductor (CPC) sized in accordance with the 17th Edition of the Institution of Electrical Engineers Wiring Regulations (BS7671:2008). Each CPC is run within the same conduit as the circuit being protected.

2.21 OVERVIEW OF BUILDING WORKS

2.4.1 Introduction

The following Building Works were provided for the new facility and to facilitate installation of the Mechanical and Electrical Engineering Services:-

- Construction of new block work walls
- Provision of a New Mezzanine Floor with UPS Room
- Raised Floor within the new UPS Room
- Fire Protection And Stopping
- Doors And Ironmongery
- Decoration
- General Builders work

2.4.2 General Building Works

Various general building works were carried out by PW Buiding Services. These included:

Ground Floor

- Demolition and removal of existing block work wall
- Installation of steel support beam
- Installation of new door and frame
- Construction of new block work walls to underside of Mezzanine floor level

Mezzanine Floor

- Installation of concrete planks to form Mezzanine floor
- Construction of Stud partition walls to form UPS Room
- Installation of raised access floor within UPS Room
- Installation of new door and frame
- Installation of steel access staircase and handrails

2.4.3 Access Staircase

A galvanised steel staircase and handrails has been installed to provide safe access and egress to the Mezzanine floor. The installed staircase complies with the currently applicable sections of the Building Regulations.

The supply and installation of the staircase was carried out by a specialist subcontractor, Fire Escape Ltd.

2.4.4 Structural Steelwork

The supply and installation of the structural steelwork was carried out by a specialist subcontractor, Fire Escape Ltd.

2.4.5 Raised Floor

A heavy grade raised access floor has been installed within the Mezzanine floor UPS Room.

The raised floor installation was carried out by a specialist subcontractor, L & G Raised Access Floors Ltd.

RESIDUAL HAZARDS AND HEALTH AND SAFETY

SECTION CONTENTS

3.1 INTRODUCTION

This Part of the Manual is concerned with the Health, Safety and Care of maintenance personnel whilst they are carrying out their duties and also the risks they impose on others if adequate protection and precautions are not provided.

Certain Risks, considered by the Author of this Manual, are identified within this Section, which could apply to Personnel Operating and Maintaining the Services described within this Manual. These considered Risks must be addressed by the 'Responsible Person' nominated by the Company carrying out the Operating and Maintenance Duties.

The Building Operator (the person overall responsible for the operation and maintenance of the Services Installation) must nominate a 'Responsible Person' to ensure that all operation and maintenance works are carried out in the safest possible manner, with minimum Risks. Additional Risk Assessments will be required to be produced to clearly identify the 'Responsible Person' opinions in these matters.

The Building Operator's Responsible Person for Health and Safety should carry out Risk Assessment's as required by the Health and Safety Commission, the Health and Safety Executive and EEC requirements. Reports, instructions and recommendations should be issued by the Responsible Person as necessary. This Operating and Maintenance Manual should then be suitably modified or addendum sheets issued, which must take precedence over this Manual.

It is probable that HSE requirements for Risk Assessments will be continuously reviewed, revised and updated. It is therefore essential that the Responsible Person is fully aware of latest requirements.

Note:

The Building Operator's Health and Safety Policies must also be strictly complied with. These are regularly reviewed and therefore all maintenance personnel must ensure that they are fully conversant and comply with the latest issues, together with any temporary requirements which may be in force. The Building Operator's current Health and Safety Policy must take precedence over the requirements of this operating and maintenance manual.

3.2 RESIDUAL RISK ASSESSMENT

For the purpose of this Manual 'Residual Risks' are deemed to be defined as Risks which have not been avoided, eliminated or transferred from the initial Risk Assessment and Method Statements for the project and / or would not be evident to personnel who are adequately trained and qualified to carry out the work task they are undertaking.

The initial Risk Assessments and Method Statements have been reviewed and it is confirmed that no Risks identified at that stage remain.

It is further confirmed the final installation in total has been considered, together with all required maintenance and operation activities. It is considered there will not be any unexpected risks or dangers if any maintenance, operation, removal and disposal works are carried out in accordance with normal accepted good practice by adequately trained, experienced and competent personnel.

On that basis it is considered there are no Contractor's Residual Risks associated with the Mechanical Services, Electrical Services and Building Works Installation.

3.3 GENERAL INHERENT RISKS ASSOCIATED WITH THE INSTALLATION

There will be certain inherent potential General Risks during the operating, maintenance and demolition of the Buildings and Engineering Services. These General Risks are typical of those to be expected and should be apparent to the skilled and trained personnel who carry out the tasks, or those who manage and supervise the tasks.

It is therefore essential that correct Industry Standards and Building Operator Standing procedures are strictly followed to ensure these risks are correctly managed and kept to a minimum. It is essential in particular that:

- Activities are correctly and safely controlled and monitored before, during and subsequent to the tasks being carried out.
- Method statements must be produced for all activities to ensure that all those involved have a full understanding of the tasks to be carried out and the method in which they should be undertaken.
- Risk assessments must be produced for all maintenance activities.
- Permit to Work Systems should be implemented to facilitate safe control and monitoring of works.
- The activities must be carried out by suitably trained, experienced and competent personnel or any personnel who do not meet these criteria must be adequately supervised by someone who does.
- Assumptions are not made.
- The correct tools are used for the tasks.
- The correct PPE is used by all operatives.
- All works are carried out with due diligence and in a professional manner.
- Safe procedures are always observed and unnecessary risks are not taken.

It is the Building Operator's responsibility to ensure the above matters are enforced and that Responsible Persons are nominated, as necessary, to manage and oversee the tasks.

3.4 RISK ASSESSMENT

During the operation and maintenance of the completed services, it is essential that the maintenance contractor carefully considers the Health and Safety implications of all of his actions.

Reference should in particular be made to the following:

- The Health and Safety at Work Act 1974, etc and Associated Statutory Instruments.
- The Control of Substances Hazardous to Health Regulations 2002 (COSHH) (amended 2004) incorporating Chemical (Hazard Information and Packaging) Regulations (CHIPS)
- The Health and Safety Commission document 'Legionnaires' Disease - The Control of Legionella Bacteria in Water Systems Approved Code of Practice and Guidance'.
- The Chartered Institute of Building Services Engineers publication TM13:2000 'Minimising the Risk of Legionnaires Disease'.
- The Electricity at Work Regulations 1989.
- The Electricity Supply Regulations 1989.
- The Institution of Electrical Engineers Regulations for Electrical Installations 17th Edition. (BS7671:2008).
- The Water Regulations.
- The Building Regulations.
- The Clean Air Acts.
- The Control of Pollution Acts.
- The Environmental Protection Act 1990.
- The Management of Health and Safety at Work Regulations 1999.
- Safety Symbols EC Directive 92/58/EEC.
- The Health and Safety (Safety Signs and Signals) Regulations 1996.
- British Standards.
- British Standard Codes of Practice.
- Manufacturers' Recommendations.
- Good Workmanship Practices.
- Any other relevant regulations, recommendations or requirements that may apply.

3.5 HEALTH AND SAFETY

3.5.1 Safety And Care Requirements

The Health and Safety at Work Acts are mandatory for all employers, employees and individuals. Failure to comply with the requirements could potentially be very dangerous and may lead to legal action against the individuals responsible, together with their employer.

Under the Health and Safety at Work Acts it is the responsibility of individuals to ensure that their own actions and the actions of any individuals under their control do not cause danger, injury or death to others. It is also the responsibility of individuals to notify The Health and Safety Officers and to do their utmost to prevent undue risk, danger, injury or death due to any improper actions or works carried out by any individuals or organisations of which they become aware.

In particular:-

1. It is the duty of every employer:
    a. To ensure, so far as is reasonably practical, that the Health, Safety and Welfare are maintained at work, not only for all his employees but also for other people who use his premises or are affected by his undertaking.
    b. To provide the information necessary for (a) above.
2. It is the duty of every employee whilst at work:
    a. To take reasonable care for the Health and Safety of himself and/or other people who may be affected by his acts or omissions at work.
    b. To co-operate with his employer or any other person, so far as is necessary, for the provision of the various relevant Acts to be complied with.
3. Harmful emissions must not be discharged into the atmosphere.
4. All places of work must be kept as clean as possible consistent with their use. Dirt and refuse must not be allowed to accumulate.
5. Work must never be carried out under conditions where there is any element of danger if it is reasonably practicable to eliminate the risk.
6. Safe access and working conditions must be provided to give adequate protection. Access doors and panels to all areas containing mechanical or electric plant must carry appropriate warning notices. Proper scaffold, guard rails, toe boards, ladders etc., must be provided and used.

7. Where appropriate protective equipment (e.g. goggles, screens, respirators, protective clothing, safety belts, etc.) must be used.

8. All materials and substances must be safely disposed of in accordance with the appropriate Regulations.

It is imperative that all personnel involved with the operation and maintenance of the services installation comply with the latest edition of the following relevant documents:-

- The Health and Safety at Work Acts and Associated Statutory Instruments.
- The Control of Substances Hazardous to Health Regulations 2002 (COSHH) (amended 2004) incorporating Chemical (Hazard Information and Packaging) Regulations (CHIPS)
- The Health and Safety Commission document 'Legionnaires' Disease - The Control of Legionella Bacteria in Water Systems Approved Code of Practice and Guidance'.
- The Chartered Institute of Building Services Engineers publication TM13:2000 'Minimising the Risk of Legionnaires Disease'.
- The Electricity at Work Regulations 1989.
- The Electricity Supply Regulations 1989.
- The Institution of Electrical Engineers Regulations for Electrical Installations 17th Edition. (BS7671:2008).
- The Water Regulations.
- The Building Regulations.
- The Clean Air Acts.
- The Control of Pollution Acts.
- The Environmental Protection Act 1990.
- The Management of Health and Safety at Work Regulations 1999.
- Safety Symbols EC Directive 92/58/EEC.
- The Health and Safety (Safety Signs and Signals) Regulations 1996.
- British Standards.
- British Standard Codes of Practice.
- Manufacturers' Recommendations.
- Good Workmanship Practices.
- Any other relevant regulations, recommendations or requirements that may apply.

3.5.2 Basic Safety Precautions

The following list contains basic safety precautions which should be observed when carrying out operation, maintenance or inspection of the services installation. The list is not necessarily complete due to the limitless range and permutations of activities resulting from these tasks.

1. Before attempting any task plan the method in which it will be undertaken. Always check that the activity to be undertaken is safe to do so in itself, will not cause damage to any other equipment, will not cause danger to others and will not cause any other equipment to become dangerous.

2. Before you start always inform a responsible person of your location, what tasks you will be undertaking and the estimated length of time you will be at that location. This is particularly important if you are working alone or in a remote location. Never attempt a job single handed if in doubt as to whether it is safe or adequate to do so. Never take risks.

3. Always ensure that adequate safety labels, notices, barriers and protective devices are provided to safeguard yourself and others. These must be non-metallic where located close to electrical appliances.

4. Always replace guards, access doors and other safety devices immediately the work in hand is completed. Never work on moving parts of machinery. Exercise extreme care if working on the stationary parts of machinery or in the close vicinity of machinery which is operating. Ensure that all moving parts of machinery are adequately protected by suitable guards.

5. Check regularly that the equipment, tools and devices you are using to undertake the task are correctly maintained, are not damaged or in need of repair or replacement and are the correct type for the task in hand.

6. Always ensure that personnel are adequately trained and capable in the tasks they will be undertaking.

7. Never lift, move or carry loads which are liable to cause personal injury. Suitable lifting or other tackle must always be used.

8. Adequate ventilation and lighting must be provided. Special precautions must be taken where there is a risk from steam, smoke, asbestos or other unhealthy or dangerous substances.

9. The means of escape from the building must be maintained and kept clear of obstructions at all times. Escape and emergency doors must be regularly inspected to ensure that they open freely.

10. First Aid boxes or cupboards must be provided in accessible positions and the supplies maintained. A responsible and readily available person trained in first aid treatment must be named and placed in charge of the equipment during working hours.

11. Always electrically isolate and remove fuses before working on or near plant or equipment and place a warning notice on the isolator and fuse carrier.

12. Always allow plant to stop naturally.

13. Do not place hands on any item of stationary rotating machinery as the equipment may start automatically and cause injury or damage.

14. Remove hand wheels from isolating valves where there is a risk that operation of such valve may cause danger or damage. Never rely solely on isolating valves to prevent water flow. Always install a temporary blanking flange as soon as possible.

15. Never smoke, use naked flames or use equipment likely to produce a spark when working on or near gas services. Smoking is not permitted within any Plant Room or service space.

16. Oil, chemical and water spillage's must be thoroughly cleaned and suitably treated to prevent danger to personnel.

17. Lighting levels within all Plant Rooms and service areas must be adequate to enable inspections and works to be correctly and safely executed.

18. Power operated hand held tools and hand lamps must conform to the required safety standards and be regularly inspected and certified as complying in accordance with the Portable Appliance Testing requirements of The Electricity Supply Regulations 1989 and of The Institution of Electrical Engineers Regulations for Electrical Installations 17th Edition. (BS7671:2008).

19. A high degree of cleanliness both of rotating machinery and static equipment is of the utmost importance. Loose materials, containers and paper must not be allowed to accumulate.

20. All drains must be cleared of silt or any refuse to ensure that they are free and unobstructed at all times.

21. Any potentially harmful or offensive emissions must not be discharged into the atmosphere.

22. Refrigerant gas should not be inhaled or exposed to a naked flame.

23. Refrigerant gas should be decanted and reclaimed and not discharged to atmosphere. It is unlawful to discharge refrigerants into the atmosphere.

24. Always use adequate protective clothing including suitable gloves, overalls and eye protection where there is a risk of refrigerant leakage. Physical contact with refrigerant can cause severe freeze burns. Acid from contaminated refrigerants and oils can also cause skin burns or irritation.

25. Always ensure that there is no risk of back-siphonage or contamination to water supply systems when using water supplies for maintenance tasks.

26. Always ensure that your spare hand is not touching any equipment when working on or near electrical components. Never touch two sides of a circuit simultaneously even if it is supposedly isolated.

27. Assume that every circuit is live until it is checked with a suitable instrument. Always check instruments with a known electrically live source before and after use.

28. Never remove a fuse from a live circuit unless essential. Always isolate the circuit first where possible. Always use the correct fuse puller on circuits which cannot be isolated.

29. All tools and instruments must have adequate electrical insulation. Never use metal rules near electrical equipment.

30. Never work on or near a live circuit unless essential. If it is essential, make sure that someone else is present at all times. That person must be familiar with first aid procedures associated with electrocution. Adequate protection must be taken against shock by the use of insulating stands, screens, boots, gloves, tools, etc. These must be inspected and checked immediately before use. Suitable caution notices should also be displayed to prevent interference or interruption by non-authorised personnel.

31. Fire fighting equipment must be provided, regularly tested, maintained and kept readily available. All extinguishers must be periodically examined and contents renewed as required.

32. Consider de-activating automatic fire-extinguishing equipment in the vicinity of works on electrical apparatus.

33. Always isolate or disconnect control circuits as well as power circuits to equipment being maintained.

3.6 FORMULATION OF A HEALTH AND SAFETY POLICY

To comply with the Health and Safety at Work Acts, the Client must nominate a Responsible Person to formulate a Health and Safety Policy which must include emergency procedures for all considered probable occurrences. The Policy must clearly state the procedures which should be adopted by all members of staff in the event of a considered emergency. The Policy must be made available to all members of staff and personnel using the building. The Policy should contain such matters as the key personnel to notify for the various possible emergencies, their location and telephone numbers, actions which should and should not be taken by personnel, description on the use of emergency facilities, etc. The contents of the Policy must take precedence over the contents of this Manual.

3.7 THE CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH

Legislation was introduced during 1988 with amendments subsequently issue in the form of The Control of Substances Hazardous to Health Regulations 2002 (COSHH) (amended 2004) incorporating Chemical (Hazard Information and Packaging) Regulations (CHIPS).

These Regulations stipulate general Legal requirements which must be observed by all firms and individuals governed by the Health and Safety at Work Acts. These include requirements for protective measures which must be taken to ensure the well being of personnel from any hazards during the manufacturer, use and disposal of any substance.

The COSHH Regulations also relate to further more detailed Legal Documents and Recommended Codes of Practice compiled by the Health and Safety Commission and the EC Directive, which provide requirements for specific subject matters. These include, in particular the following relevant Documents:-

- The Health and Safety Commission document 'Legionnaires' Disease - The Control of Legionella Bacteria in Water Systems Approved Code of Practice and Guidance'.
- The Electricity at Work Regulations 1989.
- The Electricity Supply Regulations 1989.
- The Environmental Protection Act 1990.
- The Management of Health and Safety at Work Regulations 1999.
- The Chemical (Hazard Information and Packaging) Regulations.
- Safety Symbols EC Directive 92/58/EEC
- The Health and Safety (Safety Signs and Signals) Regulations 1996.

Further Documents will be issued in the future. These will be enforceable under the COSHH Regulations. All maintenance personnel should ensure that they keep fully abreast of current requirements.

3.8 RISK ASSESSMENTS

The COSHH Regulations, Management of Health and Safety at Work Regulations and other associated documents detailed within the previous Sub-Section, place Legal requirements on Building Operators and employers to assess the level and extent of any risk resulting from the usage of the building, from activities carried out by personnel and from external risks to which personnel could be exposed.

It is necessary for Building Operators and Employers to carry out Risk Assessments, or to ensure that these are being correctly carried out by other persons, in order to comply with these Regulations. The requirements for Risk Assessments are extensive, relatively complicated and open to interpretation. Adequate Professional advice must therefore be obtained to ensure that the Legal and the Technical requirements are fully understood. The Risk Assessments must:-

- Identify risks;
- Include recommendations for reducing any un-necessary risks;
- Include recommendations for monitoring the Risks;
- Include recommendations for the operation and maintenance of the Risks;
- Include recommended procedures should there be an occurrence due to the Risks.

The recommendations contained within Risk Assessments must take precedence over information contained within this Manual.

It is also necessary for Building Operators and Employers to nominate a single 'Responsible Person' whose duty is to ensure that the requirements of each Risk Assessments are being carried out correctly. This single person must ensure:-

- That the Risk Assessment itself is correctly carried out;
- That the recommendations of the Risk Assessment are fully complied with;
- That the elements affecting the Risk are being correctly operated and maintained;
- That adequate precautions are being taken to minimise and control the Risk;
- That adequate documentation and log books are correctly maintained to record all matters associated with the Risk Assessment;
- That further necessary Risk Assessments are carried out due to changes or alterations occurring which may affect the Risk as and when necessary.

The duties of the Responsible Person are of a very important nature and the acceptance of such an appointment must not be taken lightly. It should be noted the Legal action could be taken against the Responsible Person if the required duties are not carried out correctly. In extreme cases this could involve imprisonment.

Requirements for the nomination of a Responsible Person and for Risk Assessments to be carried out are contained, in particular, within the following relevant documents:-

- The Health and Safety Commission document 'Legionnaires' Disease - The Control of Legionella Bacteria in Water Systems Approved Code of Practice and Guidance'.
- The Environmental Protection Act 1990.
- The Electricity at Work Regulations 1989.
- The Management of Health and Safety at Work Regulations 1999.
- Safety Symbols EC Directive 92/58/EEC
- The Health and Safety (Safety Signs and Signals) Regulations 1996.

3.9 THE CONTROL OF LEGIONELLOSIS INCLUDING LEGIONNAIRES' DISEASE

As detailed within the preceding Sub-Section, a Risk Assessment must be carried out with regard to the control of legionellosis including Legionnaires' disease. The requirements are detailed within the following particular documents:-

- The Health and Safety Commission document 'Legionnaires' Disease - The Control of Legionella Bacteria in Water Systems Approved Code of Practice and Guidance'.
- The Chartered Institute of Building Services Engineers publication TM13:2000 'Minimising the Risk of Legionnaires Disease'.

The Responsible Person must ensure that the Risk Assessment is carried out prior to placing the systems into operation and whenever alterations are made which may have an affect on the Risk.

The recommendations contained within Risk Assessment must take precedence over information contained within this Manual.

The Risk Assessment must consider the **Ductwork Distribution System And air conditioning condensate drainage removal system**.

In addition, risks associated with potential back flow from above ground sanitation and below ground drainage should be considered.

The Responsible Person must ensure that adequate documentation and log books are produced to enable the systems to be correctly and safely operated and maintained.

It has been determined by authoritative research that Legionella is a micro-organism which can exists within water and moisture. The organism favours temperatures between 20 and 40 °C, particularly where stagnant conditions occur.

It is known that the micro-organism can be effectively destroyed by temperatures in excess of 55 °C and by contact with chlorine and other biocides.

It is most important that Legionella be prevented from colonisation to reduce the risk of legionellosis and Legionnaires' disease.

It is essential that good housekeeping measures are taken to reduce the risk of colonisation of Legionella. Such measures are recommended within the documents detailed earlier within this Section.

3.10 ELECTRICAL TESTING AND PORTABLE APPLIANCE TESTING

The Electricity at Work Regulations 1989 place a legal obligation on Building Operators and Employers to ensure that all electrical equipment and appliance are correctly used, operated and maintained.

The actual requirements are extensive, relatively complicated and open to interpretation. Adequate Professional advice must therefore be obtained to ensure that the Legal and the Technical requirements are fully understood.

Generally compliance with The Institution of Electrical Engineers Regulations for Electrical Installations 17th Edition, with regard to periodic testing of electrical systems and Portable Appliance Testing (PAT), is considered adequate to meet the requirements of The Electricity at Work Regulations 1989. This however must be ascertained for this particular Building.

The required testing is likely to include:-

- Inspection and testing of all portable appliances on an annual basis or whenever the portable appliance is moved;

- Quinquennial inspection and testing of fixed appliances and installations (five yearly).

Adequate documentation and logs must be produced and maintained to record tests carried out. All appliances and sections of systems must be provided with unique references to ensure that the tests can be correctly recorded.

3.11 PERMIT TO WORK SYSTEM

A Permit to Work System must be implemented. This will provide the following benefits:-

- Ensure only correctly trained and experienced personnel undertake maintenance activities.
- To enable an outline approach and method of works to be determined and agreed to ensure that no personnel or plant hazard to the working environment is created.
- Ensure that maintenance may be carried out safely and that starting up or running of equipment presents no environmental hazard.
- Enable co-ordination of staff requirements in relation to maintenance procedures and operations to eliminate exposure of the workforce to any hazard.
- To ensure that the correct procedures for shutting down of systems are observed.
- To ensure that no work is undertaken on or close to moving equipment where guards or housings have been removed.
- To ensure that members of the maintenance staff only carry out work within their own discipline and job description.
- Reduce the risk of injury to maintenance personnel.
- Reduce the risk of injury to personnel in general.
- Reduce the risk of damage to, or incorrect adjustment of, the services installation.
- Assist with the monitoring of maintenance activities.
- Reduce the risk of the works being carried out in-efficiently.
- Provide evidence to the Health and Safety Executive that safety precautions against accidents are being taken.

The Permit to Work system operates on the basis that personnel are only allowed to carry out certain maintenance or operational activities if they possess a permit which has been issued and authorised by a nominated responsible person. The responsible person must be advised precisely of the tasks which will be undertaken. The responsible person must then satisfy himself that the person requesting the permit has adequate knowledge, experience and training to undertake the task and that the works will not adversely affect or be affected by other works being carried out or other requirements being imposed on the systems. Details of the works to be carried out are also entered into a log. The responsible person must be informed and approve when the works are to be commenced and completed.

The Permit of Work System could incorporate such matters as:-

- Any work on live electrical supplies (Note that it is illegal for any persons under the age of eighteen to work on live electrical supplies);
- Starting and shutting down of services;
- Any works involving hot work, naked flames or sparks;
- Any work involving shutting down of the electrical power system;
- Any work on the UPS or battery systems;
- Any work on the condenser / compressors;
- Any work associated with the use of refrigerants;
- Any works associated with chemicals;
- Any other works or activities where it is considered there is any potential risk.

3.12 WARNING AND SAFETY NOTICES

It is a requirement under the Safety Symbols EC Directive 92/58/EEC and The Health and Safety (Safety Signs and Signals) Regulations 1996 that all plant, equipment and services be adequately labelled to prevent Risks to personnel.

This includes all pipes and equipment containing or transporting dangerous substances, all Plantroom Areas, all fire fighting appliances, etc.

Notices covering First Aid and Resuscitation for Electric Shock must be displayed in all Plant Rooms.

At all times warning and safety notices must be maintained correctly, properly displayed and worded to provide clear instructions.

3.13 TRAINING

To increase awareness on the dangers to themselves and others and to ensure that correct procedures are taken in the event of an accident or emergency it is recommended that all maintenance personnel should attend regular training courses in such matters as the following:-

- First aid.
- Treatment of electric shock.
- Fire awareness and the use of fire fighting appliances.
- Plantroom awareness.
- Machineroom awareness.
- Developments in maintenance techniques.
- Security alerts.
- Any other applicable matters associated with Health and Safety.

In addition all maintenance personnel and others who may carry out any operation or maintenance activities should receive specific oral and written instruction and training associated with the extent of their responsibilities. This should include a statement of the activities they are authorised to carry out.

3.14 TOOLS

Using incorrect or poorly maintained tools and equipment is potentially dangerous and also will usually result in the maintenance activity taking longer to complete. It is therefore false economy to ignore the importance of obtaining and correctly maintaining adequate tools and equipment. Care must be taken when using tools and equipment to ensure that they do not cause damage to equipment or personnel. Care must be taken to ensure that un-authorised personnel are not accidentally harmed by their own or any other persons actions.

In particular:-

- Ensure that the correct tools and equipment are used for the task in hand. Regularly inspect, maintain and replace tools and equipment as necessary.

- Never leave tools unattended.

- Ladders must be the correct length and type for the purpose, fitted with non slip feet and adequately secured. A minimum of three feet overlap must be provided at the top of a ladder where it meets an access platform or other point of access. The bottom of a ladder must never be more than one quarter it's height away from the vertical. Both hands must be kept free and the body kept as close as possible to the ladder whilst climbing.

- Ensure that personnel are kept clear of the space below ladders and scaffolding. Provide adequate notices and barriers.

- Use only approved scaffold clamps and adapters for erecting scaffolding and ensure all wheels, swivels, etc., are locked when scaffolding is in use. Scaffold planks must be correctly supported without excessive overlaps. Adequate kick boards must be provided.

- All tools and equipment must be removed from scaffolding towers and ladders before moving or removal.

CLEANING, MAINTENANCE AND DEMOLITION

SECTION CONTENTS

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SECTION CONTENTS

4.1 INTRODUCTION

WARNING: BEFORE CARRYING OUT ANY MAINTENANCE WORKS ENSURE THE PLANT AND EQUIPMENT ARE ELECTRICALLY ISOLATED, SECURE AND SAFE. REMOVE FUSES AND SECURE MCB's WHERE NECESSARY TO ENSURE THAT THE PLANT CANNOT BE INADVERTENTLY STARTED.

The details contained within this Section of the Manual include the general requirements and procedures for maintenance of the Mechanical and Electrical Services installation and Builders Work, together with recommendations regarding the formulation of a Planned Preventative Maintenance System. Planned Preventative Maintenance Schedules for the installation are included with suggestions for the extent and frequency of maintenance activities.

Reference in particular should be made to manufacturers' and specialists' documentation which include further specific and important information regarding the requirements and methods of maintenance procedures.

It is of the utmost importance that a Planned Preventative Maintenance System be implemented, controlled and monitored to ensure:-

1. The installation operates correctly and efficiently;
2. Internal conditions are correctly controlled;
3. Plant and systems are available for operation when required;
4. The installation is maintained in a safe condition;
5. The installation does not fail prematurely.

Specialist equipment and trained personnel are required for certain maintenance activities. These must only be carried out by the manufacturer, agent for the plant or alternatively a specialist maintenance company.

The frequency at which maintenance should be carried out varies considerably due to various factors including hours of usage, type of usage, age, etc. It is therefore not possible to provide definitive advice in this respect and any references in this Manual to maintenance frequencies must only be considered as an initial guideline to assist with formulating a suitable programme.

Detailed records and log books must be kept describing all maintenance works carried out. The records should include a description of the works, the maintenance technicians name, time taken, materials used and any observations noted. This is essential in order to assist in future planning, budgeting and work scheduling. The log book should also include details of the operation of the plant regarding plant selection, performance, gauge readings and hours of operation. Gauge readings and other measurements should be compared with previous readings to ensure that the plant is performing correctly.

The Building Insurers and Fire Officer should be advised of the services installation and invited to submit any requirements they may have for the operation, maintenance, testing or the witnessing of these. It is essential that their requirements are strictly complied with.

Set points for equipment will be found within Volumes Two and Three of this Manual Set, where available.

4.2 RISK ASSESSMENTS

To comply with The Health and Safety Executives requirements, a Responsible Person must be nominated by the Building Operator to ensure that certain aspects of the installation are being correctly operated and maintained and adequate precautions are being taken to minimise and control risks to personnel. Refer to Section Three of this Manual, “Health and Safety, and Emergency Procedures ".

The Responsible Person must ensure that all necessary Risk Assessments and Log Books are produced and kept up to date. The Risk Assessments must be carried out prior to placing the systems into operation and whenever alterations are made which may have an affect on the Risk. The recommendations within the Risk Assessments must take precedence over information within this Manual.

4.3 DUPLICATE ELECTRICAL SUPPLIES

It should be noted that in addition to normal back up battery supply systems e.g. emergency lighting, fire alarms, security, etc., extensive use is made of Uninterruptible Power Supply (UPS) systems.

It is therefore essential that special consideration be given to the implications of this alternative supply system being activated either deliberately or accidentally. In particular do not assume that because an item of equipment is shut down that this has made the installation safe to work on or safe to be left unattended.

4.4 SPECIALIST SYSTEMS

Specialist Engineering Services have been installed which require the attention of specialist training, tools and equipment to ensure that they are correctly maintained. Certain aspects of these systems are required, by the Health and Safety Executive and Commission, to be maintenance in accordance with set procedures and by suitably qualified technicians. It must therefore be ensured that the specialist maintenance company accept responsibility to comply with all necessary Regulations, Legislation, Health and Safety Executive Recommendations, Manufacturers' Recommendations, British Standards, Codes of Practice and other Authoritative Guides and Recommendations.

It is recommended that a maintenance agreement be entered into with a specialist contractor for the following to be regularly maintained and tested. This should include Planned Preventative Maintenance, Corrective Maintenance and Breakdown Maintenance. The Client may also wish to consider the benefits of arranging maintenance agreements for other less specialist equipment:-

- Direct Expansion Comfort Cooling System
- Uninterruptible Power Supply (UPS) System
- Fire Detection and Alarm System

The actual correct operation of these systems will generally be determined during normal daily usage. Status indicating and warning lamps should be inspected daily.

4.5 TOOLS LIST

4.5.1 General

This Section of the Manual includes recommendations for tools and keys which should be made available for the maintenance technicians' use. These recommendations should be considered as the minimum requirement and do not include tools for specialist maintenance activities which are required to be provided by the specialist maintenance technicians. Recommendations are included for two levels of tool requirements:-

1. Normal operation and general maintenance of the services.
2. Specific maintenance tasks

Tools for normal operation and general maintenance of the services should be made readily available to all those responsible for the general daily operation and maintenance of the services. The tools under this category may be required a number of times each day and will facilitate access for inspection of equipment and components, enable general adjustments, tightening of loosened nuts and bolts, etc. The tools for specific maintenance tasks should also be made readily available but will generally only be required for planned preventative maintenance activities and unexpected failures.

4.5.2 Normal Operation and General Maintenance of the Services Minimum Recommended List of Tools

- One set of metric open ended and ring spanners
- One set of A/F and BA open ended and ring spanners
- 250 mm and 450 mm adjustable spanners
- Metrinch spanner
- Torque wrench
- 1/4 and 1/2 inch socket set, with extension bars, T-handle, ratchet, universal joint, etc.
- Set of A/F and metric hexagon keys
- 200 mm insulated pliers
- 150 mm long nose pliers
- 150 mm circlip pliers
- 200 mm pincers
- 250 mm mole wrench
- 250 mm multi-grip wrench
- Cord-less electric screwdriver with assorted bits
- Flat head, Philips and Pozidrive screwdriver set (insulated)
- Impact screwdriver with assorted bits
- Junior hacksaw
- 250 mm hacksaw
- Wanderlead light with rough service GLS or miniature fluorescent lamp
- Pop rivet gun
- Hand drill
- 15mm chuck variable speed electric hammer drill
- Set of twist drill bits
- Set of wood bits
- Set of masonry bits
- Set of countersink drill bits
- 8 oz., 16 oz and ball pein hammers
- Selection of files
- 3 metre steel rule
- 1 metre straight edge

6.5.2 Normal Operation and General Maintenance of the Services Minimum Recommended List of Tools continued

- Wire brush
- 250 mm scissors
- Centre punch
- Scriber
- Electronic thermometer (0 deg.C to 100 deg.C)
  with Binder, surface temperature and air temperature probes.
- Set of vent keys
- Soldering iron
- Fire alarm panel key
- Fire alarm call point key
- Set of paint brushes
- Floor tile lifting tools

4.5.3 Specific Maintenance Tasks Minimum Recommended List of Tools

- 250 mm and 450 mm stilsons
- 200 mm chain wrench
- Set of feeler gauges
- 100 mm electric grinder
- 15mm to 28mm pipe bender
- Micrometer and vernier gauge
- 600 mm spirit level
- Set of cold chisels
- Universal 2, 3 and 4 leg hub pullers
- 15 metre steel rule
- Set of wood chisels
- Air differential manometer with pitot static tubes
- Switchboard keys
- Clamp type Ammeter
- RCCB Tester
- 1000/500/250V Insulation Tester
- Multi Meter reading Volts/Amps/Ohms
- L-E Loop Impedance Tester
- Continuity Tester (Ohm Meter accurate to 2 decimal places)
- Insulated Wire Strippers
- Insulated "Side" Cutters
- Coloured Insulating Tape
- Crimping Tool plus assorted Cable Crimps
- "Heat-Shrink" Insulation Sleeving

4.6 GENERAL MAINTENANCE OF ELECTRICAL EQUIPMENT

Extreme care must be exercised whilst maintaining the switchgear, fusegear and associated control circuits and power supplies. It is strongly recommended that all maintenance personnel should be trained in the treatment of electric shock. British Standard BS 6423:1983 (with amendments 1992) "Maintenance of Electrical Switchgear and Controlgear" provides recommendations which should be followed during maintenance works.

The electrical power supplies and control circuits should always be isolated whilst carrying out works on the apparatus unless essential for the maintenance task. Always ensure that loose cable ends are insulated with tape and tagged with an identification mark.

When cleaning components ensure that all traces of cleaning agents, cloth fibres, bristles, dust and dirt, etc. are removed. Brushes and air blowers must not contain any metal fibres.

Any evidence of unusual noises or heat should be thoroughly investigated. These may indicate loose connections, poorly mating contacts, etc.

4.7 MOTOR CONTROL PANELS

Safety door interlock isolators should not be overridden unless essential for maintenance works. Where this is essential the panel must never be left unattended. Works within a panel must only be carried out by a qualified electrician.

The panels should be regularly checked to ensure that all integral isolation and circuit protective devices are functioning correctly and are not seized in one position. They should be regularly internally and externally cleaned, switches checked for damage or malfunction, instrument covers checked for damage, all components checked for security and door and access panel seals checked for integrity and to ensure they seat correctly.

Labelling, circuit charts, etc., should be cleaned, their fixings checked and read to ensure they are not fading or becoming illegible. Where alterations to the installation have been carried out the circuit charts should be checked to ensure that they have been correctly and fully amended to take account of the alterations.

Instrument readings should be regularly checked and compared to past records. Indication lamps should be regularly checked and replaced immediately if found faulty. Time switches should be re-set to suit British Standard Time and Greenwich Mean Time as soon as possible.

4.7 MOTOR CONTROL PANELS continued

A trip condition indicates that a motor has drawn an excessive running current, causing the starter inside the panel to cut out on high motor thermal overload protection.

This could be due to a high starting current, when the motor is faulty or fails to turn properly, or due to motor seizure.

After a trip condition, the plant must be reset by pressing the red button on the offending starters.

If tripping occurs frequently, examination of the motor is required to identify the problem. The full load running current should be checked on the motor housing nameplate and checked to ensure the starter overloads in the panel are set correctly.
On no account should an overload be adjusted in order to prevent the device tripping. If, after resetting, the overload trips again, then leave the device for approximately 1 hour to allow the element to cool.

If after resetting a second time, the device trips again, then further investigation is required. DO NOT keep resetting or attempt to change the overload to its auto reset position.

If the control panel appears to be 'dead' although power is still available, first check the control circuit fuse.

If any fuse has ruptured then the cause of the failure must be investigated before replacement. A fuse must always be replaced with one of the correct value as shown on the circuit diagram or fuse chart. Never replace with a different value fuse in order to avoid a further rupture occurring. Always use the correct replacement type and never use fuse wire, nails etc, even in an emergency.

Before assuming there is a panel fault, first check that the device has not manually been turned off either at the panel or at any local isolator. Ensure fuel, if required, is available and that all safety devices are 'healthy'.

4.8 CONTROL SETTINGS

All control set-points, differentials, proportional bands, authorities, integral times, etc., should be checked and recorded on schedules prior to maintenance works for future reference. This will assist should any settings be accidentally disturbed at a latter date. Adjustment of control settings without a full appreciation of the implications can result in serious limitations in the control ability of the system. Therefore any re-adjustments or correction of faults should only be dealt with by trained personnel having a full appreciation the control philosophy. To that end, all control devices should be tamper-proof wherever possible and covers should be kept securely in place utilising any locking devices provided. Consideration should also be given to removing adjusters to prevent unauthorised tampering.

All control devices should be kept clean. A device which has been damaged should be replaced even if it appears to operate correctly. Once damaged the accuracy of a control device cannot be relied upon.

Sensors should be kept clean with covers kept securely in place to ensure accurate measurements occur. Where temperature sensors are located in pockets, rather than in direct contact with the medium, it is essential that the gap between the sensor and pocket be filled with heat conducting oil or grease. A sensor which has been damaged should be replaced even if it appears to operate correctly. Once damaged the accuracy of a sensor cannot be relied upon.

4.9 STARTERS

Electrical supplies should be isolated and covers and enclosures cleaned with a soft cloth and brush before being opened or removed. The starters should be inspected in detail for indication of over-heating, cracking of casings, etc. Ensure that all ventilation openings are un-obstructed.

Testing of starters should be carried out under all operating modes (e.g. hand, auto, etc.). When testing an allowance of 30 seconds per kW of motor rating, with a minimum of 60 seconds, should be allowed between starts to reduce strain and overheating.

The operation of local lock-stop buttons and isolators should be regularly checked to ensure that they prevent the associated motors from running.

4.10 OVERLOADS

Overloads should be set to suit the nameplate full load current rating of the motor rather than the actual current it consumes. All overloads, unless specifically stated to the contrary, should be selected for "hand" reset. Adequate time should be allowed for an overload to cool before resetting.

Overloads should be tested regularly for single phase protection and over-current protection. Single phase protection can be tested by withdrawing one fuse only and then attempting to start the motor. The overload should generally trip within two minutes. Over-current protection is not possible to test unless the motor can actually be overloaded or held in a "stalled rotor" state. Therefore the test method usually adopted is to reduce the setting to a value below the drawn motor current and note the time taken at a measured current value for the overload to trip. This value should then be compared with the manufacturer's current/time characteristics curve for the overload and should be within plus/minus 20% of the corresponding time on the curve. These curves are theoretical only and do vary according to conditions and application.

4.11 SWITCHBOARDS

Safety door interlock isolators should not be overridden unless essential for maintenance works. Where this is essential the panel must never be left unattended. Works within the Board must only be carried out by a qualified electrician.

The Boards should be regularly checked to ensure that all integral isolation and circuit protective devices are functioning correctly and are not seized in one position. They should be regularly internally and externally cleaned, switches checked for damage or malfunction, instrument covers checked for damage, all components checked for security and door and access panel seals checked for integrity and to ensure they seat correctly.

Labelling, circuit charts, etc. should be cleaned, their fixings checked and read to ensure they are not fading or becoming illegible. Where alterations to the installation have been carried out the circuit charts should be checked to ensure that they have been correctly and fully amended to take account of the alterations.

Instrument readings should be regularly checked and compared to past records. Indication lamps should be regularly checked and replaced immediately if found faulty.

4.12 DISTRIBUTION BOARDS / POWER DISTRIBUTION UNITS

These should be regularly checked to ensure that all integral isolation and circuit protective devices are functioning correctly and are not seized in one position. This work should be carried out by a qualified Electrician. They should be regularly internally and externally cleaned, checked for security and to ensure doors and access panels seal correctly.

Labelling and circuit charts should be cleaned, their fixings checked and read to ensure they are not fading or becoming illegible. Where alterations to the installation have been carried out the circuit charts should be checked to ensure that they have been correctly and fully amended to take account of the alterations.

4.13 SWITCHGEAR

Switchgear should be inspected and cleaned quarterly using a vacuum cleaner, soft cloth and brush. Moving contacts and mechanisms should be lightly smeared with petroleum jelly after cleaning. Connections should be checked for security.

4.14 UNINTERRUPTIBLE POWER SUPPLY SYSTEM (UPS)

An operational fault within the uninterruptible power supply system should activate an alarm. The units should however be generally checked for correct operation on a daily basis.

In addition to routine inspection, the operation of the system must also be regularly checked in detail by a specialist technician, familiar with the particular arrangement.

The full maintenance of the UPS system is a specialist operation which must be carried out by specialist trained technicians having the necessary knowledge, equipment, tools and materials. A maintenance agreement should be entered into to include all routine planned preventative and breakdown maintenance.

4.15 LEAD ACID BATTERIES

Lead acid batteries are provided for the uninterruptible power supply system control circuits, and fire alarm system.

Batteries require regular attention. Battery ratings will reduce if they are not correctly maintained. The battery and the battery area must be kept clean and dry. To avoid contamination of the battery, vent plugs where provided must be in place before cleaning.

Filled and charged batteries must always be stored in a cool, dry, well ventilated place. The vent caps, where provided, must be securely screwed down, or pushed home at all times, except during maintenance.

The battery terminals and connections must be kept free from corrosion and coated in petroleum jelly.

The batteries are 'maintenance free' and therefore the electrolyte should not require topping up under normal usage. If it is found the electrolyte level does require adjustment it should be ensured that only distilled or de-ionised water is added in accordance with manufacturers' recommendations. The vent plugs must be correctly replaced once filling is completed. Never add ordinary tap, bottled water or well water to lead acid batteries and never allow the battery electrolyte to drop below the top of the plates.

Battery recharging must take place when the Specific Gravity drops below 1.220 until the Specific Gravity in all cells rises and remains constant for 3 hours. In all cases where use is infrequent, batteries must be put on a monthly re-charge schedule to ensure that a fully charged condition is maintained.

Caution: Never allow a battery to become completely flat (fully discharged), or to stand in a discharged condition, or damage will result.

Always remove the vent caps before carrying out charging.

Do not put a filled battery into storage without first giving the battery a commissioning charge.

Batteries must be given a further charge every 6 months at the normal initial charge rate until the voltage and specific gravity cease to rise.

At the end of the charging process, the electrolyte levels must be checked and restored, if necessary, by the addition of electrolyte of the specific gravity. The vent caps must then be replaced. Any further topping up of the electrolyte must be made using distilled or de-ionised water.

4.16 FUSES

Fuse-links should always be mounted so that their indicator windows are visible without the need to remove the fuse. If a fuse rating is changed for any reason ensure that the fuse chart is amended. Never change a fuse rating unless system requirements have changed. Never bridge a fuse or withdraw a fuse from a circuit which is passing current.

Fuses will be affected by degradation. This will depend upon many factors including the loads which are imposed on the fuses.

It is of the utmost importance that when fuses are replaced, the new fuses have the same design device characteristics as the fuses they replace.

4.17 CONTACTORS

Contactors should be regularly inspected in detail. Electrical supplies must be isolated. Covers and enclosures should be cleaned with a soft cloth and brush before being opened or removed.

Check for noisy operation. Excessive humming or chatter from contactors and relays is usually due to the following:-

i. Dirt on the magnet faces.

ii. Magnet faces touching (there should always be a small air gap when energised).

iii. Magnet shading ring broken.

Check for indication of overheating, cracking or deterioration. These items cannot be services. Replace if necessary.

4.18 CABLE TRAYS, LADDER RACK, BASKET TRAY, CONDUIT AND TRUNKING

Cable trays, ladder rack, basket trays, trunking and conduits do not require regular planned preventative maintenance although visual inspections should be carried out especially in areas where they may be subject to damage or corrosion. Consideration should be given to repairing damaged components and any cables which may also have been damaged. Corrosion and rust should be suitably treated or sections replaced as necessary.

4.19 ISOLATORS, SWITCHES, SOCKET OUTLETS MCB's, ACB's, MCCB's AND RCD's

These should be cleaned and checked for correct operation at least every year.

Test pushes are provided to enable testing to ensure that contacts will be released. These should be pressed quarterly to ensure that they trip correctly and then re-set to enable the unit to operate correctly. The Department Managers should be advised before testing takes place to ensure that any connected equipment is safely shut down beforehand and a Permit to Work obtained.

Circuit breakers are generally capable of performing three interrupting operations at their service short circuit breaking capacity and two operations at their ultimate short circuit breaking capacity without maintenance. After this duty has been performed, miniature and moulded case circuit breakers must be replaced, if required by the manufacturer, and air circuit breakers maintained in accordance with the manufacturer's instructions. The same degree of wear may result from the performing of a larger number of operations at a lower short circuit current. If there is no record of the operations that have been performed since the last maintenance, suitability for further service may be assessed by considering the contact erosion, available contact over-travel, chute erosion and insulation strength.

4.20 ELECTRICAL TESTING

The electrical system must be regularly checked for damage, corrosion and decay.

Terminals should be inspected for security and to ensure that identification tags are in place. Sheathing must be intact.

Testing for the complete installation must be routinely checked in accordance with the requirements BS 7671: 2008 (The 17th Edition of The Institution of Electrical Engineers Regulations for Electrical Installations).

These must be carried out in the following order in accordance with BS 7671:2001:

Sequence of Inspection and Testing of Electrical Services

Before Connection of The Supply:

1. Continuity of Protective Conductors
2. Main and Supplementary Bonding Continuity
3. Continuity of Ring Final Circuit Conductors
4. Insulation Resistance
5. Sire Applied Insulation
6. Protection by Separation
7. Protection by Barriers and Enclosures
8. Insulation of Non-Conducting Floors and Walls
9. Polarity
10. Earth Electrode Resistance With an Earth Electrode Resistance Tester (Or Alternatively See Item 11 below)

With Supply Connected:

11. Earth Electrode Resistance Using The Earth Fault Loop Tester or Ammeter and Voltmeter Method (Or Alternatively See Item 10 Above)
12. Confirm Correct Polarity
13. Earth Fault Loop Impedance
14. Correct Operation of Residual Current Devices
15. Correct Operation of Switches and Isolators

It is anticipated that Testing will be required initially every five years (Quinquennial), although reference must be made to the latest Test Reports for confirmation of future Testing Frequencies.

4.21 FIRE ALARM SYSTEM

A maintenance agreement must be entered into with a specialist contractor for the system to be regularly maintained and tested in accordance with British Standard BS 5839. Maintenance, adjustments and repair of the system must only be carried out by the specialist maintenance company.

In addition to the specialist contractor's duties the control panels should be inspected on a daily basis for fault indication and the alarm and zone circuits tested weekly in accordance with BS 5839. All results and details of tests must be recorded in a Fire Alarm Log Book. All devices should be cleaned externally on a weekly basis using a soft cloth dampened if necessary.

Any faults must be attended to as a matter of priority and alternative temporary methods provided, as necessary, to ensure that personnel safety and safety of the building are fully considered. The Building Insurers should be informed immediately should the system be inoperable.

4.22 LIGHTING AND LUMINAIRES

The operation and correct functioning of all switches and circuits should be checked regularly.

Consideration should be given to changing lamps as part of the Planned Maintenance Procedure on a regular basis. This will ensure maximum light output from the luminaires and reduce the risk of lamp failure. The frequency for replacement will vary dependant upon the types of lamps, hours of usage, maintenance budgets and maintenance policy. Reference should be made to the manufacturers' technical data and pricing lists when determining an economic replacement frequency. It will generally be found economically beneficial to change fluorescent lamps which are in use for between eight and twelve hours per day approximately every two years. Any lamps which do fail should be replaced as soon as possible

The gases inside lamps are harmful to the environment and personnel. Lamps must be carefully disposed of to avoid breakage. Disposal should be in a purpose designed crusher. Alternatively the un-broken lamps should be collected and disposed of by a Licensed Waste Collector. New and old lamps must be stored in locations where they cannot be broken accidentally or by vandals. Failure to ensure that the harmful gases are not released into the atmosphere could result in Legal Action against individuals and the Company under The Control of Substances Hazardous to Health Regulations 2002 (COSHH) (amended 2004) incorporating Chemical (Hazard Information and Packaging) Regulations (CHIPS) and The Environmental Protection Act 1990.

4.22 LIGHTING AND LUMINAIRES continued

Luminaire diffusers, covers and reflectors should be cleaned at least every six months as part of the Planned Maintenance Procedure using a specialist cleaner. Cotton gloves should be worn when handling diffusers and reflectors to limit damage. Luminaire fixings should be checked at the time of cleaning. Any signage provided should also be checked to ensure it is correct and is legible.

Lighting levels do not require checking under normal maintenance. Where partition layouts or the usage of rooms have been changed it is advisable to check the resultant levels with a meter and compare the results with an authoritative Design Guide, such as the Chartered Institute of Building Services Engineers. Lighting levels must only be checked by a trained and qualified engineer or lighting specialist.

The Emergency Lighting System must be routinely tested by a **Competent Person**. The Building Operator's nominated **Health and Safety 'Responsible Person' must ensure that:**

1. The person carrying out the testing is adequately trained, qualified and experienced to carry out the tasks
2. The person carrying out the testing is adequately familiar with the emergency lighting arrangement, in total, within the Building
3. The person carrying out the testing has adequate documentation (drawings, Log Books, etc) to enable the tasks to be carried out correctly

Any defects noted associated with the system **must** be recorded in the Log Book and must be corrected immediately or if this is not possible, as soon as practically possible. The person responsible for testing the system should be given authority to have any repairs conducted as necessary without delay.

Testing procedures are required to be carried out:

- **Daily**
- **Monthly**
- **Six Monthly**
- **Annually after the battery system has been installed for three years**

The **Daily Test** comprises a visual inspection of the emergency luminaires and a check to ensure that any previously reported deficiencies or failures have been rectified.

The **Monthly Test** comprises a practical test to ensure each emergency luminaire functions correctly.

4.22 LIGHTING AND LUMINAIRES continued

The **Six Monthly Test** comprises a detailed examination of each emergency luminaire, a practical test to ensure each emergency luminaires function correctly and general cleaning of the fitting.

All tests **must** be recorded in an Emergency Lighting Log Book.

Testing **must** be carried out with the batteries in their fully charged condition.

The tests carried out on the emergency luminaires must **only be carried out after the system has been reinstated and remained on line for at least twenty four hours, to ensure that the batteries are fully charged.**

Do not **carry out testing within three hours preceding darkness or during darkness. Otherwise personnel may be at unnecessary risk should the electrical supply system fail as the emergency luminaires may not function correctly. Consideration must also be given when carrying out testing within any other areas where natural light is not available.**

The Building Operator's nominated Health and Safety 'Responsible Person' should operate a Permit to Work System to ensure correct testing procedures are carried out.

All emergency luminaires must be tested on a monthly basis to check for correct operation. The Monthly Test should last no longer than 45 minutes.

Additionally, every 6 months, the luminaires must be fully tested for at least one third of the rating of the batteries (for one hour) during the first three years battery life, and for their full duration of rated running period (3 hours), annually thereafter.

4.23 MAINTENANCE OF THERMAL INSULATION

Any insulation removed from pipework, ductwork, plant, etc., for the purpose of maintenance or repair should be replaced on completion of the work. Vapour seals, paint finishes and identification markings must be maintained in good condition. Energy wastage and condensation may occur if insulation is not complete or vapour seals are not continuous.

Insulation should be inspected regularly for external damage, signs of deterioration, slack or missing securing bands, bonding of adhesive, etc. Staining on insulation surface may be evidence of system leakage.

4.24 MAINTENANCE OF AIR FILTERS

4.24.1 Air Pressure Differentials

Where the facility is provided, differential air pressures across filters should be checked regularly and compared with manufactures' recommendations. The air volume flow through the system will decrease as the differential pressure increases and the fan motor absorbed electrical power will probably increase. To avoid system operating deficiencies and increased energy consumption the filter elements must therefore be cleaned or renewed before the differential pressure rises above the recommended maximum figure.

4.24.2 General Requirements

An adequate stock of filter elements should always be maintained on site irrespective of whether they are of the washable or throw away type.

The fan must be de-energised and allowed to come naturally to rest before removing the filter access panel.

Washable filters should be cleaned in accordance with the manufacturer’s instructions and left to dry naturally. Manufacturers usually recommend cleaning in a weak water and detergent solution; however some manufacturers recommend their own cleaning agent. Reference in this respect should be made to the individual manufacturer's operating and maintenance manuals.

Filters must always be replaced in the correct direction of air flow unless they are of the type which operates in either direction.

Any accumulated dirt must be wiped from the retaining channels and frames prior to replacing the filter, using a soft cloth and mild detergent solution or cleaning agent. The access panel seals should be closely inspected for damage and integrity and to ensure that they are seated correctly. The seals should be replaced if they are not in good condition.

When the filter has been replaced the access panel should be closed and the fan energised. The access panel should be inspected to ensure that a good air tight seal has been maintained. Particular care and attention should be taken when replacing filters to ensure that dust, dirt, debris or any other contaminants do not enter the ductwork system or the space which they serve. Clean protective clothing and gloves should be worn and the highest standard of cleanliness observed at all times.

4.25 MAINTENANCE OF BEARINGS

4.25.1 General

It is essential that correct and adequate lubrication is provided for bearings. This includes ensuring that lubricants are maintained in the correct quantities and replaced as necessary. Bearing surfaces can be damaged when the bearing remains stationary for long periods. It is therefore recommended that run and standby motors are changed over at least every week and other normally stationary shafts are also rotated at least every week. Spare motors must be stored in strict accordance with manufacturers' recommendations, usually up-right on the motor end. Spare motors should only be stored for essential plant.

When removing or replacing bearings, always use the correct procedures and tools. Always ensure that all parts likely to damage oil seals (threads, etc.) are taped up. Take particular care of bearings which are to be re-used. Ensure they are kept clean and not subjected to ill-treatment, in-correct leverage, hammer blows, etc.

To ensure maximum life it is advisable to re-lubricate a new bearing after two days operation (except sealed for life bearings). The temperature and correct operation of new or re-lubricated bearings should be monitored for 3 hours. A healthy bearing emits a low humming noise, a dry bearing emits a squealing noise and a damaged bearing emits a rumbling irregular noise

4.25.2 Grease-Lubricated Bearing

Good quality lithium hydroxystearate grease containing anti-oxidant, anti-rust and anti-wear additives should be used for general purposes. Where excessive temperatures or moisture are likely to be encountered special consideration should be given to the type of grease used and manufacturers recommendations obtained.

When packing or lubricating bearings with grease ensure that the bearing is clean, oil free and dry, otherwise the grease will not adhere properly to surfaces and will de-grade. The bearing should be packed as fully as possible with grease but adequate space allowed in the housing for displacement and expansion. If overfilled the grease may break down due to excessive overheating and will then not provide the correct protection to the bearing. Where it is known that overheating has occurred the grease **and** the bearing should be replaced.

It is normal for a rolling bearing to run hot for a few hours after lubrication until the grease distributes itself between the bearing and the housing.

It is essential before replenishing grease bearings to ensure that the vent hole, relief plug or relief valve are clean, free to operate and any caps fitted removed to prevent pressurisation of the bearing or escape of grease through the seals. Grease should be added using a low pressure type grease gun with the correct connector, preferably with the drive in motion. Relief plugs must not be replaced until all excess grease has been expelled.

Bearings should generally require replenishing with grease every six months. Bearings and their housings should generally be cleaned of all grease traces and re-lubricated every twelve months. Manufacturers' requirements must however be complied with if more frequent attention is recommended due to loadings, temperatures or usage. The bearing manufacturers produce usage against lubrication graphs which should be referred to should operating conditions change, or when bearings are replaced with a different type.

4.26 MAINTENANCE OF GENERAL VENTILATION DUCTWORK, DAMPERS AND AIR TERMINALS

The ductwork system should be regularly inspected to ensure that brackets, flanges and connectors are secure and for evidence of corrosion and air leakage.

Volume control dampers should be operated every six months through their total range of travel and returned to the correct regulated position. The damper quadrants should be marked and the dampers locked in position. The dampers should also be cleaned and pivots and linkages lubricated with oil.

Fire and smoke dampers should be tested in an agreed programme, to the strict requirements of the Fire Officer and the particulars recorded on logs at the time of the test. These tests are usually required on an annual basis. Fusible links and dampers should be cleaned where accessible using a soft cloth, brush and a detergent and water mixture or proprietary cleaning agent. All moving parts should be lightly oiled using a general purpose lubricant.

Grilles, diffusers and louvres should be cleaned every six months together with the surrounding areas if staining has occurred using a detergent and water mixture or proprietary cleaning agent.

4.27 MAINTENANCE OF VENTILATION FANS

Fans should operate without excessive noise or vibration. A detailed inspection of the fan, anti vibration mountings, flexible connections, drive arrangements and all components should be regularly carried out. The security of all bolts, nuts, screws and other fixings should be regularly checked to ensure that they have not worked loose due to vibration.

The performance of the equipment should be checked against the original system commissioning reports for fan shaft speed, air velocity, pressure and motor full load current after major fan or motor overhauls.

4.28 DUCTWORK AIR QUALITY AND SAMPLING

Provisions have been incorporated within all ductwork to facilitate regular inspection and cleaning.

A complete internal inspection of the installation together with sampling for supply air quality and contamination should be carried out annually. A specialist Accredited Company should be employed to carry out the sampling and analysis.

Disinfecting of the supply air system should be carried out if considered necessary after analysing the samples.

4.29 MAINTENANCE OF ELECTRIC MOTORS

4.29.1 General

Standard electric motors should not be subjected to excessive temperature, dust and moisture. Where necessary, specially designed motors should be used for this purpose.

Temperatures should be regularly checked to ensure that bearings and windings are not overheating. Specific manufacturers' instructions relating to checking for bearing wear, end float and permissible running temperatures should be carefully noted.

Motor casings should be cleaned and inspected to ensure that ventilated openings are not obstructed. A vacuum cleaner, clean cloth, cleaning agent and fan powered blower (not compressed air) should be used to remove deposits. Electrolytic capacitors should be checked for signs of overheating and liquid leakage.

Bearings should be carefully examined during inspection or overhaul of the plant served by the motor and replaced if excessive wear is noticeable.

4.30 DOWNFLOW AIR CONDITIONING UNITS

4.30.1 General

The correct operation of the downflow air conditioning units is critical. Consideration should therefore be given to a maintenance agreement being entered into for these units to be maintained.

Maintenance should be carried out every three months.

4.30.2 Filters

The changing of the unit filters and general unit external cleaning may be carried out by the Client's trained maintenance technicians.

4.30.3 Cooling Coils

Regular maintenance of cooling coils is essential to ensure that they will operate in accordance with design requirements at times of peak load and also to reduce the risk of harmful bacteriological growths.

Cooling coils should be inspected and flushed through every month with disinfectant. The effectiveness of the condensate drainage system should checked at the same time to ensure that the condensate discharges correctly. The condensate traps should be left filled with water.

During the Building Operator's Risk Assessment for legionella (refer to Section Three of this Manual) consideration could be given to inserting disinfectant pads within the condensate tray system. This may be considered adequate to avoid the need for monthly inspections.

The fan should be isolated and the coil temperature allowed to stabilise prior to cleaning the cooling coils. The maintenance technician should wear protective overalls, eye protectors, head protector, gloves and a filtered face mask.

The coil fins and headers should be cleaned using a soft long bristle brush and small short bristle brush, with a mild detergent solution. Light pressure should be applied to dislodge contamination and to clean the coil. If the coil is heavily contaminated a high pressure water spray will assist the cleaning process. **Do not use steam cleaners.**

All particles removed should be collected by vacuum cleaner or pan and brush. The fins should be inspected to ensure that they are straight. Bent fins should be straightened using pliers or a purpose designed comb. Damaged fins should be repaired or replaced.

When all visible contamination has been removed the coil, headers and enclosure should be rinsed using the brushes with clean water. The water should then be removed using a clean absorbent cloth. The coil, headers, enclosures should finally be cleaned with disinfectant using a clean brush and cloth. The condensate pan and drainage system of cooling coils should be disinfected.

Each refrigeration circuit must be regularly checked for leaks. If a major leak is found a full dehydration procedure must be carried out after repair.

The installation, testing and charging of refrigeration systems is a specialist operation which must be carried out by specialist refrigeration engineers having the necessary knowledge, equipment, tools and materials. Moisture and dirt must at all times be excluded from the refrigeration circuits.

Note: It is a Legal requirement that refrigerant must not be discharged into the atmosphere. This includes intentional and un-intentional discharges.

4.30.4 Fans

The fans should operate without excessive noise or vibration. A detailed inspection of the fan, anti vibration mountings, flexible connections, drive arrangements and all components should be carried out. The security of all bolts, nuts, screws and other fixings should be regularly checked to ensure that they have not worked loose due to vibration.

The performance of the equipment should be checked against the original system commissioning reports for fan shaft speed, air velocity, pressure and motor full load current after major fan or motor overhauls.

4.31 CONDENSER UNITS

4.31.1 General

It is essential that the correct air flow is available across condenser coils.

The manufacturer's specific maintenance manual includes detailed requirements and instructions for the maintenance of the plant. These works must be carried out by trained and competent technicians. It is recommended that the supplier or another specialist maintenance company be employed to carry out these works. The operation of the refrigeration system must be regularly checked by a specialist refrigeration technician, familiar with the particular arrangement.

4.31.2 Cleaning Condenser Coils and Fins

Dirt or scale on fins and tubes must be regularly removed. Loss of heat transfer may result in operational problems with the refrigeration circuit.

The maintenance technician should wear protective overalls, eye protectors, head protector, gloves and a filtered face mask when cleaning the coils.

The coil fins should be cleaned using a stiff long bristle brush and small short bristle brush, with a mild detergent solution. Light pressure should be applied to dislodge contamination and to clean the coil and fins. If the coil fins are heavily contaminated a high pressure water spray will assist the cleaning process. If a spray is used the technician must wear positive pressure breathing apparatus. **Steam must never be used to clean refrigerant coils**.

All particles removed should be collected by vacuum cleaner or pan and brush. The fins should be inspected to ensure that they are straight. Bent fins should be straightened using pliers or a purpose designed comb. Damaged fins should be repaired or replaced

When all visible contamination has been removed the coil and fins should be rinsed using the brushes and clean water.

4.31.3 Refrigeration Charge

Each refrigeration circuit must be regularly checked for leaks. If a major leak is found a full dehydration procedure must be carried out after repair.

The installation, testing and charging of refrigeration systems is a specialist operation which must be carried out by specialist refrigeration engineers having the necessary knowledge, equipment, tools and materials. Moisture and dirt must at all times be excluded from the refrigeration circuits.

Note: It is a Legal requirement that refrigerant must not be discharged into the atmosphere. This includes intentional and un-intentional discharges.

4.32 DIRECT EXPANSION COMFORT COOLING SYSTEMS

The changing of the unit filters and general unit external cleaning may be carried out by the Client's trained maintenance technicians. All other maintenance must be carried out by a specialist refrigeration technician, familiar with the particular arrangement. Any works on the refrigerant system must be carried out by a specialist.

The manufacturer's specific maintenance manual includes detailed requirements and instructions for the maintenance of the plant. These works must be carried out by trained and competent technicians, familiar with the particular arrangement.

Each refrigeration circuit must be regularly checked for leaks to comply with the COSHH Regulations. If a major leak is found a full dehydration procedure must be carried out after repair.

The installation, testing and charging of refrigeration systems is a specialist operation which must be carried out by specialist refrigeration engineers having the necessary knowledge, equipment, tools and materials. Moisture and dirt must at all times be excluded from the refrigeration circuits.

Note: It is a Legal requirement that refrigerant must not be discharged into the atmosphere. This includes intentional and un-intentional discharges.

The maintenance technician should wear protective overalls, eye protectors, gloves and a filtered face mask when cleaning the coils.

The coil fins should be cleaned using a stiff long bristle brush and small short bristle brush, with a mild detergent solution. Light pressure should be applied to dislodge contamination and to clean the coil and fins. If the coil fins are heavily contaminated a high pressure water spray will assist the cleaning process. If a spray is used the technician must wear positive pressure breathing apparatus. **Steam must never be used to clean refrigerant coils**.

All particles removed should be collected by a 'wet and dry' vacuum cleaner or pan and brush. The fins should be inspected to ensure that they are straight.

4.33 SILICONE SEALANTS

Periodic cleaning of sealant may be required. This should be carried out using a cloth and warm water alternatively a non-acidic proprietary cleaner. Any cleaner used should first be approved by the manufacturer.

The sealant should be inspected annually to ensure that it has not degraded or been damaged. When necessary the sealant should be carefully removed and replaced on a like for like basis in strict accordance with manufacturer's recommendations.

4.34 PAINT FINISHES

Surface cleanliness is essential to the satisfactory performance of coating systems. Soap or detergent solutions or proprietary powder cleaners are usually adequate for normally soiled surfaces. For removal of oil or grease proprietary solvent-emulsion cleaners may be required.

If coatings are generally in sound condition and of types not likely to be effected by wetting, superficial dirt can be removed by washing with a solution of sugar soap, household detergent, cleaning powder or mild soap. Strong alkaline solution, which may attack the coating or leave undesirable residues, should not be used. Proprietary cleaning materials should be used strictly in accordance with manufacturers' instructions. With all types of cleaning solutions, final rinsing with clean water before the solution has dried is essential. After rinsing, surfaces should be dried off and time be allowed for absorbed or trapped moisture to dry out.

Most good quality emulsion paints will, however, withstand sponging with a mild cleaning solution and even light scrubbing of soiled areas. If there is any doubt about the advisability of wetting the surface, cleaning should be limited to dry abrasion and dusting off.

Washing with the cleaning solutions referred to above may not remove contaminants such as oil, grease and wax polish which can impair the adhesion or prevent the drying to coatings. Contamination of this kind may in particular occur around opening edges of doors or on skirting adjacent to polished floors. Light contamination can usually be removed by wiping with a clean cloth and white spirit followed by washing with cleaning solutions and rinsing with clean water. Proprietary emulsion cleaners or degreasing solutions may be required for the removal of heavy deposits of oil or grease.

4.35 SIGNAGE

Regular cleaning as follows should be carried out:

Painted surfaces: Interior signs should be cleaned by means of a soft cloth moistened with a mild window detergent.

Exterior signs should be washed with clean water and a car shampoo 3-4 times a year or as required. Car shampoo contains wax to protect and preserve the painted surface.

Plastic surfaces and components: Use a clean cloth moistened with mild detergent.

Never use:

- Methylated spirits, solvents or any acids
- Detergents containing abrasives
- Coarse cloths or cleaning brushes
- Powerful steam or high pressure cleaning machines

4.36 RAISED FLOORING

Vinyl finished panels should never be cleaned wet **(A bucket and mop must not be used)** as this may lead to delamination of the adhesives or deterioration in the system performance

No lacquers, polishes or surface sealants should be applied to the vinyl finish without prior consultation with either Connaught Floors or the vinyl manufacturer as this may impair the electrical performance of the vinyl specification

Any cleaning should be carried out as follows:-

- The floor surface should be thoroughly vacuumed cleaned of all contaminates.
- A rotary floor polishing machine with no polish should be used for additional cleaning providing this is used in conjunction with a detergent mist spray used sparingly, applied from a hand held trigger mechanism bottle, this spray should be absorbed into the cleaning pad, therefore, keeping the moisture content used on the floor surface to a minimum.

It is recommend that vinyl finished floors are cleaned on a weekly basis if necessary.

Periodic checks and tests on the main floor support system should not be necessary unless other trades have been working in the floor void.

4.37 THE PURPOSE OF MAINTENANCE

4.37.1 Introduction

The services will continuously be subjected to wear and tear which will affect their operation and efficiency and unless controlled within acceptable limits will also lead to failure. To safeguard against unexpected failures it is imperative that wear and tear is reduced to a minimum by adequate maintenance and monitored by regular inspections. Wear and tear is due to four main causes; stress and strain, friction, corrosion and contamination particles.

4.37.2 Stress and Strain

The services and their components will continuously be subjected to stress and strain from thermal expansion, vibration, external forces, surges etc. It is essential that all services be frequently inspected, including those which are normally considered not readily accessible (e.g. within false ceilings, ducts, floor spaces, etc.). In addition items known to suffer from a high degree of stress and strain should be inspected in detail more frequently as found necessary. Often one component failure or partial failure can cause additional stress and strain on a number of other components.

4.37.3 Wear Due to Friction

Wear due to friction can be reduced considerably, but not totally eliminated, by ensuring that components are correctly and frequently lubricated and that contamination particles are excluded as far as possible by frequent careful cleaning. Excessive lubrication can in certain circumstances, however, be as harmful as inadequate lubrication. Manufacturers' recommendations must therefore always be followed carefully.

Wear should be frequently monitored and components replaced before they reach manufacturers' tolerance limits. This will reduce the possibility of unexpected failures. Frequently wear accelerates as a component reaches the end of its useful life.

4.37.4 Corrosion

Corrosion can considerably reduce the life expectancy of the services installation and components. It is therefore essential to ensure that corrosion is regularly monitored and that adequate precautions are taken to reduce such effect. These precautions include ensuring that the correct water treatment requirements are maintained, water leakage is kept to a minimum, protective coatings on metal components are maintained in good condition and dis-similar metals are not present in a manner likely to cause electrolytic corrosion.

4.37.5 Contamination Particles

Contamination particles include dirt, dust, grit, sludge, etc. These have an abrasive effect on the services installation and can also cause blockages.

The harmful effects of these contamination particles can be minimised by excluding them from the working environment. This can largely be achieved by ensuring that filter media and strainers are frequently cleaned, replaced and located correctly in their housings; by keeping doors, access panels, windows etc., closed where possible; by cleaning grease, oil and water deposits and by dust sealing floors and walls.

4.38 PLANNED PREVENTATIVE MAINTENANCE SYSTEM

It is recommended that a Planned Preventative Maintenance System be implemented to ensure that the services are always in good repair, operate efficiently and failures are kept to a minimum.

A Planned Preventative Maintenance system relies on regular and frequent pre-planned inspections, maintenance and monitoring of the plant, equipment and services to ensure that they operate within recommended tolerances at all times. This entails maintaining equipment in first class condition and replacing components just prior to the end of their anticipated useful life expectancy.

General maintenance activities such as inspections, re-lubrication, etc., are usually carried out at pre-planned set periods or after pre-determined hours run, where this is known. Both these methods are quite satisfactory. The former usually involves increased maintenance but generally this additional cost is offset by improved efficiency and increased life expectancy of the systems.

Replacement of components are usually carried out at pre-planned set periods, after pre-determined hours run or when it is considered from frequent monitoring and the maintenance personnel experience that the item is reaching the end of its anticipated or economic life expectancy. Replacement of components is generally expensive in terms of both labour costs and parts. It is usually therefore false economy to replace components at pre-planned set periods or after pre-determined hours run unless adequate frequency adjustments can be made for actual operating conditions, plant loadings, etc. Planned Preventative Maintenance includes a requirement for frequent inspections, testing, monitoring and logging of these findings. From these routines it is a relatively simple task to continuously update required replacement intervals to ensure optimum cost effectiveness.

4.39 FORMULATING A MAINTENANCE PROGRAMME

Note: To ensure that manufacturer's guarantees will be honoured a maintenance programme must be formulated immediately after handover of the services installation. The programme must take into consideration the periods of time plant and equipment may have been operated or installed prior to Handover. The installing contractor' Contractual Defects Liability Period obligations do not include for the regular servicing and maintenance of the installation.

A Planned Preventative Maintenance Programme must be pre-planned for a minimum period of one year with an outline programme for the following year. This will ensure that adequate resources, spare parts and budgets can be allocated in advance. Consideration must be given to the number of staff who will be employed, their hours of works and the duties they will perform.

The frequency at which maintenance should be carried out on any plant, equipment or service varies considerably due to various factors including hours of usage, type of usage, age, etc. It is therefore not possible to provide definitive advice in this respect. Any references in this Manual to maintenance frequencies are therefore only to be considered as an initial guideline to assist with formulating a suitable programme, which in itself must be continuously revised to suit actual requirements found necessary.

The following should be considered in particular when formulating a maintenance programme:-

1. Adequate man hours must be allowed for the scheduled maintenance requirements.
2. An allowance must be made for emergencies, breakdowns and communication with staff.
3. A Planned Preventative Maintenance Programme must be supervised, monitored and continuously up-dated.
4. The purpose of regular routine scheduled visual inspections should not be under- estimated. These will often provide advance warning of system breakdowns.
5. Group activities together, where possible, to improve maintenance personnel efficiency, reduce disruption and reduce plant shut down times.
6. Maintenance activities should be carried out, where possible, to minimise disruption of the system and building operation.
7. Where guidelines are available for frequency of maintenance checks and inspections (e.g. Electricity at Work Requirement, British Standard Guidelines, The IEE Regulations for Electrical Installations Guidance Notes etc.), these should be adhered to or taken as maximum time intervals and carried out more frequently if required.

4.40 MAINTENANCE RECORDS

Detailed records and log books must be kept describing all work carried out under maintenance. The records should include details of the works carried out, the maintenance technicians name, the time taken, materials used and any observations noted. This is essential in order to assist in future planning, budgeting and work scheduling. This information could also assist with tracing malfunctions.

The log book should also include details of the operation of the plant regarding plant selection, performances, gauge readings and hours of operation. Gauge readings and other measurements should be compared with previous readings to ensure that the plant is performing correctly.

It should be noted that the Health and Safety Commission issue guidelines recommending that certain documentation, maintenance requirements and activities are kept within logs. In particular this applies to the control of legionellosis, the Electricity at Work Act and Management of Maintenance. (Refer to Section Three “Emergency Procedures - Health and Safety" for further information). Failure to comply with these recommendations could result in legal action being taken against individuals and firms.

4.41 COMPUTERISED PLANNED PREVENTATIVE MAINTENANCE SYSTEM

It is recommended that a computerised planned preventative maintenance system be implemented to facilitate managing and monitoring of the maintenance and operation of the Services Installation.

The computer programme should as a minimum incorporate the following components modules:-

- System Security;
- Suppliers And Contractors Details, Addresses, Etc.;
- Production Of Maintenance Purchase Orders;
- Mark-Up Percentages For Overhead And Profit And Government Value Added Tax;
- Cost Centres To Which Maintenance Activities May Be Charged;
- Property Details;
- Building Details;
- Room Location Details;
- Department Details;
- Maintenance Personnel Details;
- Staff Holiday Database;
- Staff Sickness Database;
- Staff Training Database;
- Key Personnel Database;
- Plant Condition Description;
- E Mail Communication Link;
- Call Logging (Help Desk) Facility;
- Portable Appliance Testing Database;
- Stock Control;
- Asset Register Of All Plant And Equipment;
- General Report Generator;
- User Defined Report Generator;
- Work Permit Generator;
- Planned Preventative Maintenance Work Sheet Generator;
- Call Logging (Help Desk) Work Sheet Generator;
- Planned Preventative Maintenance Planner;
- A Link Facility To Other 'Live' Programme Files Such As Word processing, CAD, Etc.
- Import and Export Facilities To 'Live' Word Processing, Spreadsheet and Database Programme To Facilitate Data Entry, Analysis And Updating Of Data.

4.42 USING THE PLANNED PREVENTATIVE MAINTENANCE SCHEDULES

The Planned Preventative Maintenance Schedules which follow are intended to provide the basis for the formulation of a suitable programme. The schedules are arranged in groups for frequency periods. The frequency period groups are sub-divided for general maintenance items, system maintenance items and plant and equipment maintenance items.

The schedules are produced in a format to enable maintenance personnel to use the activities as a check list.

The schedules should be used to compliment the detailed records and log books discussed previously within this Section of the Manual.

The schedules should in particular be read in conjunction with manufacturer's leaflets and literature which include specific maintenance requirements for the plant and equipment and advice regarding the methods, sequence and extent of maintenance activities.

Certain maintenance activities should only be carried out by trained personnel having specialist knowledge, tools and equipment. Where this is recommended the manufacturer, agent or a specialist maintenance company should be employed to carry out the works.

4.43 MECHANICAL SERVICES MAINTENANCE SCHEDULES

4.43.1 Daily - General Mechanical Services

ACTIVITY

Walk around buildings entering all rooms. Visually inspect all readily accessible services, components and plant. Check that services are generally operating correctly and as their design intent. In particular check for the following:-

1. Signs of water leakage from services including obvious water presence, dampness, chemical salt deposits, saturated thermal insulation, stains on carpets, false ceilings, etc.

2. Excessive or unusual noise from services.

3. Excessive movement of services.

4. Excessive vibration from services.

5. Unusual smells of fumes, drainage etc.

6. Obvious mal-function of services.

7. Services failed, tripped and any other warning lamps, alarms or signals activated. Operate panel lamp test buttons to ascertain whether any lamps have failed.

8. Incorrect temperature in room spaces.

9. Check that all indicator gauges are recording correct conditions.

10. Complete services log book.

4.43 MECHANICAL SERVICES MAINTENANCE SCHEDULES

4.43.2 Weekly - General Mechanical Services

ACTIVITY

1. Service filters if necessary.

2. Operate any stationary plant for a minimum of five minutes each week. If stationary plant is non-operational, turn shafts manually and provide lubricants as appropriate.

3. Determine current situation of spares held on site with regard to recent usage and future planned maintenance requirements. Order of chase suppliers as necessary.

4. Complete services log book.

4.43 MECHANICAL SERVICES MAINTENANCE SCHEDULES

4.43.3 Monthly - General Mechanical Services

ACTIVITY

1. Thoroughly clean downflow unit and direct expansion system cooling coil condensate pans. Check that pans are not damaged and that water drains freely from pans. Disinfect pans with a solution of 20 ppm chlorine. Flush through condensate drain systems and ensure traps are left sealed with water. Ensure water drains freely. Alternatively consider under Risk Assessment whether inserting disinfectant pads within the condensate tray system would be adequate to avoid the need for monthly inspections. **Before preceding it must be ensured that any material within the system which could be damaged by the quantities of chlorine used has been removed or hydraulically isolated.**

2. Check condition of downflow unit and direct expansion system unit filters. Clean or replace as necessary.

3. Ensure no carry over is occurring from cooling coils.

4. Complete services log book.

4.43 MECHANICAL SERVICES MAINTENANCE SCHEDULES

4.43.4 Bi-Annual - General Mechanical Services

ACTIVITY

1. Thoroughly and closely inspect all readily accessible services and also services which are not normally readily accessible e.g. builders work ducts, false ceilings, etc. Check for leakage, security of brackets, flanges and joints, condition of brackets, fixings, hangers, thermal insulation, etc.

2. Check operation through full travel of all valves, check valves and stopcocks. Check for leaking washers, glands, stiffness of operation and failure of tight shut-off.

3. Clean all air grilles, diffusers and louvres with cleaning agent and soft cloth.

4. Thoroughly clean all plant, equipment and exposed services. De-rust, prime and paint any damaged paint finishes.

5. Check all fire stopping of services are intact and have not deteriorated.

6. Complete services log book.

4.43 MECHANICAL SERVICES MAINTENANCE SCHEDULES

4.43.5 Annual - General Mechanical Ventilation System

ACTIVITY

1. Check operation of fire and smoke dampers to ensure that blades move freely when fusible link is removed.

2. Clean fire dampers and smoke dampers with soft cloth and cleaning agent. Lubricate moving parts with oil.

3. Clean volume control dampers and linkage with soft cloth and cleaning agent. . Lubricate moving parts with oil.

4. Inspect ductwork closely for air leakage.

5. Remove ductwork access panels and inspect internally. Chemically or steam clean if necessary.

6. Check for water presence in ductwork. If water is lying in ductwork, dry, out rectify incorrect gradient and disinfect local area.

7. Ensure that access door and seal are not damaged and that they seat correctly preventing air leakage.

8. Arrange for specialist to take swabs from ductwork systems and analyse for contamination.

9. Complete services log book.

4.43 MECHANICAL SERVICES MAINTENANCE SCHEDULES

4.43.6 Quarterly – Downflow Air Conditioning Unit

ACTIVITY

The maintenance of the refrigeration system require specialist knowledge, tools and equipment. It is therefore essential that maintenance of this unit is only carried out by suitably qualified technicians. The manufacturer's technical manuals include detailed requirements of the maintenance activities.

1. Check filters. Determine whether filters are receiving adequate regular cleaning. Clean filter thoroughly or replace if damaged.

2. Check security, cleanliness and condition of electrical components.

3. Inspect internal and external casing for general condition, security of fixings, etc.

4. Check for unusual or excessive noise from fan and motor. Check bearings for excessive play. Replace bearings if necessary.

5. Check operation and condition of fan/motor assembly anti-vibration mounts.

6. Check condition of fan flexible connections.

7. Check fan wheel set screws and tighten if necessary.

8. Check condition and alignment of fan drive arrangement.

9. Check condition of access panels and seals and ensure they seat correctly

10. Check condition of cooling coil and clean if required using a soft brush, soft cloth and cleaning agent. Straighten any bent fins.

11. Check compressor condition (refer to works manual)

12. Check for excessive or unusual condenser bearing noise, wear and end float. Replace bearings and components as necessary.

13. Check refrigerant charge and top up if necessary.

4.43 MECHANICAL SERVICES MAINTENANCE SCHEDULES

4.43.6 Quarterly – Downflow Air Conditioning Unit continued

ACTIVITY

14. Clean condenser coils with brush and a mild detergent solution. If coils are heavily contaminated use a high pressure water spray.

15. Check operation and condition of all control devices, contactors, relays and switches.

16. Clean condensate tray and flush through condensate pipework system using a sodium hypochlorite solution. Before proceeding it must be ensured that any material within the system which could be damaged by the quantities of chlorine used has been removed or hydraulically isolated. Flush through with potable water.

17. Check unit for correct operation. Investigate any deficiencies.

18. Clean inside and outside casing using a soft cloth, cleaning agent, soft brush and vacuum cleaner particularly around motor ventilation openings.

19. Carry out inspections and maintenance included within detailed manufacturer's instructions.

20. Complete services log sheet.

4.43 MECHANICAL SERVICES MAINTENANCE SCHEDULES

4.43.7 Quarterly – Direct Expansion Cooling System

ACTIVITY

The maintenance of the Direct Expansion system requires specialist knowledge, tools and equipment. It is therefore essential that maintenance of this system is only carried out by suitably qualified technicians. The manufacturer's technical manuals include detailed requirements of the maintenance activities.

Compressor/Condenser Unit

1. Inspect unit for general condition.

2. Check security of brackets, supports and components.

3. Check for excessive or unusual bearing or compressor noise, wear and end float. Replace bearings and components as necessary.

4. Check refrigerant charge and top up if necessary.

5. Service unit in strict accordance with manufacturer's instructions.

6. Check running current of unit.

7. Check security and cleanliness of electrical connections. Clean inside and outside of terminal boxes and control boxes with a soft cloth.

8. Using a soft cloth, cleaning agent, soft brush and vacuum cleaner generally clean unit. De-rust, prime and re-paint any damaged paint finishes.

9. Check unit for correct operation. Investigate any deficiencies.

4.43 MECHANICAL SERVICES MAINTENANCE SCHEDULES

4.41.7 Quarterly – Direct Expansion Cooling System continued

ACTIVITY

Internal Unit

1. Check filter. Determine whether filters are receiving adequate regular cleaning. Advise User if filters should be cleaned more regularly. Clean filter thoroughly or replace if damaged.

2. Check security, cleanliness and condition of electrical components.

3. Inspect internal and external casing for general condition, security of fixings, etc.

4. Check for unusual or excessive noise from fan and motor. Check bearings for excessive play. Replace bearings if necessary.

5. Clean condensate tray and flush through condensate pipework system using a sodium hypochlorite solution. Flush through with potable water.

6. Check general operation of unit.

7. Check condition of evaporator coil and clean if required using a soft brush, soft cloth and cleaning agent. Straighten any bent fins.

8. Clean inside and outside casing using a soft cloth, cleaning agent, soft brush and vacuum cleaner particularly around motor ventilation openings.

9. Check unit for correct operation. Investigate any deficiencies.

10. Complete services log book.

4.44 ELECTRICAL SERVICES MAINTENANCE SCHEDULE

4.44.1 Daily - General Electrical Services

ACTIVITY

Walk around buildings entering all rooms. Visually inspect all readily accessible services, components, equipment, building fabric and building structure to check that services are generally operating correctly and as their design intent. In particular check for the following:-

1. Operation of all luminaries for correct normal operation, reduction in illuminance and erratic illuminance (flickering).

2. Escape and emergency luminaire light are intact with no visible sign of damage and emitting diodes are operational. Ensure that any previously reported deficiencies or failures associated with the emergency lighting system have been rectified.

3. Extension leads are not being used except where authorised.

4. Local wiring, to equipment, telephone, etc. is not routed in a manner which could cause danger to personnel or equipment.

5. Obvious mal-function of services.

6. Excessive or unusual noise from services.

7. Ensure all isolators and switches are correctly set.

8. Check correct operation of UPS systems.

9. Record findings in the log.

4.44 ELECTRICAL SERVICES MAINTENANCE SCHEDULES

4.44.2 Weekly - General Electrical Services

ACTIVITY

1. Check UPS system batteries are correctly charging and that terminals are clean and secure.

2. Record findings in the log.

4.44 ELECTRICAL SERVICES MAINTENANCE SCHEDULES

4.44.3 Monthly - General Electrical Services

ACTIVITY

1. Determine current situation of spares held on site with regard to recent usage and future Planned Preventative Maintenance requirements. Order or chase supplies as necessary.

2. Record findings in the log.

4.44 ELECTRICAL SERVICES MAINTENANCE SCHEDULES

4.44.4 Annual - General Electrical Services

ACTIVITY

1. Check condition, security and operation of all isolators, socket outlets, light switches, MCB's and RCD's. Clean with a soft cloth. Ensure labels are correctly fitted and legible.

2. Check all accessible cables, flexes, trays, trunking, distribution boards, power distribution units, etc. for general condition and security of fixings, connectors and covers.

3. Inspect and clean changeover switches. Check for signs of arcing or overheating. Check operation of changeover switches ensuring that they function correctly.

4. Check continuity, earth fault loop impedance and insulation resistance of a sample from electrical power, lighting and conduit systems.

5. Inspect items of electrical equipment for plug, flex and item general condition. Check continuity and earth leakage if faulty.

6. Inspect a sample of earthing and bonding connections for cleanliness and security.

7. Carry out a full visual inspection of the earthing system and connections. Carry out continuity testing and resistance to earth. This should be carried out in accordance with BS7671 and BS6651.

8. View condition of all accessible fixings, supports, drop rods, etc. particularly where built into the structure.

9. Record findings in the log.

4.44 ELECTRICAL SERVICES MAINTENANCE SCHEDULES

4.44.5 Quinquennial - General Electrical Services

ACTIVITY

1. Employ the services of an independent qualified Electrical Contractor or Electrical Engineer to carry out a full test and inspection of Electrical Installation as prescribed in the 17th Edition of the Regulations for Electrical Installations (BS7671:2008), Guidance Note No. 3 "Inspection and Testing".

2. Carry out repairs as necessary.

3. Obtain an "Inspection Certificate" complete with Test Results and Instrument Readings for the Installation from the Company carrying out Test.

4. Record details in the log.

4.44 ELECTRICAL SERVICES MAINTENANCE SCHEDULES

4.44.6 Quarterly - Switch Board

ACTIVITY

1. Operate all breakers and switches to ensure correct operation.
2. Clean breakers with a soft cloth and brush.
3. Check correct operation of breaker test buttons. Re-set correctly.
4. Check correct operation and condition of all gauges and meters.
5. Ensure that all labels are legible and in place.
6. Ensure all fuses are of the correct rating.
7. Ensure all fuses and components are correctly and securely fitted.
8. Check condition of capacitors.
9. Check security and cleanliness of all connections.
10. Check all connections, glands and wiring are in good condition.
11. Check operation and accuracy of all instrumentation.
12. Clean panel with a soft cloth, soft brush and cleaning agent.
13. Carry out maintenance as recommended by the manufacturer.
14. Record findings in the log.

4.44 ELECTRICAL SERVICES MAINTENANCE SCHEDULES

4.44.7 Quarterly - Distribution Boards and Power Distribution Units

ACTIVITY

1. Open each distribution board and power distribution unit and check operation of all switchgear, MCB’s, RCD’s and switches. Clean MCB's and RCD's with a soft cloth and brush.

2. Operate all breakers and switches to ensure correct operation.

3. Check correct operation of breaker test buttons. Re-set correctly.

4. Check operation of EPO knock off systems. Re-set correctly.

5. Check correct operation and condition of all gauges, meters and displays.

6. Ensure that all labels are legible and in place.

7. Ensure all fuses, RCD's and MCB's are of the correct rating.

8. Ensure all fuses and components are correctly and securely fitted.

9. Check security and cleanliness of all connections.

10. Check all connections, glands and wiring are in good condition.

11. Check operation and accuracy of all instrumentation.

12. Clean boards with a soft cloth, soft brush and cleaning agent.

13. Carry out maintenance as recommended by the manufacturer.

14. Record findings in the log.

4.44 ELECTRICAL SERVICES MAINTENANCE SCHEDULES

4.44.8 Annual - Lighting System

ACTIVITY

1. Clean the luminaires, diffusers, closures, control gear and lamps with a soft cloth and cleaning agent. Check security and cleanliness of electrical connections. Inspect internal wiring in luminaire. Ensure that luminaires are secure and replace diffusers, reflectors and closures.

2. Record findings in the log.

4.44 ELECTRICAL SERVICES MAINTENANCE SCHEDULES

4.44.9 Biennial - Lighting System

ACTIVITY

1. Replace all fluorescent lamps.

2. Record findings in the log.

4.44 ELECTRICAL SERVICES MAINTENANCE SCHEDULES

4.44.10 Monthly - Emergency Lighting System

ACTIVITY

Note:

Testing **must** be carried out with the batteries in their fully charged condition.

The tests carried out on the emergency luminaires must only be carried out after the system has been reinstated and remained on line for at least twenty four hours, to ensure that the batteries are fully charged.

Testing should be carried out at a time of low risk to ensure maximum safety as the batteries are re-charged. Do not carry out testing within three hours preceding darkness or during darkness. Otherwise personnel may be at unnecessary risk should the electrical supply system fail as the emergency luminaires may not function correctly. Consideration must also be given when carrying out testing in any areas where natural light is not available.

The Building Operator's nominated Health and Safety 'Responsible Person' should operate a Permit to Work System to ensure correct testing procedures are carried out.

Emergency lighting must be tested in accordance with BS EN 50172:2004 (also known as BS5266-8:2004).

1. Simulate a failure of the normal lighting systems by operating circuit key test switches and check that each escape and emergency standby sign and luminaire is energised from the battery pack. Rectify as necessary. The Monthly Test should last no longer than 45 minutes.

2. If an emergency luminaire has been shut down for more than seven days, the fitting must also be subjected to a Monthly Test.

3. Record findings in the log.

4.44 ELECTRICAL SERVICES MAINTENANCE SCHEDULES

4.44.11 Bi-Annual - Emergency Lighting System

ACTIVITY

Note:

Testing **must** be carried out with the batteries in their fully charged condition.

The tests carried out on the emergency luminaires must only be carried out after the system has been reinstated and remained on line for at least twenty four hours, to ensure that the batteries are fully charged.

Testing should be carried out at a time of low risk to ensure maximum safety as the batteries are re-charged. Do not carry out testing within three hours preceding darkness or during darkness. Otherwise personnel may be at unnecessary risk should the electrical supply system fail as the emergency luminaires may not function correctly. Consideration must also be given when carrying out testing in any areas where natural light is not available.

The Building Operator's nominated Health and Safety 'Responsible Person' should operate a Permit to Work System to ensure correct testing procedures are carried out.

Emergency lighting must be tested in accordance with BS EN 50172:2004 (also known as BS5266-8:2004).

1. Energise each emergency luminaire and illuminated sign for a period of one third of its rated capacity during the first three years battery life of the unit-which equates to one hour. (Note after three years the luminaires should be energised from their batteries for the full duration of their rating (three hours).

2. Check condition of re-chargeable battery packs in escape and emergency lighting. Check that charging system is functioning correctly. Ensure that battery packs and fittings are replaced and re-assembled correctly.

3. Ensure all luminaires function correctly for the duration of the test.

4. Clean all fittings and check all emergency signs are legible and correctly fixed.

5. Record findings in Log.

4.44 ELECTRICAL SERVICES MAINTENANCE SCHEDULES

4.44.12 Uninterruptible Power Supply System

The maintenance of the UPS system requires specialist knowledge, tools and equipment. It is therefore essential that maintenance of this system is only carried out by suitably qualified technicians. The manufacturer's, technical manuals include detailed requirements for the maintenance. It is recommended that a maintenance contract be arranged for this equipment with a specialist contractor to include regular planned preventative maintenance and breakdown maintenance.

4.45 BUILDING WORKS MAINTENANCE SCHEDULE

4.45.1 Daily – Building Works

ACTIVITY

Walk around buildings entering all rooms. Visually inspect all building fabric, building structure and building works elements to check that they appear sound and are generally operating correctly. In particular check for the following:-

1. Evidence of general damage or failures.
2. Doors not functioning correctly.
3. Handrails insecure.
4. Floor finishes not secured down correctly.
5. Signage obscured, illegible or failing.
6. Record findings in the log.

4.45 BUILDING WORKS MAINTENANCE SCHEDULES

4.45.2 Weekly – Building Works

ACTIVITY

1. The floor surface should be thoroughly vacuumed cleaned of all contaminates.
2. A rotary floor polishing machine with no polish should be used for additional cleaning of floor surfaces providing this is used in conjunction with a detergent mist spray used sparingly, applied from a hand held trigger mechanism bottle. This spray should be absorbed into the cleaning pad, therefore, keeping the moisture content used on the floor surface to a minimum. **Do not use water for cleaning the raised floor as this may damage the tiles.**
3. Inspect gates, barriers and fencing for signs of damage or false entry. Arrange for repairs as necessary. Arrange for any necessary repairs to be carried out as soon as possible by a specialist.
4. Record findings in the log.

4.45 BUILDING WORKS MAINTENANCE SCHEDULES

4.45.3 Monthly – Building Works

ACTIVITY

1. Clean glazing with water and a window cleaning mild detergent as necessary.
2. Record findings in the log.

4.45 BUILDING WORKS MAINTENANCE SCHEDULES

4.45.4 Quarterly – Building Works

ACTIVITY

1. Clean mastic with a cloth and warm water or alternatively a non-acidic proprietary cleaner.
2. Clean paintwork surfaces using soap or detergent solutions or proprietary powder cleaners. If oil or grease deposits are evident use a proprietary solvent-emulsion cleaners.
3. Clean doors with water and mild detergent.
4. Clean signage thoroughly with a soft cloth moistened with a mild window detergent. Use car wax for exterior signs. Check for any damage to lettering or detail. Arrange for repairs as necessary.
5. Record findings in the log.

4.45 BUILDING WORKS MAINTENANCE SCHEDULES

4.45.5 Bi-Annual – Building Works

ACTIVITY

1. Inspect sealant to ensure that it has not degraded or been damaged. Remove and replace as necessary.
2. Thoroughly inspect partitioning for evidence of damage or failures. Check that fixings are secure particularly around doorways and openings. Arrange for repairs as necessary.
3. Inspect flooring for evidence of movement of raised flooring tiles, damage and failure. Arrange for repairs as necessary.
4. Thoroughly inspect flooring finishes for evidence of damage and failure. Arrange for repairs as necessary.
5. Check handrail fixings for security. Tighten as necessary.
6. Open and close each door three times to check operation of hinges and moving components.
7. Ensure doors open and close smoothly. If they do not, lubricate and / or adjust components as required.
8. Check operation of lock and handles. Ensure locks and handles function correctly.
9. Inspect doors, frames and seals for signs of damage. Arrange for repairs as necessary. Arrange for repairs to any finishes to be carried out as soon as possible.
10. Arrange for a specialist to inspect gates, barriers and fencing for damage.
11. Specialist to check operation of gates and barriers and to carry out maintenance and adjustment of moving components.
12. Gates and barriers should be maintained and adjusted in accordance with manufacturers' detailed instructions.
13. Record findings in the log.

4.45 BUILDING WORKS MAINTENANCE SCHEDULES

4.45.6 Annual – Building Works

ACTIVITY

1. Inspect the false ceiling in detail. Any damage must be repaired in accordance with the specialist supplier's recommendations.
2. Record findings in the log.

PLANT REPLACEMENT AND SAFE ACCESS

SECTION CONTENTS

5.1 INTRODUCTION

This section contains information pertinent to the access, removal and disposal of installed plant.

Further information in respect of individual elements that comprise the Installation is contained within other sections of this Health and Safety File / Operating and Maintenance Manual In particular, reference should be made to Section Three, 'Residual Hazards and Health and Safety', and Section Ten, 'Dangerous Substances', which include further relevant information. Section Eight, 'Operating Procedures' includes details of Shut Down and Start Up Requirements of the Mechanical and Electrical Services.

Always ensure that equipment is correctly shut down and made safe, as necessary, prior to commencement of works and ensure all tasks are carried out safely and in accordance with Regulations and Authoritative Requirements.

All plant replacement works must be carried out under the control and supervision of Site Facilities Management. All method statements must be approved prior to the carrying out of any works.

Removal and disposal of plant, equipment and materials must only be under taken by suitably qualified individuals.

Materials detailed within 'Disposal / Demolition' require special consideration during normal maintenance and during demolition and disposal.

All operating and maintenance personnel and demolition contractors must provide due diligence prior to carrying out

5.2 HAZARDS AND RISKS

The following is a list of significant hazards and risks that must be addressed, by formal procedure, safe systems of work or by dedicated risk assessments when carrying out any work within the confines of the boundary.

- Locations with inherent dangers.

  The following locations should be restricted to trained competent persons, due to their location or because of equipment contained therein and which could present a significant danger to unauthorised persons.

  Each location should be restricted to authorised personnel and should be under a permit to work system with dedicated risk/method statements being prepared to address the hazards:-

  - Roof, general access and working
  - Electrical LV Switchrooms
  - Work within Floor Voids (Confined Space)
  - Work within Ceiling Voids (Confined Space)
  - Working at height

- Any Work at height

  Refer in particular to The Work at Height Regulations 2005.

  - Carry out Risk Assessment
  - Produce Method Statement as to the manner in which the works will be carried out
  - Only to be carried out by competent and trained persons
  - Use all necessary safe working platforms
  - Provide all necessary safe access to and egress from all places of work and working platforms
  - Use all necessary fall restraint systems; ensure that they have a current test date.
  - Provide all necessary edge protection, barriers, signage etc. for protection of other workers, visitors and members of the public.
  - Ensure any fragile roofs are adequately protected and strengthened.
  - Ensure that lightning conductors are protected and are not in contact with works, tools, plant or equipment being used.
  - Ensure there is no risk from overhead or trailing services.

- Any Work in occupied areas
  - Only to be carried out by competent, trained and authorised persons
  - Segregate the work areas from the occupier's activities, staff, public etc.
  - Provide all necessary barriers, signage etc.

- Access to roofs
  - To be restricted to approved persons only who are suitably trained for the work to be carried out and have been made fully aware of the relevant risks and the procedures to follow, with a Permit-to-Work system in force.
  - Fall restraint systems, harnesses etc. must be used strictly in accordance with the manufacturers/suppliers recommendations and/or instructions.

- Cleaning of external windows, window frames, cladding, signage etc.
  - Only to be carried out by competent and trained persons.
  - Safe access and working platforms must be used.
  - All personnel using such systems must have been fully trained in the use of the appropriate system.
  - All necessary precautions are to be taken to prevent falls, falling materials etc. and to protect others, particularly the public.

- Access to Electrical Switchrooms
  - To be restricted to authorised persons only.
  - Doors to be kept locked to prevent unauthorised access.

- Hot-Work and any work involving the risk of fire
  - Only to be carried out by competent, trained and authorised persons on a Permit-to-Work basis.
  - All necessary precautions are to be taken to prevent by removing or protecting any nearby combustible materials.
  - Only to be carried out with suitable provisions for fire fighting in place.
  - Fire alarm zones to be isolated while work is being carried out, as required.

- Work on Engineering Services
  - Only to be carried out by suitably qualified, competent and authorised persons.
  - To be carried out on in accordance with the client's procedures.
  - No work is to be carried out on live services.

- Alterations to Fire Protection
  - No alterations etc. are to be carried out without first checking whether the work will adversely affect the fire protection of the building or structure.
  - Any necessary temporary measures are to be put in place to ensure that the fire integrity is maintained.

- Work on or near public areas, traffic routes etc.
  - Only to be carried out by competent and trained persons.
  - All necessary precautions to be taken to ensure that there is no risk to the public etc. by separation of the work areas, hoardings, signage, traffic management etc.
  - Hi-Visibility clothing to be worn at all times when in the vicinity of traffic areas.

- Work in confined spaces, hazardous atmospheres etc.
  - Only to be carried out by suitably qualified, competent and authorised persons working for an approved company, on a Permit-to-Work basis.
  - Only with adequate ventilation
  - Only with outside assistance available

- Any work involving fumes, noise, dust etc.
  - Only to be carried out by suitably qualified, competent and authorised persons working for an approved company.
  - Permit-to-Work system to be in force where appropriate.
  - Adequate ventilation to be provided at all times

- Any work on or near electronic equipment and computer related equipment
  - Only to be carried out by suitably qualified, competent and authorised persons working for an approved company.
  - Permit-to-Work system to be in force where appropriate.
  - Electronic equipment and computer related equipment has been installed within the Building by the Client subsequent to Handover by PW Building Services. This equipment may also be updated / upgraded to suit changes in requirements and technology available. The Client should be consulted prior to maintaining, altering, dismantling and disposing of any such equipment to determine the particular Risks that may be applicable at that point in time and to determine whether there are any related dangerous substances.
  - Hazards and Risks related to this equipment must be obtained from the Client.
  - Ensure electronic equipment and computer related equipment is safely shut down and made safe, as necessary, when working on or near the equipment, or where works to be carried out could have an adverse effect on the operation of the equipment. Consult the Client's nominated Responsible Person for Health and Safety and the nominated Responsible Person for operation of the equipment.

5.3 SAFE ACCESS FOR PLANT REPLACEMENT STRATEGY

No new plant has been installed during these Works. The safe Access for Plant Replacement Strategy therefore remains as previously defined by others.

5.4 REMOVAL OF PLANT AND EQUIPMENT

The dismantling, demolition and removal of Plant and Equipment must be carried out under the control and supervision of Site Facilities Management. All method statements must be approved prior to the carrying out of any works.

Demolition, removal and disposal of plant, equipment and materials must only be under taken by a qualified demolition contractor.

Materials detailed within 'Disposal / Demolition' require special consideration during demolition, removal and disposal.

All personnel and demolition contractors must provide due diligence prior to carrying out any works to ensure all tasks are carried out safely and in accordance with Regulations and Authoritative Requirements. It must be ensured that all services are isolated and made safe where necessary.

Large items of equipment may need to be dismantled or cut into smaller sections to enable removal and transportation to be carried out safely. The following table provides information of main matters which will require consideration:

Ensure all equipment is correctly shut down and made safe prior to dismantling or removal.

Risk Assessments and Method Statements must be produced for all removal / disposal activities.

It is recommended that removed materials should be recycled where possible.

Ensure adequate protection against dust, dirt, debris, etc is provided within the workspace and adjacent areas.

5.4 REMOVAL OF PLANT AND EQUIPMENT continued

Plant or Equipment	Consideration For Removal
Cabling	Ensure electrical supplies are safely disconnected. The cabling can be cut into smaller sections and disposed of via a Licensed Waste Disposal Carrier.
Glazing	Individual glazing panels can be removed for disposal. This must be carried out by a specialist disposal contractor. Glazing units must be disposed of by a Licensed Waste Disposal Carrier.
Brickwork, Blockwork, Cladding, False Ceiling, Doors And General Building Materials	Generally these components can be broken or cut down into small manageable sections, as required. A Risk Assessment must be carried out to determine the exact make up of the components and to enable a Method Statement to be produced. It must be ensured that the complete Building structure and components remain stable and safe during removal / demolition.
Individual Engineering Services Components And Building Components	Generally these components can be broken or cut down into small manageable sections, as required. A Risk Assessment must be carried out to determine the exact make up of the components and to enable a Method Statement to be produced. It must be ensured that the complete Building structure, installation and components remain stable and safe during removal / demolition.
Electronic Equipment and Related Equipment	The Client and must provide necessary advice as to the manner in which these systems are removed and disposed of. Also be aware that information contained within these systems may be highly confidential and therefore this matter must be considered by a specialist.

5.5 DISPOSAL / DEMOLITION

5.5.1 Risk Assessments

To comply with The Health and Safety Executives requirements, a Responsible Person must be nominated by the Building Operator to ensure that certain aspects of the services installation are being correctly operated and maintained and adequate precautions are being taken to minimise and control risks to personnel. For further information, please refer to Section Three "Residual Hazards and Health and Safety" and Section Six "Emergency Procedures and Fire Strategy".

The Responsible Person must ensure that all necessary Risk Assessments and Log Books are produced and kept up to date. The Risk Assessments must be carried out prior to placing the systems into operation and whenever alterations are made which may have an affect on the Risk. The recommendations within the Risk Assessments must take precedence over information within this Manual.

5.5.2 Schedule Of Disposable Items

The following items have been installed which will require special consideration should replacement or disposal be necessary:-

- General Oil and Grease
- Lamps
- Sealed Lead Acid Batteries
- General Rechargeable and Non-Rechargeable Battery Packs
- Insulation
- Electronic Equipment and Computer Related Equipment

General Oil and Grease

Oil and grease is used extensively for cooling and lubrication of moving components.

Oil and grease will be stored on site for use during routine maintenance.

Always use adequate protective clothing including suitable gloves, overalls and eye protection where there is a risk of contact with oil, grease or silicon fluid.

Acid and chemicals within oil, grease and silicon fluid can also cause skin burns, irritation and even long term damage to skin and the body in general. Avoid contact wherever possible. Clean skin thoroughly using appropriate cleanser should contact with oil, grease or silicon fluid occurs. Rinse deposits off skin with copious amounts of warm water.

Use an eye wash immediately should oil, grease or silicon fluids enter the eye or area around the eye. Rinse deposits away with copious amounts of warm water. Seek medical assistance immediately.

Waste oil and grease must be stored in labelled containers away from heat and flames. The materials may be recycled - alternatively, disposal must be via a Licensed Carrier. Do not dispose of oil or grease by discharging down a drain or emptying into general refuse containers.

Cloth and other materials used to soak up oil and grease will be highly flammable. Keep away from heat and flames.

Lamps

The gases inside lamps are harmful to the environment and personnel. Glass particles would be present in the event of breakage. This could cause injury to personnel.

Lamps must be carefully disposed of to avoid un-controlled breakage. Disposal should be in a purpose designed crusher. Alternatively the un-broken lamps should be collected and disposed of by a Licensed Waste Collector.

New and old lamps must be stored in locations where they cannot be broken accidentally or by vandals.

Failure to ensure that the harmful gases are not released into the atmosphere could result in Legal Action against individuals and the Company under the Control of Substances Hazardous to Health Regulations 2002 (COSHH) (amended 2004) incorporating Chemical (Hazard Information and Packaging) Regulations (CHIPS) and The Environmental Protection Act 1990.

Sealed Lead Acid Batteries

Various equipment items are provided with sealed lead acid batteries to provide emergency standby operation in the event of normal mains failure and to preserve electronic memory settings. This includes, but may not be limited to:

- The Fire Alarm System
- Security Systems
- Uninterruptible Power Supplies

The battery packs contain a mixture of sulphuric acid and water. The mixture is corrosive, poisonous and will cause burns if contact is made with any part of the body.

Ensure that batteries are stored within adequate ventilated areas, particularly if charging of the batteries is to take place. All spillages should be treated with an alkali e.g. soda ash, sodium bicarbonate or sodium carbonate, followed by copious amounts of clean water.

If contact occurs with the eyes, irrigate with copious amounts of clean water or use an eye wash solution. Seek urgent medical advice at the earliest opportunity. If contact occurs with the skin, wash thoroughly with copious amounts of clean water.

If ingestion occurs copious amounts of clean water plus milk of magnesia should be drunk. Seek immediate medical assistance if contact with eyes or other sensitive parts of the body occur.

The corrosive nature of the substance may also cause secondary Risks if it incorrectly comes into contact with certain components, e.g. it could cause leakage of pipework systems which in turn could represent a Risk to electrical appliances, etc.

The Risk of contact with any part of the body must be strictly avoided. Gloves, overalls, safety shoes and eye protectors must be used when handling the batteries.

Follow manufacturer's recommendations when handling and maintaining batteries.

Never add acid to water. Always add water to acid should concentrations require to be changed. Water must be distilled. Do not use ordinary tap or bottled water.

Ensure that naked flames, lighted cigarettes and sparks do not occur in vicinity of batteries or acid / water mixtures.

The integral lead plates within the battery can be harmful. Lead is toxic if ingested or if dust is inhaled.

The battery packs must not be split open.

Do not burn batteries. Do not subject batteries to temperatures over 40°C. Do not place batteries in waste bins.

Do not dispose of the sulphuric acid / water mixture into the drainage system.

Only use dry and clean chemical bottles for storing sulphuric acid or acid water mixtures. Do not mix with any other chemicals or substances. Ensure the bottles are correctly labelled and kept in a secure place, where there is minimum risk of breakage or unauthorised access.

Do not remove lead from battery cases. Dispose of the complete battery case containing the lead plates and also acid / water mixture wherever possible.

The battery packs must be disposed of by a Licensed Waste Collector. They should be re-cycled where possible.

General Rechargeable and Non-Rechargeable Battery Packs

Various equipment items are provided with general rechargeable and non-rechargeable battery packs to provide emergency standby operation in the event of normal mains failure and to preserve electronic memory settings. This includes, but may not be limited to:

- Emergency Luminaires
- Time Switches
- Torches
- Test Equipment
- Security devices

The battery packs contain chemicals and substances which could cause skin irritation or be harmful to the human body.

The battery packs should not be split open.

Direct contact with the chemicals and substances must be avoided. Protective gloves, eye protectors and other protective clothing should be used if contact is likely.

Do not burn batteries and do not subject batteries to temperatures over 40°C.

Do not place batteries in waste bins - the batteries must be disposed of by a Licensed Waste Collector.

Insulation

Insulation is used for control of sound and noise and for thermal insulation.

Insulation particles may cause serious illness and skin irritation.

Personnel who are sensitive to breathing difficulties, asthma, etc should be particularly careful when handling or coming into close contact with insulation.

The material may contain harmful micro-biological growth.

Always wear gloves and face masks when handling new or used insulation material. Use positive breathing apparatus if there are large quantities of particles released within the air.

Ensure that insulation ready for disposal is bagged and sealed. Do not burn insulation as harmful particles may be released. Disposal must generally be via a Licensed Carrier.

Electronic Equipment and Computer Related Equipment

Electronic Equipment and Computer Related Equipment have been provided by the Client. Refer to Client's Responsible Person for details of required considerations.

5.6 STRUCTURAL ENGINEER'S DEMOLITION STATEMENT

Ultimately demolition will signify the end of the building's life cycle.

A suitably qualified Structural Engineer will be required to provide a demolition statement together with full details of requirements and procedures to follow.

The information provided will alert those responsible for demolition of the significant residual hazards which may exist; such as structural elements which may contain stored energy, unusual stability concepts, alterations that have changed a structure etc.

EMERGENCY PROCEDURES AND FIRE STRATEGY

SECTION CONTENTS

6.1 INTRODUCTION

This section of the Health and Safety File / Operating and Maintenance Manual details suggested procedures to take in the event of an emergency or other major situation occurring. Reference in this respect should also be made to Section Seven, 'General Fault Finding Procedures', which details methods to be adopted to trace the cause of faults, and to Section Eight, 'Operating Procedures', which details the normal Operating Procedures used.

6.2 EMERGENCY SHUT DOWN CONSIDERATIONS

A judgement has to be made as to the most suitable course of action in the event of an emergency situation at the time of the occurrence. It is essential that the following points are considered in order of priority:-

1. Reduce the risk to human life to an absolute minimum.

2. Reduce the risk to human injury to an absolute minimum.

3. Reduce the risk of human suffering to an absolute minimum.

4. Reduce the risk to the building and surrounding buildings to an absolute minimum.

5. Reduce the risk to the services installation, internal fittings, furniture, decorations, etc., to an absolute minimum.

The actual procedure adopted for the Emergency Shutdown will depend upon:

- The severity of the situation.

- The location of the situation.

- The location of the relevant plant or systems.

- The location and method of plant local electrical isolators, control switches, knock-off buttons, etc., relative to the occurrence and the personnel involved. **At all times actions must be taken to avoid panic.**

It is essential that all maintenance personnel are familiar with the location of plant local electrical isolators, control switches, knock-off buttons, etc., together with the start-up, shut-down and operation procedures detailed within this manual.

The Building Manager may have particular requirements regarding certain emergency procedures, which where applicable, should take precedence over the details contained in this Manual. These requirements may also vary from time to time due to such matters as National Security, etc.

If in any doubt regarding procedures which should be taken in an emergency situation, consult the Site Safety Officer, Health and Safety Officer, manufacturer, accredited agent or appropriate specialist engineer. The procedures should be regularly reviewed and practised.

6.3 EMERGENCY SHUTDOWN, ALARMS SCHEDULE AND ACTIVITIES – MECHANICAL SYSTEMS

The following procedures should be adopted in the event of an emergency situation occurring which requires an immediate shut-down of plant or systems where a normal shut down would not be appropriate.

1. Where possible turn the 'on / off', 'off / auto', 'hand / off / auto' switches on the control panel serving the equipment or the local controller serving the equipment to the 'off' position. This will ensure that any safety interlocks are not over-ridden.

2. If 1. is not practical, knock-off the required local plant isolators**. Note that this action should only be carried out if essential due to the risk of resultant damage to equipment due to safety interlocks being over-ridden. Also note that associated standby equipment may automatically be activated.**

3. If both 1. and 2. above are not practical due to the location or number of plant items requiring to be simultaneously shut-down, all plant and equipment served from a control panel can be shut down by switching off the main control panel isolator. Where the equipment is served from a distribution board, the outgoing MCB's from the distribution board or, if necessary, the distribution board incoming breaker can be switched off**. Note that this action should only be carried out if essential due to the risk of resultant damage to equipment due to safety interlocks being over-ridden. Also, this action must only be carried out providing it will not cause a greater danger by disconnecting supplies to other equipment or systems not in the vicinity of the emergency.**

6.4 EMERGENCY SHUTDOWN, ALARMS SCHEDULE AND ACTIVITIES – ELECTRICAL SYSTEMS

WARNING

Emergency shut down of systems serving computer and communication equipment, security, fire alarms, lighting and emergency lighting should only be carried out if essential.

It should be noted that certain systems such as the security, fire alarms and emergency lighting have built in battery back-up systems and will continue to remain live and operational in the event of a supply shutdown.

In addition, Uninterruptible Power Supply systems are provided which will start / maintain supplies in the event of normal mains supply failure.

The following procedures should be adopted in the event of an emergency situation occurring which requires an immediate shut-down of equipment or systems where a normal shut down would not be appropriate.

1. Isolators or manual re-set stop pushes are provided local to most items of plant and equipment. The individual isolators can be switched off or the stop pushes pressed to disconnect the electrical supply to the equipment they serve.

2. Power Distribution Units (PDU's) are provided with emergency power off (EPO) knock-off buttons, which will shut down the complete PDU.

3. Where it is not practical to reach the local isolator or stop push or where a number of items are required to be simultaneously isolated the final sub-circuit should be switched off at the distribution board or switchgear location supplying the area concerned. This action must only be carried out providing it will not cause a greater danger by disconnecting supplies to other equipment or systems not in the vicinity of the emergency.

4. Where it is not immediately apparent which MCB or fuse controls the area concerned the main incoming isolator controlling the complete distribution board should be switched off, provided this will not cause a greater danger by disconnecting supplies to other equipment or systems not in the vicinity of the emergency.

6.5 EMERGENCY SHUTDOWN, ALARMS SCHEDULE AND ACTIVITIES – UNINTERRUPTIBLE POWER SUPPLY SYSTEMS

An Uninterruptible Power Supply (UPS) provides continuous power to a connected load on loss of the mains supply. A UPS will then support its connected load until one of the following occurs:

- Normal mains power returns
- The UPS power source (typically one or more batteries) can no longer support the load
- An alternate power supply (such as a generator) comes online

The purpose of a UPS is not to allow its connected load to lose power. Therefore, design engineers will provide multiple circuits to connected equipment, internal bypass feeds around the power components in the UPS and maintenance bypass feeds around the entire UPS. These alternate and bypass feeds may not allow you to isolate the UPS for the purposes of lockout.

Failure to understand how the UPS is supported electrically may result in a fatal electric shock.

The following procedures should be followed in the event of an emergency occurring that requires an immediate shutdown of equipment or systems where a normal shut down would not be appropriate.

1. Emergency Power Off (EPO) knock-off buttons are generally provided which will shut down the complete UPS - **only use this method of shutdown in an emergency, as this may cause failure or damage to the connected equipment.**

2. Where possible, always follow the shutdown instructions indicated on the UPS unit, or within the Manufacturers Instruction Manual.

3. A UPS may have an alternate energy source connected to it. This may be a battery bank, flywheel, or another UPS - you must also ensure that this external source has been isolated.

4. In some UPS configurations, you must also shut down the connected load before isolating the UPS.

6.6 EMERGENCY PROCEDURES FOR REFRIGERANT LEAKS

NOTE

a) The refrigerant that leaks out will most probably be in vapour form, and therefore the source of the leak will be hard to find without proper leak detection equipment.

b) The refrigeration equipment will automatically shut down on lock-out by detection from the internal control system if the leak is very severe.

c) Repairs must only be carried out by specialist technicians.

d) It is illegal to discharge refrigerants into the atmosphere. Refrigerants must be re-claimed.

e) All disposal of refrigerants must be fully documented.

f) Always use adequate protective clothing including suitable gloves, overalls and eye protection where there is a risk of refrigerant leakage. Physical contact with refrigerant can cause severe freeze burns. Acid from contaminated refrigerants and oils can also cause skin burns or irritation.

g) Ensure that there is an adequate first aid box local to the area of works being carried out, including an emergency eye wash.

PROCEDURE

1. Shut down and electrically isolate the refrigeration equipment from which it is suspected a leak is occurring.

2. Clear all personnel from the surrounding area and call in specialist engineers.

3. Ensure area where leak is occurring is well ventilated.

4. Ensure that refrigerant cannot collect under any temporary coverings.

5. Ensure that access to the area by un-authorised personnel is prevented.

6. DO NOT USE FLAMES OR HEAT SOURCES IN THE VICINITY OF REFRIGERANT LEAKAGE AS DANGEROUS FUMES COULD RESULT.

6.7 EMERGENCY PROCEDURES FOR FIRE

This procedure describes the general action to take in the event of a fire occurring.

- Immediately a fire or smoke is detected shout 'FIRE - FIRE - FIRE' loudly.
- Unless the fire can be immediately contained, break nearest call point break-glass and follow Standing Fire Procedures for the building. The Standing Fire Procedures for the building must be strictly followed.
- For certain locations, outbreak of fire will be detected and the alarm initiated automatically.
- The Site Fire Officer must always be informed of any out-break of fire.
- Unless the fire is a very minor, the Fire Service must be informed.
- Never attempt to carry out first aid fire fighting alone.
- Never use a liquid type extinguisher to fight electrical fires.
- Beware of toxic fumes when in vicinity of fire. These are not necessarily visible.
- If in doubt, abandon attempt to fight fire. **Remember**, the gases are usually buoyant due to the heat; therefore the air is usually purer nearer floor level.
- Fires are classified as follows:

a) **Wood, Paper, Textiles**

Extinguish using water hose reels, water or spray foam extinguishers.

b) **Flammable Liquids**

Extinguish using anything that starves the fire of oxygen e.g. foam extinguishers or fire blanket.

c) **Flammable Gases**

Try to turn off source of gas and cool surrounding area.

d) **Metals**

Use special dry powder.

e) **Electrical**

Use following in order of preference:

CO_2
Dry Powder

6.8 EMERGENCY PROCEDURES FOR FIRST AID

This procedure describes the general action to take in the event of injury occurring to personnel. All maintenance personnel should be trained for procedures to take in the event of electrocution and for standard resuscitation procedures.

1. Ensure that the cause of the injury does not represent a further risk to those injured or to others. Use whatever means are appropriate to avoid or reduce further risk.

2. Contact a member of staff who has been trained and designated as a First Aid Assistant, if possible.

3. Raise the alarm and request assistance from a suitable source.

4. Ensure that the injured person is kept as physically comfortable as possible. Eliminate or reduce pain as much as possible.

5. Avoid panic of the injured person and others within the vicinity.

6. Ensure that the injured person is not crowded around.

7. Relieve any pressures, tight collars, etc. which may restrict breathing.

8. Follow the Standing Building Procedures for First Aid.

9. If the injury is severe request medical assistance immediately.

10. The injured person should only be medically attended to by trained personnel. If for any reason trained staff personnel are not readily available and it is considered that immediate attention is absolutely essential before medical assistance is likely to arrive, attempt to obtain direction from a person having some medical knowledge.

11. At all times keep calm yourself, ensure that the injured person remains calm and all those in attendance also remain calm.

12. As soon as the emergency is over record in the accident book full details regarding the cause, reason and result of the occurrence.

6.9 DESCRIPTION OF EMERGENCY AND FIRE FIGHTING SYSTEMS

As part of the overall Works, minor alterations were made to the fire detection coverage within the Building.

Augmentation of the existing fire alarm system was undertaken to provide smoke detection and fire alarm sounders within the new UPS switch room at mezzanine level. All the equipment used for the installation was of the same design and manufacturer as the existing system.

6.10 FIRE STRATEGY REPORT & DRAWINGS

An overall 'Fire Strategy' for the Building has been developed fort he whole site to reduce Risks to the Building, Occupants and surrounding areas, should a fire or smoke generating situation occur. This includes Means of Escape in the event of a fire situation occurring. A copy of this document should be incorporated within this Health and Safety File / Operating and Maintenance Manual after this page, or should be readily available to all those carrying out maintenance and operating activities.

GENERAL FAULT FINDING PROCEDURES

SECTION CONTENTS

7.1 INTRODUCTION

This Section includes suggestions for general procedures which should be taken when a fault has occurred with an item of equipment or a complete system. The procedures assume that the installation has been fully tested, commissioned and functional prior to the fault occurring.

Fault finding can be dangerous by nature due to the unknown element of the cause and reason for the occurrence. It is therefore essential that only fully trained and experienced personnel should carry out fault finding procedures.

This complete Health and Safety File / Operating and Maintenance Manual must be studied prior to undertaking any fault finding procedures to ensure that all necessary equipment and tools are available and that the implications of carrying out the procedure is fully understood. It is essential that the design and circuitry of the systems are also fully understood; this can be achieved by studying the As Installed Drawings and inspecting the installation physically on site. Familiarity with the installation is essential, particularly when dealing with emergency situations. The exact location of all electrical isolators, valves and control devices should also be determined.

7.2 GENERAL FAULT FINDING CONSIDERATIONS

When a fault occurs it is essential that a clear and methodical approach is taken to determine the cause. Each check has to be made in a logical manner which will determine the fault, eliminate the fault or provide guidance as to what other checks should be made.

Always exercise extreme care when fault finding and consider the following:

1. The fault may have left a component in a dangerous condition.
2. A component may move or start unexpectedly which may be dangerous to personnel or may cause damage to the services.
3. Be particularly cautious of electrical components. Any failure in electrical supplies may only be temporary.
4. Carry out fault finding with an assistant where possible. If it is not possible always inform a responsible person of what you are doing.

Always make notes of checks which have been made to prevent repetition and to enable results to be analysed. These may prove to be particularly useful to any specialist employed if the fault cannot be readily traced.

Due to the limitless permutations of possible faults, it is not possible to define set procedures to trace faults. This is left to the maintenance engineer to determine based on his own ability and experience. The following schedules however provide a suggested sequence of general checks for the most common system faults occurring. Reference should be made to the manufacturers' technical literature for specific fault finding procedures for the plant and equipment. These details have not been duplicated within this Section. **If in doubt always arrange for a specialist to trace the fault.**

The following notes should be borne in mind when consulting fault finding schedules.

a) The schedules assume that the Services to which they refer have been commissioned properly and have run without significant faults for a reasonable period since the commissioning stage.

   e.g. The design settings were initially correct and equipment is of the correct size for its application.

b) Any repeated faults during the initial warranty period should be relayed direct to the installation contractor for attention/rectification.

c) Plant setting should not be altered as balance of the complete system(s) can be affected, resulting in a costly re-balancing operation. Re-balancing/ commissioning should only be carried out by competent engineers.

7.3 PROCEDURES FOR GENERAL FAILURE

1. The plant operator should fully use all the skills and resources at his disposal, including a study of this Manual and the manufacturers' technical literature. If a fault or breakdown occurs and the reason for it is not immediately apparent, the following should be considered:

   a. Is the breakdown due to plant or supply failure.
   b. If it is plant breakdown - identify the plant.
   c. Determine whether the plant failure can be rectified or repaired with the labour and materials available at site.
   d. If the breakdown is due to supply failure - identify the supply.
   e. Determine whether the supply can be restored.

2. If the above cannot be ascertained it will probably be necessary to obtain assistance from a specialist service technician or the relevant Supply Authority.

3. Provide as much information as possible when requesting assistance from others. This could save considerable time and expense.

4. Dependent upon the type of breakdown, a decision must be taken as to whether it is urgent and requiring immediate attention. It may be necessary to carry out a temporary repair to restore the services to an acceptable standard quickly. Where this occurs always ensure that the full and complete repair is carried out as soon as possible.

5. When a breakdown occurs, action may need to be taken immediately to render the plant safe. In such cases the procedure as outlined elsewhere for shutting down the plant and switching off, etc. must be followed before any other action necessitated by the breakdown is carried out.

6. Always try to establish the cause of a breakdown as distinct from merely rectifying the effect. Although the immediate need may be to restore the plant to working order without delay and by whatever means are possible, never be satisfied with any action which only repairs the defect or replaces the part. Investigation in depth may reveal some underlying fault, which if not corrected may result in a recurrence of the trouble, or even perhaps later development of other or more serious faults which are not yet apparent.

7. Careful and complete details should be recorded of all breakdowns in the log book. Date of occurrence, which particular item of equipment, details of the breakdown, any immediately previous maintenance work carried out, previous warnings or evidence of trouble, how the plant generally was operating, any special circumstances or relevant details, or similar information. These facts should all be accurately and fully recorded, together with full details of action taken, including either temporary and/or permanent repairs or replacements. Such records are not only useful to the operating staff, but often are invaluable to outside specialists and service technicians. From the information given, they may be able to offer advice on improved operating techniques, to prevent or minimise the risk of recurrence of the breakdown.

7.4 ELECTRIC MOTORS

Warning:

Disconnect Electrical Power Before Inspecting Or Servicing The Unit And Allow All Rotating Equipment To Stop Completely. Failure To Do So May Result In Personal Injury Or Death From Electrical Shock Or Moving Parts.

REF	SYMPTOM	POSSIBLE CAUSE	ACTION
1)	**Motor fails to start**	Defective power supply	Check voltage across all phases above disconnector switch.
		Blown or defective primary fuses	Check voltage across all phases above disconnect switch
		Blown or defective secondary fuses	Check voltage below fuses (all phases) with disconnect closed.
		Open control circuit	Push reset button
		Overload trips are open	Push reset button
and		Defective holding coil in magnetic switch (starter if fitted)	Push start button allow sufficient time for operation of time delay, then check voltage across magnetic holding coil. If correct voltage is measured, coil is defective. If no voltage is measured, control circuit is open.
		Loose or poor connections in control circuits	Make visual inspection of connections in control circuit.

7.4 ELECTRIC MOTORS continued

REF	SYMPTOM	POSSIBLE CAUSE	ACTION
1)	**Motor fails to start cont.**	Magnetic switch closes (starter if fitted) or bad switch contact	Open manual disconnect switch, close magnetic switch by hand and examine contactors and springs.
		Open circuit in control panel	Check voltage at terminals.
		Open circuit in leads to motor	Check voltage at leads in outlet box.
		Lead improperly connected	Check lead numbers and connections
2)	**Motor fails to come up to speed**	Low or incorrect voltage	Check voltage at terminals in control panel and at motor leads in outlet box.
		Incorrect connection at motor	Check for proper lead connections at motor compare with connection diagram on motor
		Overload - Mechanical	Check impeller setting Check for a locked or tight shaft.
		Overload - Hydraulic (pump only)	Check impeller setting. Check flowrate against pump capacity and head.

7.4 ELECTRIC MOTORS continued

REF	SYMPTOM	POSSIBLE CAUSE	ACTION
3)	**Motor runs hot**	Inadequate ventilation	Assure adequate supply of air. Check air flow through motor by feeling air discharge through motor
		Overload	Check load with ammeter
		Unbalanced supply voltage	Check supply voltage with voltmeter.
4)	**Motor noisy**	Worn thrust bearing	Remove dust cover, rotate rotor by hand and make visual examination of ball and races. Bearing noise is usually accompanied by a high frequency vibration
		Electrical noise	Most motors are electrically noisy during the starting period but noise should diminish as motor runs

7.5 FANS

Warning:

Disconnect Electrical Power Before Inspecting Or Servicing The Unit And Allow All Rotating Equipment To Stop Completely. Failure To Do So May Result In Personal Injury Or Death From Electrical Shock Or Moving Parts.

VIBRATION AND NOISE

Most noise and vibration problems are caused by components being worn, misaligned or loose. These conditions can usually be found by observation. The problem is solved by replacement, realignment or tightening of the parts involved. Other vibration and noise sources include:-

1. Wheel unbalanced
2. Driving components unbalanced or misaligned
3. Shaft bent
4. Belts incorrectly adjusted.
5. Bearing defective, contaminated or not lubricated adequately.
6. Foreign material in fan housing
7. Electrical hum from motor
8. Air velocity higher than design
9. Fan operating in surge
10. Isolation system not functioning properly
11. Abrupt turns/transitions into or out of the fan

MOTOR OVERLOADED (CURRENT TOO HIGH)

Check the following:-

1. Fan speed above design
2. Fan wheel installed backward
3. High voltage
4. Excessive friction in bearing

HIGH AIR FLOW RATE

Check the following:-

1. System resistance below design
2. Fan wheel installed backwards
3. Speed too high

7.5 FANS continued

LOW AIR FLOW RATE

Check the following:-

1. Drive belts slipping
2. Leaks or obstructions in duct system
3. Fan running backwards
4. Speed too low
5. System resistance higher than design
6. Access door open
7. Abrupt turns or transitions into or out of the fan
8. Low fresh air temperature (cut out fans)

OVERHEATED BEARING

Bearings on high speed fans in particular can run at a high temperature (up to 55 ºC). They may feel very warm with no problem being present. This is especially true immediately after lubrication when it is normal for bearings to run hot (up to 65 ºC) while they purge excess grease.

Abnormal high temperatures can be caused by the following conditions:

1. Too much grease in bearing
2. Inadequate lubrication
3. Foreign material in bearing
4. Poor drive alignment
5. Bent shaft
6. Damaged or worn bearing

7.6 BATTERIES

REF	SYMPTOM	POSSIBLE CAUSE	ACTION
1)	**Battery Completely Discharged**	Poor battery terminal connection	Clean connections, replace and tighten.
		Mains battery charger/charger connections fault/mains supply fault	Check battery charger, charger mains supply and charger connections
		Blown Fuse	Change fuse.
		Battery Fault	Remove and check using specialist equipment.
2)	**Battery Low Charge**	Poor Battery connection	Clean connections, replace and tighten.
		Mains battery charger/charger connections fault	Check battery charger and charger connections
		Un-equal Cell Charge	Boost (equalise) charge required.
		Battery fault	Remove and check using specialist equipment.
3)	**Battery Overcharged**	Mains battery charger fault	Check mains battery charger.
4)	**Battery Terminals Getting Hot**	Poor Battery connection	Clean terminals, reconnect and tighten securely.

7.7 AIR CONDITIONING SYSTEM

Detailed fault finding procedures are included within the Operating and Service Manuals for each type of unit, which are available to authorised service technicians.

Client's trained and authorised technicians should carry out the fault finding procedures indicated within the Operating Manuals. If these actions do not resolve the issue, then further help or assistance should be sought from the Original Equipment Manufacturer (OEM), Clivet SpA. Their contact details can be found in Section Fifteen of this manual.

7.8 AN INDIVIDUAL ITEM OF EQUIPMENT FAILS TO OPERATE

Check the following:-

1. Check if supply is available at point of connection to wiring system. e.g., at socket outlet or ceiling rose.

2. If no supply is available check whether local circuit MCB is switched on, or that circuit protective fuse is intact.

3. If supply is available check local connector fuse and replace if necessary, having first ascertained cause of blown fuse. In luminaires check for lamp failure. Check for starter and control gear failure.

7.9 FAILURE OF ELECTRICAL POWER AND LIGHTING

Check the following:-

1 Check that incoming disconnector to the local distribution board is correctly set.

2 Check all MCB's in distribution board are correctly set. If protective device has tripped, reset and investigate cause of tripping. If reset cannot be achieved isolate all individual items on circuit. Reset and re-connect items one by one until tripping occurs. Leave item causing tripping isolated and re-connect remaining items.

3 If protective device cannot be reset when all items are isolated from circuit check for fault on wiring of sub-circuit.

4 Check there is an electrical supply to the distribution board serving the area.

5 If no supply is available at distribution board check the LV distribution supply which serves the distribution board to determine the extreme of the failure of supply. Ensure all relevant main isolators, breakers and MCB's are in the on (closed) position. Ensure all fuses are intact.

7.10 FAILURE OR FAULTS ASSOCIATED WITH SPECIALIST SYSTEMS, SPECIALIST EQUIPMENT AND INDIVIDUAL ITEMS OF EQUIPMENT

Reference should be made to the technical documentation and operating and maintenance instructions produced by the suppliers or manufacturers of these systems and equipment.

The maintenance company should always be requested to attend and rectify the fault where failure of these items form part of a maintenance agreement.

A specialist maintenance company should be requested to attend to a fault where a maintenance agreement is not in place and the cause of the fault cannot be readily identified, or rectified using resources available on site.

In particular reference should be made to the following specialist documentation:

Manufacturer/Supplier	Equipment
Castell Safety International	**Switchgear Interlocks**
Clivet SpA	**DX Air Conditioning Units**
Emerson Network Power Ltd	**Uninterruptible Power Supplies**
Prism Power Ltd	**Power Distribution Units**
Schneider Electric Inc	**PowerLogic Power Meter**
Wetac UK Ltd	**Sealed Lead Acid Batteries**

OPERATING PROCEDURES

SECTION CONTENTS

8.1 INTRODUCTION

This Section of the Manual is concerned with the operating procedures for the Mechanical and Electrical Services installation. The operating procedures include requirements and methods for normal shut down, normal start up and normal operation of the services installation. **Reference should be made to Section Three, 'Residual Hazards and Health and Safety', and Section Six, 'Emergency Procedures and Fire Strategy' for details of Emergency Shut Down requirements**.

Only competent personnel trained in the operation of the plant, equipment and systems and conversant with the relevant Health and Safety Regulations should carry out the procedures described within this Section.

This complete Manual and associated documentation must be studied prior to operating any services to ensure that all necessary equipment and tools are available and that the implications of carrying out the procedure are fully understood. It is essential that the design and circuitry of the systems are also fully understood; this can be achieved by studying the As Installed Drawings and inspecting the installation physically on site. Familiarity with the installation is essential, particularly when dealing with emergency situations. The exact location of all electrical isolators, valves and control devices should also be determined.

It must be appreciated that the starting or shutting down of any equipment may have an affect on the operation of other systems and plant. It is therefore essential that consideration be given to these implications prior to carrying out any operating procedure.

Reference should also be made to the manufacturers' and specialists' literature which includes specific details and requirements for the procedures and operation of the plant.

8.2 PROCEDURES FOR MECHANICAL PLANT AND EQUIPMENT

8.2.1 Fan Unit

For Shut-Down:

1. Switch fan local controller to 'off' position.
2. Switch off fan unit local isolator.

8.2 PROCEDURES FOR MECHANICAL PLANT AND EQUIPMENT

8.2.1 Fan Unit continued

For Re-Starting:

1. Ensure that fan unit local isolator is in the 'off' position.
2. Ensure fan unit local controller is switched to 'off'.
3. Check all tools, materials and debris have been removed from inside the unit. Vacuum clean if necessary.
4. Ensure the fan and motor mountings are secure.
5. Check motor ventilation grilles to ensure that they are clean, wiring connections are secure and clean and general condition of motor.
6. Ensure flexible electrical conduits are free to flex.
7. Manually rotate fan to ensure freedom of operation.
8. Ensure that intake and discharge air terminals are clean.
9. Carry out fan unit pre-commissioning procedures as detailed in manufacturer's literature.
10. Ensure that all access doors and panels are correctly fitted.
11. Switch on fan unit local isolator.
12. Switch fan local controller to ‘on’ position..
13. Operate fan to ensure that rotation is correct and the fan operate without undue noise.
14. Carry out fan unit commissioning procedures as detailed in manufacturer's literature.
15. After one hours operation switch fan unit off at local controller and local isolator.
16. Check that fan and motor bearings are not overheating.
17. Switch on fan unit local isolator.
18. Switch fan local controller to ‘on’ position..
19. Inspect the unit frequently in the first few hours and take action if undue noise is observed.

8.2 PROCEDURES FOR MECHANICAL PLANT AND EQUIPMENT

8.2.2 Downflow Air Conditioning Unit

For Shut-Down:

1. Shut down air conditioning unit at unit control panel. Refer to manufacturer's documentation.
2. Switch air conditioning unit local isolator to 'off' position.
3. Switch condenser unit local isolator to 'off' position.

For Re-Starting:

1. Ensure that air conditioning unit local isolator is in the 'off' position.
2. Ensure air conditioning unit is shut down at unit control panel.
3. Ensure that condenser unit local isolator is in the 'off' position.
4. Ensure that no materials or tools, have been left inside the close control air conditioning unit.
5. Ensure filters are clean and correctly fitted.
6. Ensure the fan motor mountings are secure, check condition.
7. Check fan motor ventilation grilles to ensure that they are clean, wiring connections are secure and clean and general condition of motor.
8. Ensure supply fan rotates freely.
9. Ensure that flexible duct connections are in good condition and fitted correctly.
10. Ensure that intake and discharge grilles are clean.
11. Ensure that cooling coil is clean and fins are in good condition.
12. Chemically clean coil drain pan using a sodium hypochlorite solution or other suitable substance. (First ensure that components are compatible with chemicals). Flush through with potable water.
16. Ensure that condenser unit is clear of debris.
17. Ensure that wiring connections to condenser unit are correctly tightened.
18. Ensure that condenser unit fixings are correctly in place and tightened.
19. Carry out pre-commissioning checks of air conditioning unit and condenser unit as detailed within manufactures literature.
20. Ensure that all access doors and panels are correctly fitted.
21. Switch on condenser unit local isolator.
22. Switch on air conditioning unit local isolator.

8.2 PROCEDURES FOR MECHANICAL PLANT AND EQUIPMENT

8.2.2 Downflow Air Conditioning Unit continued

For Re-Starting continued:

23. Carry out air conditioning system commissioning procedures as detailed in supplier's literature.
24. Operate air conditioning unit fan to ensure that rotation is correct and the fan operate without undue noise. (If rotation is incorrect, reverse the connection polarity of the motor).
25. Operate condenser unit fans to ensure that rotation is correct and the fans operate without undue noise. (If rotation is incorrect, reverse the connection polarity of the motor).
26. Set system for normal operation at unit control panel. Refer to supplier's documentation.
27. After one hours operation switch system off at unit control panel.
28. Check that fan and motor bearings are not overheating.
29. Re-start unit.
30. Frequently check unit is operating correctly during following 24 hours.

8.2 PROCEDURES FOR MECHANICAL PLANT AND EQUIPMENT

8.2.3 DX Air Conditioning Systems

For Shut-Down:

1. Switch units off at local controllers.
2. Allow ten minutes for unit to stabilise and then switch off local fan coil unit and compressor / condenser unit isolators and remove fuses.
3. Any dismantling of the direct expansion system must only be carried out by specialist maintenance technicians.

8.2 PROCEDURES FOR MECHANICAL PLANT AND EQUIPMENT

8.2.3 DX Air Conditioning Systems continued

For Re-Starting:

Note: The unit must only be started by trained personnel.

1. Ensure unit local controllers are switched to the 'off' position.
2. Ensure local fan coil unit and compressor / condenser unit electrical isolators are in the 'off' position.
3. Check that there is no debris or tools within unit fan coil unit casing.
4. Vacuum clean if necessary.
5. Check that fan coil unit filters are correctly fitted.
6. Ensure fan coil unit fan and motor mountings are secure.
7. Check fan coil unit motor for unobstructed ventilation grille, security of terminal connections and mounting bolts and general cleanliness.
8. Ensure flexible electrical conduits are free to flex.
9. Ensure that wiring connections are correctly tightened.
10. Manually rotate fan to ensure freedom of operation.
11. Check fan coil unit grilles are clean and unobstructed.
12. Check that all fan coil unit access doors are correctly fitted and securely sealed.
13. Ensure that condenser / compressor unit is clear of debris.
14. Ensure that wiring connections are correctly tightened to condenser / compressor unit.
15. Ensure that condenser / compressor unit fixings are correctly in place and tightened.
16. Carry out pre-commissioning checks as detailed within manufactures manual.
17. Replace fuses and switch on unit local electrical isolators
18. Select low fan speed at local unit controllers.
19. Bring units on line and carry out commissioning and testing procedures as detailed in manufacturer's literature.
20. Check operation of condensate pump and water level controllers.
21. Ensure fan coil units are operating correctly without undue noise..
22. Ensure compressor / condenser unit is operating correctly without undue noise..
23. Set units for operation mode as required. Refer to manufacturer's literature.
24. Inspect the internal and external units frequently in the first few hours and take action if undue noise or incorrect operation is observed.

8.3 PROCEDURES FOR ELECTRICAL SERVICES

8.3.1 LV Switchpanel

Operation Dependant On The Following Systems:-

1. Incoming electrical supply.
2. Incoming isolator correctly set.
3. Board MCB's correctly set.

Normal Operation:-

1. Incoming isolator should be in the 'on' (closed) position.
2. All outgoing feed MCB's should be in the 'on' (closed) position.

Operating Procedures:-

The following describes the general procedure for shut-down and re-starting of the system for maintenance purposes.

WARNING

The electrical supplies from the Distribution Board are relied upon for the safe and correct operation of the equipment served. It is therefore essential that these supplies are not isolated except when absolutely necessary. Where possible shut-down individual outgoing feeds rather than the complete Board. Always try to keep shut-down time to the absolute minimum. A Permit to Work must be obtained prior to any works being carried out on this Board.

For Shut-Down

1. Produce the necessary Method Statements and Risk Assessments.
2. Advise the Responsible person for issuing Permits of the full extent of proposed works and obtain a Permit to Work.
3. Arrange for temporary electrical power supplies if necessary.
4. Ensure all Staff are made aware of shut-down.
5. Ensure that all critical equipment which could be adversely affected by the shut down is safely disabled.
6. Switch individual outgoing feed MCB's to the "off" (open) position and lock in place.
7. Switch ingoing isolator to the "off" (open) position if necessary and lock in position.
8. Advise the Responsible person for issuing Permits that the board is shut down.

8.3 PROCEDURES FOR ELECTRICAL SERVICES

8.3.1 LV Switchpanel continued

Operating Procedures:-

For Re-Starting

1. Produce the necessary Method Statements and Risk Assessments.
2. Advise the Responsible person for issuing Permits of the full extent of proposed works and obtain a Permit to Work.
3. Ensure that the outgoing circuit MCB's are in the 'off' (open) position.
4. Ensure that all critical equipment supplied is safely disabled.
5. The ingoing isolator should be switched to the 'on' (closed) position.
6. The circuit MCB's should be switched on, one by one allowing time to limit load peaks.
7. Any critical equipment users should be advised that supplies have been reinstated.
8. Advise the Responsible person for issuing Permits that the electrical services are operating.

8.3 PROCEDURES FOR ELECTRICAL SERVICES

8.3.2 Lighting and Power Distribution Boards

Operation Dependant On The Following Systems:-

1. Incoming electrical supply.
2. Incoming isolator correctly set.
3. Board MCB's and MCB/RCD's correctly set.

System Serving:-

1. Small power outlets.
2. General lighting.
3. Security systems.
4. UPS Systems.
5. Mechanical services

Normal Operation:-

1. Incoming isolator should be in the 'on' (closed) position.
2. All outgoing feed MCB's and MCB/RCD's should be in the 'on' (closed) position.

8.3 PROCEDURES FOR ELECTRICAL SERVICES

8.3.2 Lighting and Power Distribution Boards continued

Operating Procedures:-

The following describes the general procedure for shut-down and re-starting of the system for maintenance purposes.

WARNING

Each distribution board supplies essential lighting and services requirements for the Building. The electrical supplies from the Distribution Boards are relied upon for the safe and correct operation of many facilities. It is therefore essential that these supplies are not isolated except when absolutely necessary. Where possible shut-down individual outgoing feeds rather than the complete Board and keep shut-down time to the absolute minimum. A Permit to Work must be obtained prior to any works being carried out on these Boards. The Department Managers of any areas likely to be affected must be notified. Alternative temporary lighting and supply provisions may be necessary.

For Shut-Down

1. Produce the necessary Method Statements and Risk Assessments.
2. Advise the Responsible person for issuing Permits of the full extent of proposed works and obtain a Permit to Work.
3. Arrange for temporary electrical power supplies if necessary.
4. Arrange for temporary lighting supplies if necessary.
5. Arrange for additional security facilities if necessary.
6. Ensure all Staff, etc., are made aware of shut-down.
7. Ensure that all affected areas are vacated where necessary.
8. Ensure that all critical equipment which could be adversely affected by the shut down is safely disabled.
9. Switch individual outgoing feed MCB's / RCD's to the "off" (open) position and lock in place.
10. Switch ingoing isolator to the "off" (open) position if necessary and lock in position.
11. Advise the Responsible person for issuing Permits that the board is shut down.

8.3 PROCEDURES FOR ELECTRICAL SERVICES

8.3.2 Lighting and Power Distribution Boards continued

Operating Procedures:-

For Re-Starting

1. Produce the necessary Method Statements and Risk Assessments.
2. Advise the Responsible person for issuing Permits of the full extent of proposed works and obtain a Permit to Work.
3. Ensure that the outgoing circuit MCB's / RCD's are in the 'off' (open) position.
4. Ensure that all critical equipment supplied is safely disabled.
5. The ingoing isolator should be switched to the 'on' (closed) position.
6. The circuit MCB's / RCD's should be switched on, one by one allowing time to limit load peaks.
7. Computer users and other critical equipment users should be advised that equipment can be reinstated if their supplies have been disrupted.
8. Advise the Responsible person for issuing Permits that the electrical services are operating.

8.3 PROCEDURES FOR ELECTRICAL SERVICES

8.3.3 Switchgear Interlocks

Switchgear Interlocks are designed for use as a mechanical interlock for electrical switchgear. The interlock unit is fitted with a spigot that engages an actuating lever that can be used to operate an isolator or control access to a power distribution cubicle.

The key is normally trapped within the lock assembly. Turning the key moves the spigot through predetermined angular rotation (45º - 360º), which isolates the supply and releases the key. The free key can then be transferred to an access interlock.

Reference should be made to the detailed operating instructions produced by the suppliers of the Switchgear Interlocks for the correct operation of the equipment.

8.3.4 Uninterruptible Power Supply (UPS) Units

The purpose of a UPS is not to allow its connected load to lose power. Therefore, design engineers will provide multiple circuits to connected equipment, internal bypass feeds around the power components in the UPS and maintenance bypass feeds around the entire UPS. These alternate and bypass feeds may not allow you to isolate the UPS for the purposes of lockout. Failure to understand how the UPS is supported electrically may result in a fatal electric shock.

Reference should be made to the detailed operating instructions produced by the suppliers of the UPS units for the correct start up and shut down of the equipment.

8.4 SPECIALIST SYSTEM EQUIPMENT

Reference, in particular, should be made to the detailed operating instructions produced by the suppliers of the following equipment. The detailed operating instructions are included within Section Fifteen of this Manual Set:

Manufacturer/Supplier	Equipment/Service
Castell Safety International	Switchgear Interlocks
Clivet SpA	DX Air Conditioning Units
Emerson Network Power Ltd	Uninterruptible Power Supplies
Prism Power Ltd	Power Distribution Units
Schneider Electric Inc	PowerLogic Power Meter
Wetac UK Ltd	Sealed Lead Acid Batteries

EQUIPMENT SCHEDULES

CONTENTS

9.1 INTRODUCTION

This Section contains an Asset Register of the main equipment and materials used and installed.

The Asset Register should be read in conjunction with the manufacturers' technical literature.

This Section is intended as a source of information for future alterations, upgrading or replacement of equipment.

It is essential that the technical details and information for equipment and systems provided in this Manual are checked on site prior to any maintenance, adjustments or ordering of spare parts to ensure that no changes have occurred subsequent to the production of this Document.

Further technical data may be found within Section Fifteen, which includes the Manufacturers' and Specialist Suppliers technical documentation.

Refer to Section 15.2 for manufacturers’ and suppliers’ full contact details

9.2 AIR CONDITIONING SYSTEM

Manufacturer:	Clivet SpA
Type:	Remote Condenser
Range:	CE
Model:	CE 61 ST
Rated Output:	20.2 kW
Supply:	230V/1ph/50Hz
Number of Fans:	1
Type:	Direct Expansion Close Control Unit
Range:	MR-DX
Model:	MR-DX 61
Rated Output:	17 kW
Supply:	230V/1ph/50Hz
Number of Fans:	2

9.3 CABLE LADDER

Manufacturer:	Legrand Electric Ltd
Type:	Galvanised Steel
Range:	Swifts

9.4 CABLE TRAY

Manufacturer:	Legrand Electric Ltd
Type:	Galvanised Steel
Range:	Swifts
Range:	Swiftrack

9.5 CABLE TRUNKING

Manufacturer:	Legrand Electric Ltd
Type:	Galvanised Steel
Range:	Salamandre

9.6 CONCRETE BLOCKS

Manufacturer:	Lignacite Ltd
Type:	Medium Density Loadbearing
Range:	Lignacite

9.7 CONDUIT

Manufacturer:	Allied Tube and Conduit Inc
Type:	Galvanised Steel
Range:	IMC

9.8 COPPER TUBING AND FITTINGS

Manufacturer:	Yorkshire Copper Tube
Range:	Yorkex
Size:	22mm

9.9 DOORS AND FRAMES

Manufacturer:	Hazlin of Ludlow Ltd
Type:	Door
Size:	2040 x 926 x 44mm
Construction:	Solid Chipboard P.E.F.C blank
Finish:	European Ash Veneer
Type:	Door Frame
Overall Size:	2081 x 996mm
Finish:	Ash, laquered

9.10 ELECTRICAL ACCESSORIES

Manufacturer:	Caradon MK Electric Ltd
Range:	Commando
Range:	Metalclad Plus
Manufacturer:	Prysmian Cables Ltd
Type:	Brass Gland Kit
Range:	LSF-CW

9.11 ELECTRICAL CABLES

Manufacturer:	Batt Cables Ltd
Range:	XLPE AWA (BS5467)
Range:	XLPE SWA (BS5467)
Manufacturer:	Prysmian Cables Ltd
Range:	LSOH Conduit Wire (6491B)

9.12 EXTRACT FAN

Manufacturer:	Vent Axia
Type:	Bifurcated Axial Flow
Model:	BIF250/4/1
Supply:	230V/1ph/50Hz
Speed:	1400 RPM

9.13 FIRE ALARM DETECTOR

Supplier:	Drax (UK) Ltd
Manufacturer:	Thorn Security Ltd
Model:	MR601T
Type:	High Performance Optical Smoke Detector

9.14 GRILLES AND DIFFUSERS

Manufacturer:	GDL Air Systems Ltd
Type:	Fire Damper
Type:	Heavy Duty Floor Grille 600 x 600
Type:	External Louvre 300 x 300
Type:	Egg Crate Grille 300 x 300
Type:	PVC Flexible Duct 150mm diameter

9.15 LUMINAIRES

Manufacturer:	Siteco Ltd
Model:	FR200 Single 36W Fitting

9.16 LV SWITCHBOARD

Manufacturer:	Prism Power Ltd

9.17 MASONRY PRIMER

Manufacturer:	PPG Architectural Coatings UK Ltd
Range:	Leyland Truguard
Type:	Stabilising Masonry Primer

9.18 MCCB

Manufacturer:	Schneider Electric Ltd
Range:	Compact NSX
Rating:	800A

9.19 MORTAR PLASTICISER

Manufacturer:	Bostik Ltd
Range:	709706
Type:	Plasticiser

9.20 POWER DISTRIBUTION UNIT (PDU)

Manufacturer:	Prism Power Ltd
Range:	In Touch

9.21 POWER METER

Manufacturer:	Schneider Electric Inc
Range:	PowerLogic
Series:	800

9.22 PLASTERBOARD AND FINISHES

Manufacturer:	British Gypsum
Brand:	Gyproc
Type:	Plasterboard

9.23 RAISED ACCESS FLOORING

Manufacturer:	L&G Raised Access Floors Ltd

9.24 SAND AND CEMENT

Manufacturer:	Cemex UK Cement Ltd
Brand:	Rugby
Type:	Kiln Dried Sand

Manufacturer:	Castle Cement Ltd
Type:	Portland Cement

9.25 SEALED LEAD ACID BATTERIES

Manufacturer:	Wetac UK Ltd
Range:	See information relating to Emerson Network Power UPS units for specific battery information.

9.26 STUD AND TRACK SYSTEM

Manufacturer:	SIG plc
Range:	Speedline

9.27 SWITCHGEAR INTERLOCKS

Manufacturer:	Castell Safety International Ltd
Range:	FS
Type:	FS/Q

9.28 THERMAL INSULATION

Manufacturer:	Armacell UK Ltd
Range:	Armaflex
Class:	O

9.29 UNINTERRUPTIBLE POWER SUPPLY (UPS) UNITS

Manufacturer:	Emerson Network Power
Brand:	Liebert
Model:	Hipulse E
Type:	High Availability UPS
Rating:	400 kVA
Input:	400V/3ph/50Hz
Output:	400V/3ph/50Hz

DANGEROUS SUBSTANCES

SECTION CONTENTS

10.1 INTRODUCTION

This Section of the Health and Safety File includes details of known Dangerous or Potentially Dangerous Substances within the confines of the Site:

10.2 ASBESTOS

There are no known occurrences of Asbestos within the confines of the PW Building Services Works Area.

Normal precautions as required by the Health and Safety Executive should however ALWAYS be observed when carrying out maintenance works, excavations and demolition.

Sampling and analysis by an accredited specialist should be carried out if any materials are found which are considered may contain asbestos.

10.3 NATURAL AND MANUFACTURED GAS

There are no known natural gas supplies within the confines of the PW Building Services Works Area.

Normal precautions should be observed when carrying out maintenance works, excavations and demolition to determine the contents within any pipework found, for which the purpose is unknown.

10.4 DIESEL FUEL STORAGE AND SUPPLY SYSTEM

There are no known Diesel Fuel Storage tanks or pipelines within the confines of the PW Building Services Works Area.

Normal precautions should however be observed when carrying out maintenance works, excavations and demolition to determine the contents within any pipework found, for which the purpose is unknown.

10.5 ELECTRICITY

Electricity is distributed throughout the Site.

Supplies are generally installed within cable trays, cable trunking and conduits. Some surface mounted supplies are also provided.

Reference should be made to the As Installed Drawings of the electrical installation produced by PW Building Services, included within Section Fourteen of this Health and Safety File / Operating and Maintenance Manual.

All new electrical supplies have been installed in accordance with The Institution of Electrical Engineers Regulations for Electrical Installations 17th Edition. (BS7671:2008).

The complete electrical power installation has been tested in accordance with the procedures detailed within BS7671:2008. Copies of these test reports are included within Section Thirteen of this Manual, along with a copy of the Electrical Completion Certificate.

All future works associated with the electrical distribution system should be carried out by suitably qualified, competent and experienced Registered Electricians.

Routine testing of the complete electrical installation should be carried out. This will probably be every five years but this will be confirmed at the time each Test Completion Certificate is issued. These certificates should be inserted within Section Thirteen of this Manual. The original test certificates should also be safely retained.

10.6 LEAD ACID BATTERIES

Sealed lead acid batteries are used within the UPS and fire alarm systems.

The battery packs contain a mixture of sulphuric acid and water. The mixture is corrosive, poisonous and will cause burns if contact is made with any part of the body.

10.7 COMPUTER AND ELECTRONIC EQUIPMENT

It should be noted that electronic and computer related equipment has been installed within the Building by the Client subsequent to Handover by PW Building Services. This equipment may also be updated / upgraded to suit changes in requirements and technology available.

The Client should be consulted prior to maintaining, altering, dismantling and disposing of any such equipment to determine the particular Risks that may be applicable at that point in time and to determine whether there are any related dangerous substances.

It is recommended the Client should include details of any dangerous substances installed by them after this page. These details should be kept up to date.

STATUTORY APPROVALS, CONSENTS AND REPORTS

SECTION CONTENTS

11.1 INTRODUCTION

This Section of the Health and Safety File / Operating and Maintenance Manual contains copies of Relevant Important Records of Notifications and Approvals obtained. These relate to Health and Safety and authoritative permissions to carry out Works and Activities.

11.2 FORM F10, 'NOTIFICATION OF CONSTRUCTION PROJECT'

A copy of Form F10, 'Notification of a Construction Project' was completed and duly submitted to the Health and Safety Executive

A copy of this Form is included after this page.

11.3 PLANS APPROVAL NOTICE

Plans approval in accordance with Section 51 of the Building Act 1984 was sought and granted in relation to the works carried out.

A copy of the Approval Notice is included after this page.

IMPORTANT REFERENCE INFORMATION

SECTION CONTENTS

12.1 HEALTH AND SAFETY INFORMATION

There is no knowledge of any relevant previous Health and Safety information being available or of any previous Health and Safety Files having been produced for the Building, prior to the Works carried out by PW Building Services.

12.2 DRAWINGS AND SPECIFICATIONS

Drawings and Specifications for the Works were produced by the Design Team.

This information has been progressed during the course of the Contract by the Construction Team and is superseded by this Health and Safety File / Operating and Maintenance Manual.

12.2.1 Heat Gain and Loss Calculations

Calculations relating to Heat Gain and Loss for the installation were produced by the Design Team.

No.	Title
1.	Heat Gain Calculations
2.	Heat Loss Calculations

Copies of the calculations are included after this page.

12.2.2 Structural Load Calculations

Calculations relating to the Structural Loads for the Building Works were produced by the Design Team.

No.	Title
1.	J-N0475 Structural Load Calculations

Copies of the calculations are included after this page.

Heat Gain Calculations

Information Produced

by the Design Team

Heat Loss Calculations

Information Produced

by the Design Team

Structural Load Calculations

Information Produced

by the Design Team

TEST AND COMMISSIONING REPORTS

SECTION CONTENTS

13.1 INTRODUCTION

The following Mechanical and Electrical Services Certificates and Reports detail results obtained during the testing and commissioning carried out on plant, equipment and systems throughout the installation works. These include the final balancing, proving, commissioning, performance testing and setting to work of the installation.

The reports record standards and requirements obtained during the works and are the evidence of results obtained at the time of testing.

The Commissioning Data should be referred to by the maintenance technicians to establish the normal operating conditions of the plant and systems. The data and results detail the measurements which should be obtained at each device to ensure that the systems are operating correctly as designed.

It is of the utmost importance that the plant, equipment and systems are maintained at their design duties to ensure maximum occupant comfort, reliability, efficiency and life expectancy.

Equipment and system performance will vary due to wear and tear, malfunctions and possibly incorrect tampering. It is therefore necessary to check operating performances against the data and results contained within the Reports from time to time and re-adjust device settings accordingly. This will also be necessary after major plant maintenance.

These results can be used as a datum to determine whether the systems are operating and performing correctly.

Copies of these Reports are included at the end of this Section.

A copy of the Practical Completion Certificate is also provided for Record Purposes.

13.2 MECHANICAL SYSTEMS

System / Certificate Description:	Ref:

13.3 ELECTRICAL SYSTEMS

System / Certificate Description:	Ref:
UPS Module 1 Startup Record	90009302

AS INSTALLED DRAWINGS

SECTION CONTENTS

14.1 INTRODUCTION

The following As Installed Drawings have been produced to indicate the Services installation as at Handover to the Client. These drawings should be read in conjunction with this complete Health and Safety File / Operating and Maintenance Manual to assist with the general understanding of the services installation.

One set of the As Installed Drawings are inserted within this Manual, after the schedule, for reference purposes. The drawings are arranged in numerical order in the sequence scheduled.

14.2 SCHEDULE OF AS INSTALLED DRAWINGS

Drawing No.	Title
LCA1412-E01	Electrical Services Schematic
LCA1412-E02	Electrical Services Installation
LCA1412-M01	Mechanical Services – Comfort Cooling and Ventilation
LCA1412-001 P1	Ground and First Floor Plan – Proposed / Existing
LCA1412-001 P4	Ground and First Floor Plan – Proposed / Existing

SUPPLIERS' DOCUMENTATION

CONTENTS

15.1 GENERAL

This Section of the Manual contains copies of manufacturers' and suppliers' technical literature. The literature details, where applicable, specific instructions on the installation, operation and maintenance of the equipment installed together with lists of available spare parts. This information compliments and should be read in conjunction with the written text of this Manual.

Each item of equipment has a separate sub-section preceded by a flysheet. The sub-sections are arranged in alphabetical order of manufacturers and suppliers although the Section title relates to the actual equipment type included. This arrangement will assist with the rapid retrieval of information.

15.2 DIRECTORY OF MANUFACTURERS AND SUPPLIERS

Manufacturer/Supplier	Equipment/Service
Allied Tube and Conduit 16100 S. Lathrop Avenue Harvey IL 60426 USA Tel.: 001 800 882 5543	**Conduit**
Armacell UK Ltd Mars Street Oldham Lancashire, OL9 6LY Tel.: 0161 287 7100 Fax.: 0161 633 2685	**Thermal Insulation**
Building Automation Solutions Ltd Unit 3 Marlin Office Village Castle Vale Chester Road Birmingham, B35 7AZ Tel.: 0121 748 8750 Fax.: 0121 748 8759	**Specialist BMS / Controls System Subcontractor**
Batt Cables Ltd The Belfry Fraser Road Erith Kent DA8 1QH Tel.: 01322 441165 Fax.: 01322 440492	**Electrical Cables**
Bostik Ltd Common Road Stafford Staffordshire, ST16 3EH Tel.: 01785 255141	**Mortar Plasticiser**

Manufacturer/Supplier	Equipment/Service
British Gypsum Ltd East Leake Loughborough Leicestershire, LE12 6HX Tel.: 08705 456123	**Wall Boards**
Caradon MK Electric Ltd The Arnold Centre Paycocke Road Basildon Essex, SS14 3EA Tel.: 01268 563 000 Fax.: 01268 563 768	**Electrical Accessories**
Castell Safety International Ltd Kingsbury Road London, NW9 8UR Tel.: 0208 200 1200 Fax.: 0208 205 0055	**Switchgear Interlocks**
Castle Cement Ltd Park Square 3160 Solihull Parkway Birmingham Business Park Birmingham, B37 7YN Tel.: 0845 722 7853 Fax.: 01780 727154	**Portland Cement**
Cemex UK Cement Ltd Cemex House Evreux Way Rugby Warwickshire, CV21 2DT Tel.: 0808 145 1900 Fax.: 01788 514742	**Kiln Dried Sand**

Manufacturer/Supplier	Equipment/Service
Clivet SpA Via Camp Lonc 25 – 32032 Z.I.Villapaiera Feltre (BL) Italy Tel.: 0039 0439 3131 Fax.: 0039 0439 313300	**DX Air Conditioning Units**
Coolair Equipment Ltd 10 Hollingworth Court Ashford Road Maidstone Kent, ME14 5PP Tel: 01622 762222 Fax.: 01622 656969	**Specialist Air Conditioning Subcontractor**
Drax (UK) Ltd Pixmore Centre, Pixmore Avenue Letchworth Hertfordshire, SG6 1JG Tel: 0845 459 2300 Fax.: 0845 459 2400	**Specialist Fire Alarm Subcontractor**
Emerson Network Power Ltd Fourth Avenue Globe Park Marlow Buckinghamshire, SL7 1YG Tel.: 01628 403200 Fax.: 01628 403203	**Uninterruptible Power Supplies**
Fire Escape Ltd 141 Queens Road Croydon Surrey, CR0 2PX Tel.: 0208 665 6598 Fax.: 0208 683 0929	**Specialist Steelwork Subcontractor**

Manufacturer/Supplier	Equipment/Service
GDL Air Systems Ltd Woolley Bridge Road Hadfield Derbyshire, SK13 1AB Tel.: 01457 861538 Fax.: 01457 866010	**Grilles and Dampers**
Hazlin of Ludlow Ltd Station Works Bromfield Nr Ludlow Shropshire, SY8 2BT Tel.: 01584 856439 Fax.: 01584 856520	**Doors and Frames**
L&G Raised Access Floors Ltd 84 High St Harlesden London, NW10 4SJ Tel.: 0208 993 2633	**Raised Floor**
Legrand Electric Ltd Great King Street North Birmingham West Midlands, B19 2LF Tel.: 0870 608 9000 Fax.: 0870 608 9004	**Cable Management Systems**
Lignacite Ltd Norfolk House High Street Brandon Suffolk, IP27 0AX Tel.: 01842 810678 Fax.: 01842 814602	**Concrete Blocks**

Manufacturer/Supplier	Equipment/Service
MEP Associates Pegasus London Road Crowborough East Sussex, TN6 2TX Tel.: 01892 669978 Fax.: 08712 535676	**Production of Operating and Maintenance Manuals**
PPG Architectural Coatings UK Ltd Huddersfield Road Birstall Batley West Yorkshire, WF17 9XA Tel.: 01924 354000 Fax.: 01924 354001	**Leyland Trugard Stabilising Masonry Primer**
Prism Power Ltd Caxton Court Caxton Way Watford Business Park Watford Hertfordshire, WD18 8RH Tel.: 01923 296700 Fax.: 01923 296707	**Main LV Switchboard** **Power Distribution Units**
Prysmian Cables and Systems Ltd Chickenhall Lane Eastleigh Hampshire, SO50 6YU Tel.: 0845 767 8345 Fax.: 02380 295465	**Electrical Cables**
Schneider Electric Ltd Stafford Park 5 Telford Shropshire, TF3 3BL Tel.: 01543 490253 Fax.: 01543 491677	**Compact NSX MCCB**

Manufacturer/Supplier	Equipment/Service
Schneider Electric Inc Power Monitoring and Control Division 295 Tech Park Drive, Suite 100 La Vergne TN 37086 USA Tel.: 001 615 287 3400	**PowerLogic Power Meter**
SIG plc Signet House 17 Europa View Sheffield Business Park Sheffield South Yorkshire, S9 1XH Tel.: 0114 285 6300 Fax.: 0114 285 6385	**Speedline Partitioning System**
Siteco Ltd Unit 3-4 Grosvenor Business Park Horsfield Way Bredbury Industrial Estate Stockport Cheshire, SK6 2SU Tel.: 0161 406 0800 Fax.: 0161 494 6756	**Luminaires**
Vent Axia Terminus Road Chichester West Sussex PO19 2ZL Tel.: 01243 787943 Fax.: 01243 780041	**Extract Fans**
Wetac UK Ltd Office 17 Bolton Business Centre 44 - 46 Lower Bridgeman Street Bolton Lancashire, BL2 1DG Tel.: 01204 366728	**Specialist Battery Supplier**

Manufacturer/Supplier	Equipment/Service
Yorkshire Copper Tube East Lancashire Road Kirkby Liverpool Merseyside, L33 7TU Tel.: 0151 545 5079 Fax.: 0151 549 2139	**Copper Tube and Fittings**

15.3 SCHEDULE OF LITERATURE

The following Schedule provides in alphabetical order a list of manufacturers and suppliers whose literature is included within this Section.

Manufacturer/Supplier	Equipment/Service
Allied Tube and Conduit	**Conduit**
Armacell UK Ltd	**Thermal Insulation**
Batt Cables Ltd	**Electrical Cables**
Bostik Ltd	**Mortar Plasticiser**
British Gypsum Ltd	**Wall Boards**
Caradon MK Electric Ltd	**Electrical Accessories**
Castell Safety International Ltd	**Switchgear Interlocks**
Castle Cement Ltd	**Portland Cement**
Cemex UK Cement Ltd	**Kiln Dried Sand**
Clivet SpA	**DX Air Conditioning Units**
Drax (UK) Ltd	**Fire Alarm Detector**
Emerson Network Power Ltd	**Uninterruptible Power Supplies**
GDL Air Systems Ltd	**Grilles and Dampers**
Hazlin of Ludlow Ltd	**Doors and Frames**
Legrand Electric Ltd	**Cable Management Systems**
Lignacite Ltd	**Concrete Blocks**
PPG Architectural Coatings UK Ltd	**Leyland Trugard Stabilising Masonry Primer**
Prism Power Ltd	**Main LV Switchboard**
Prism Power Ltd	**Power Distribution Units**
Prysmian Cables and Systems Ltd	**Electrical Cables**

Manufacturer/Supplier	Equipment/Service
Schneider Electric Ltd	**Compact NSX MCCB**
Schneider Electric Inc	**PowerLogic Power Meter**
SIG plc	**Speedline Partitioning System**
Siteco Ltd	**Luminaires**
Vent Axia	**Extract Fans**
Yorkshire Copper Tube	**Copper Tube and Fittings**

Conduit

Literature

From

Allied Tube and Conduit

Thermal Insulation

Literature

From

Armacell UK Ltd

Electrical Cables

Literature

From

Batt Cables Ltd

Mortar Plasticiser

Literature

From

Bostik Ltd

Wall Boards

Literature

From

British Gypsum Ltd

Electrical Accessories

Literature

From

Caradon MK Electric Ltd

Switchgear Interlocks

Literature

From

Castell Safety International Ltd

Portland Cement

Literature

From

Castle Cement Ltd

Kiln Dried Sand

Literature

From

Cemex UK Cement Ltd

DX Air Conditioning Units

Literature

From

Clivet SpA

Fire Alarm Detector

Literature

From

Drax (UK) Ltd

Uninterruptible Power Supplies

Literature

From

Emerson Network Power Ltd

Grilles and Dampers

Literature

From

GDL Air Systems Ltd

Doors and Frames

Literature

From

Hazlin of Ludlow Ltd

Cable Management Systems

Literature

From

Legrand Electric Ltd

Concrete Blocks

Literature

From

Lignacite Ltd

Stabilising Masonry Primer

Literature

From

PPG Architectural Coatings UK Ltd

Main LV Switchboard

Literature

From

Prism Power Ltd

Power Distribution Units

Literature

From

Prism Power Ltd

Electrical Cables

Literature

From

Prysmian Cables and Systems Ltd

Compact NSX MCCB

Literature

From

Schneider Electric Ltd

PowerLogic Power Meter

Literature

From

Schneider Electric Inc

Speedline Partitioning System

Literature

From

SIG plc

Luminaires

Literature

From

Siteco Ltd

Extract Fans

Literature

From

Vent Axia

Copper Tube and Fittings

Literature

From

Yorkshire Copper Tube