UNIVERSITY OF Southampton

Briefing Notes for Electrical Services

ES/002-C

Revision history

Revision no.	Date of Revision	Revised by	Changes made
A	23.11.15	AKM	Reviewed and updated (previous reference ES/005)
B	27.06.18	RLS	Updated for comment
C	11.09.19	JCD	Incorporates changes following technical workshops

Contents

1 Introduction

1.1 General principles

These briefing notes for electrical services have been prepared to communicate the University of Southampton's requirements for electrical engineering across its estate. They are intended to guide consultants and contractors on the approaches and standards that the University finds acceptable. They do not relieve consultants and contractors of their obligations to deliver the project brief.

Manufacturers mentioned in the Section 10 of this briefing note are University preferred and supported; should alternatives be proposed they shall be submitted for approval to the University's Project Liaison Engineer. Care shall be taken to match existing systems and components where a project affects only part of a space (provided that current standards and legislation are not compromised).

All control software shall be open protocol. In this context 'open protocol' means software that can readily be accessed, maintained and modified in all respects by any competent electrical contractor without the requirement for any licence, dongle or other constraint.

All electrical systems and equipment shall comply with the latest edition of British, European or International standards.

1.2 Contractual coordination

A clause shall be included in the specification to positively identify responsibility and ensure co-ordination of services is carried out.

Electrical Consultants will be expected to liaise with consultants of other disciplines to ensure co-ordination of all aspects of the design.

1.3 Information exchange

The University of Southampton Project Liaison Engineer is available to provide information concerning its systems and nuances to the Consultant to assist in the preparation of, and be adequately covered by, the tender documentation. The role of the Project Liaison Engineer is described in document reference ES/003 'University liaison engineers, consulting engineers and their duties'.

1.4 Ancillary services

Provision shall be included to allow wiring to data, telecommunication systems, BMS etc.

The University utilises a specialist contractor to install, test, commission, and certify its data and telephony requirements - the University Project Liaison Engineer will provide contact details.

Separate specifications, published by the University's iSolutions department, exist for ICT cabling and Wi-Fi provision.

2 Electrical supply and distribution

2.1 Supply arrangements

The University operates across a number of locations in the Southampton and Winchester areas and each of these has a separate electricity supply. In addition, combined heat and power plants are situated at the Highfield and Boldrewood campuses and at Chamberlain Hall. The table below indicates the voltage rating of supplies that are within the University's ownership and control.

Table 1 – Voltage of incoming supplies that are within University ownership

Location	High voltage supply	Low voltage supply	Notes
Highfield campus	11 kV	400 V	Ring main – see section 2.3
Avenue campus	None	400 V	
Boldrewood campus	11 kV	None	
Winchester campus	None	400 V	
Astro House	11 kV	None	
Southampton General Hospital	[11 kV]	400 V	See Note 1
National Oceanography Centre	[11 kV]	None	See Note 2
Glen Eyre Halls	11 kV	None	
Montefiore Hall	6.6 kV	None	
All other halls of residence	None	400 V	

Note 1 – The University has buildings on the Southampton General Hospital site which it owns and operates. Electrical supplies to these buildings are at 400 V. There is also a HV supply at the site; however, this is operated by the Hospital Trust, not the University.

Note 2 – The University has accommodation at the National Oceanography Centre Southampton (NOCS). The operation of electrical systems on this site is under local management, not the University.

2.2 High voltage equipment – General principles

The University has 'in-house' engineers with 11 kV expertise, who are available to provide information and to proffer design and operational assistance as required. All works associated with the 11 kV network shall be agreed with the University's High Voltage Network Manager via the Project Liaison Engineer.

The University operates its own locking procedure therefore the permanent locks will be free issue.

2.3 High voltage equipment – Highfield 'ring main'

The University owns and operates its own 11 kV (400 Amp minimum) network on the Highfield campus. This comprises a 'figure of eight' arrangement with an open point. It is supplied by two incomers: the east incomer adjacent to the Energy Centre (Building 11) and the west incomer adjacent to the Mountbatten Building (Building 53). A combined heat and power (CHP) plant is located in the Energy Centre and provides up to 2.8 MW in parallel with the east incomer.

Generally the principal protection for the network on the main campus is at the intake positions via IDMT relays. The remainder of the on-site network is based upon 'Ring main' type units, both fixed pattern and extensible

2.4 High voltage equipment – substation configuration

Where the design capacity of the Substation provides for a transformer rating of 1,000kVA or below, the configuration shall be based upon a single transformer, except where specific operational criteria or user requirements indicate otherwise

Where the design capacity of the substation provides for a load over 1,000kVA, then the configuration shall be based upon a minimum of two transformers with a maximum capacity of each transformer not exceeding 1,500kVA, except where specific operational criteria or user requirements indicate otherwise

In all cases the design of the substation shall consider future maintenance of the equipment and its implication on loss of electrical power to the loads.

Adequate access for the installation and future replacement of equipment shall be allowed.

The final substation configuration shall be agreed with the University HV Network Manager.

2.5 Network transformers

Network Transformers shall conform to the specification detailed below:

- Transformers shall be to BS EN 60076 – Amorphous Super Low Loss
- Indoor / Outdoor type ground mounted. MIDEL Oil Immersed Naturally Cooled (KNAN)
- Rating (to suit)* - Minimum 500 kVA
- Phases - Three Phase (Double Wound)
- Frequency - 50Hz
- Windings - Al / Al or Cu / Cu
- HV Winding - 11000 Volts
- LV Winding** - 400 Volts (No Load)
- HV Tapings - +2.5% +5% 0 -2.5% -5%
- Tap Change - Externally operated “off load” switch, operating handle to be lockable in each position, University will provide lock.
- HV / LV Connections - Delta/Star N
- BS Vector Symbol - Dyn 11
- Insulating Oil - Midel 7131
- Tank Fittings - (Minimum requirement, any additional standard items should not be deleted.)
- Neutral - 100% Rated
- HV Terminations - Dry termination box with gasket sealed lid.
- Termination box suitable for ‘Raychem’ type termination kit, to accept a 3 core (TCTA) XLPE cable.
- LV Termination’s - Dry termination box with gasket sealed lid, to accept XLPE / AWA single cores.
- Lifting lugs (minimum 2)
- Jacking lugs / points
- Oil level indicator
- Earthing terminal
- Rating and connection plate
- Free Breathing Device, complete with Silica Gel Pot.
- Oil filling point and cap
- Oil drain sampler valve and cap
- Skid wheel mounted

* New Transformer ratings shall be 500kVA minimum, sized to match the design load profile. Consideration shall be given to 15 – 20% spare capacity for future load expansion. Bespoke ratings shall be avoided.

** LV rating shall be dependent upon the location of the transformer; where the transformer forms a replacement for an existing which is related to a second transformer then the voltage shall be matched that existing (generally 433V).

Buchholz type Transformer protection shall be considered on all transformers above 1000kVA.

L.V. busbars shall be considered on all transformers above 1500kVA.

All new installed or replacement transformers shall have an oil sample taken to produce a full TCR; this will be used as a bench mark against which future tests will be compared

Transformer L.V. interlink between the Transformer and the L.V. Switchboard shall be via single core cables; Bus bar interlinks shall only be considered for transformers of ratings above 2,500kVA, by agreement with the University Appointed HV Engineer

Resin Cast network transformers are not acceptable.

2.6 Earthing

Substation earthing is to be designed and installed in compliance with BS 7671 and with the agreement of the University's Appointed HV Engineer.

Protection against earth leakage and earth fault currents shall be provided in accordance with the current edition of BS 7671.

Each CPC shall be identified with a proprietary cable numbering system and each cable numbered with its circuit reference.

Where a standby generator is to be installed the neutral of the generator shall be connected directly to the earth system so that any changeover switch does not disconnect the generator neutral from earth. Likewise the changeover switch shall not disconnect the neutral of any power supply transformer from earth.

2.7 Primary cabling

Cabling forming part of the high voltage network shall be 3 core 185 mm^2 Cu XLPE (TCTA) / SWA. The University system is configured for a minimum current of 400 A.

Cabling from the transformer to the main LV switchboard shall include a fully rated neutral.

2.8 Main switchboard – general design considerations

The switchboard shall be fully Type Tested and certified. The manufacturer shall be responsible for final site coupling, testing and certification.

The L.V. switchboard shall be manufactured with modular construction utilising Schneider Circuit Protective Devices (CPD's)

The Neutral / Earth link point shall be located within a readily accessible section of the L.V. Switchboard, clearly labelled to indicate the location

The Main incomer ACB shall be equipped with an electronic trip unit capable of retaining fault records associated with any tripping of the ACB

The Main incomer ACB shall be equipped with a current display that will provide the indication throughout its range

An Electrical Meter shall be installed on the switchboard to each Incomer; this meter is not designated for energy consumption monitoring. The meter shall provide the following by selection:

- Individual Phase load current; the screen shall display all three simultaneously
- Phase Voltage Levels; the screen shall display all three simultaneously

- Rolling Maximum Demand for kVA, kVAh & kVA_rh
- Peak Maximum Demand for kVA, kVAh & kVA_rh
- Weight settable pulse output

An option for direct IP output should also be considered, requirement shall be agreed with University Project Liaison Engineer

A label shall be installed adjacent to the meter indicating the requirement for the Maximum Demand record to be zeroed following the event where a dual transformer fed L.V. Switchboard has operated from one transformer

Minimum 25% equipped spare capacity required in switchboard at handover.

Minimum Form 4 Standard:

- Type 6 – Additional consideration should be given for instances where large size or parallel cables are needed due to volt drop.
- Type 2 – This may be acceptable for certain low load outgoing ways, i.e. Fire Alarm supplies, where the outgoing cable can be terminated directly to the protective device which is in turn located within its own compartment; guidance will be available from the University Project Liaison Engineer prior to specifying

The configuration of the proposed L.V. switchboard shall be agreed with the University Project Liaison Engineer prior to ordering / manufacture

All incoming and outgoing devices shall be complete with fully rated switched neutral considered against the possible effects of Power Factor and Harmonics.

The external door / panel of all incoming and outgoing circuits shall be fitted with an engraved permanently fixed label detailing the Current Transformer (C.T.) Ratios installed, e.g.

Metering C.T.'s 100:5 Protection C.T.'s 2000:5 etc.

Note: Protection Type to be detailed

Outgoing circuits shall be fitted complete with suitably rated C.T.'s for an electricity consumption meter. (See Below)

Energy Metering C.T.'s shall be prewired out to the cable way, or dedicated auxiliary wiring compartment, to facilitate connection through to the meter by others, star point links shall be installed at these terminals

Internal segregation barrier panels shall be either micro perforated steel sheet or 'Makrolon' type, or similar approved 'transparent' material to permit the inspection of any and all C.T.'s installed behind

The Internal segregation barrier shall be configure to facilitate the use of Thermal Imaging devices to aid PPM at termination and C.T points

The University will require a Factory Acceptance Test for new and replacement L.V. Switchboards; attendees from the University shall be agreed with the University Project Liaison Engineer

For each L.V. Switchboard a schedule of ACB settings shall be created and included with the As Built Documentation

2.9 Main switchboard – surge protection

Each incoming device shall be fitted with a suitably rated cartridge based surge protector. The device shall provide the following protection:

- Lightning (10 / 350 micro S Wave shape)
- Transformer Tap Changing
- Power station, substation and network faults
- Power Surges and Short Circuits.

2.10 Main switchboard – harmonic filtration

In order to facilitate the installation of Harmonic Filtering, either as part of the initial installation or once the load profile is established, a suitably rated CT(s) shall be installed on the main incomer(s) and wired to a safe compartment of the switchboard.

In addition any outgoing way with a rating of 800Amp or greater shall be similarly fitted with a harmonic CT(s)

To facilitate the connection of the Harmonic Filter the first / second TP & N outgoing way from the main incomer shall be allocated on each switchboard (Section).

2.11 Main switchboard – power factor correction

In order to facilitate the installation of Power Factor Correction, either as part of the initial installation or once the load profile is established, a suitably rated CT(s) shall be installed on the main incomer(s) and wired to a safe compartment of the switchboard.

In addition any outgoing way with a rating of 800Amp or greater shall be similarly fitted with a P.F.C. CT(s).

To facilitate the connection of the Power Factor Correction the first / second TP outgoing way from the main incomer shall be allocated on each switchboard or Section.

2.12 Main switchboard – generator facility

Provision shall be included for an input connection from an emergency generator. The generator-input switch shall be rated at 400A (TPSwN) Three Phase with a fully rated switched neutral.

2.13 Switchboard schematic

Adjacent to the Switchboard a Schematic diagram, minimum size A2, shall be installed detailing the switchboard, its inputs and loads. Each circuit shall be detailed with the rating of the device.

2.14 Wiring system

Generally all cabling and wiring shall be of BASEC approved cables with copper conductors, LSF format and sized to suit their respective load.

Mains & Sub-Mains Power cables shall be generally XLPE / SWA types; sizing of cables that service other distribution, i.e. switchboards – distribution boards etc. shall consider future load expansion.

When sizing of cables the maximum permitted operating temperature of the cable shall be 70°C.

Small power ring circuits shall be wired in a minimum of 2.5mm^2 Cu

Lighting circuits shall be wired in a minimum of 1.5mm^2 Cu

Cable routing shall have accessible ‘pulling’ points.

2.15 Distribution system

Schneider (Merlin Gerin) distribution boards are preferred, with XLPE/SWA/, LSF sub-mains cabling.

Distribution boards shall be complete with 4 pole incoming devices for TPSwN distribution and 2 Pole incoming devices for SPSwN distribution. It should be noted that outgoing ways do not require the neutral to be switched, except where the circuit is to feed an additional distribution board.

TP&N and SP&N Distribution boards shall be ISOBAR Split Metered to segregate Lighting circuits from Small Power circuits. The split ratio shall be as determined by the design, in all cases a minimum of 30% spare ways shall be available to each section at the completion of the construction

All distribution boards must be lockable with removable key.

RCBO's shall generally be 30mA Type A (Type AC RCD's shall not be used). Minimum overcurrent rating shall be 6A, Type C. Note: load dynamics may require a different RCD protection Type. Consideration should also be given to the use of AFDD's (Arc Fault Detection Devices) or SPD's (Surge Protection Devices) where electrical systems supply sensitive or high risk environments.

All switchgear, distribution boards, etc. shall be labelled in compliance with University labelling guidelines; see Section 2.18 below.

Circuit Neutrals and CPC's shall be clearly identified within distribution boards / panels with a proprietary cable numbering system with their relevant circuit reference.

Data hubs shall be connected via a dedicated circuit.

2.16 Busbar distribution

Where primary building risers are present consideration shall be given to the use of copper busbar risers to facilitate ease of power distribution.

Separate busbar systems shall be installed for small power and lighting services.

The busbar configuration shall be such that floor loads utilise tap-off points on that floor.

Busbars shall be sized for the anticipated load with reasonable capacity for any additional future loads.

Coordination with other services in the risers shall be carried out to ensure that all tap-offs can be used and access to the tap-offs for cabling is maintained.

Tap-offs units shall be complete with their appropriately rated automatic protective device

2.17 Emergency Power Off (EPO) systems

EPO systems shall be installed to laboratories, works shops and locations specified by the end user

The EPO system shall isolate all electrical services, with the exception of lighting, that can be viewed from the location of the EPO unit

Zoned EPO systems are not acceptable

The EPO system shall exclude, by agreement, services to refrigerators and freezers.

The EPO button shall be shrouded to minimise accidental activation.

2.18 Circuit identification and labelling

The University of Southampton has adopted a standard method for all electrical circuit distribution and identification.

The premise of the system is to enable any circuit to be traced back to its original source and through any part.

Example: DB 40 - 06 - 11 / 3L2

The circuit identification is made up as follows:

First Alpha	**DB**	Acceptable abbreviations: SB = Switch Board DB = Distribution Board BB = Bus Bar CP = Control Panel
First Numeric	**40**	Building / Substation Number
Second Numeric	**06**	Way Number on the Switchboard. Way number may be appended with the Phase reference for single phase.
Third Numeric	**11**	Way Number on the Intermediate Distribution Board, not always present. Way number may be appended with the Phase reference for single phase.
Final Reference	**3L2**	Final circuit number on distribution board. 3 = Way L2 = Phase The phase number is used for single phase circuits only

An engraved 'Black-On-White' label shall be fixed utilising a minimum of 4 snap rivets to:-

- Switchboards 10mm Characters
- Distribution Boards 8mm Characters
- Switch-Fuses 6mm Characters
- Local Isolators 6mm Characters

All labelling shall be agreed with the University Project Liaison Engineer prior to manufacture

External Labelling shall be engraved 'Black-On-White', permanently fixed such as to ensure the weatherproof integrity.

3 Alternative power supplies

Note: The CHP plants installed at Highfield and Boldrewood campuses and Chamberlain Halls are not to be considered emergency backup supplies in the event of mains power failure as their connection to the grid is such that they will cut out on mains failure.

3.1 Generators

Where the installation of permanent generators is included in a project, including such for CHP, a connection point for a mobile load bank shall be installed

Transfer of the output of the generator to the load bank test point shall be via pad-lockable fully rated switches. The configuration of the switches shall be such that temporary cable modifications are not required. The selection of the connection arrangement shall be agreed with the liaison engineer.

The load bank connection point, cabling and switch ratings shall be a minimum of 20% above the rating of the generator

The location of the load bank connection point shall be such that the load back can be positioned in a safe location external to the building

Standby generators will be subject to monthly run tests, the configuration of the switching and controls shall be such that this can be achieved without compromising the normal operation of the building systems

The generator bulk fuel storage shall be capable of supporting the full load operation of the generator for a minimum of 48 hours; the University Project Liaison Engineer will provide guidance to any variation to this

The bulk fuel storage and any link to the generator day tank shall be subject to a permanently installed 'Fuel Polishing System'

Generator fuel systems shall be interlocked to the fire alarm system such that any activation local to the generator of fuel storage point immediately isolates the fuel delivery to the generator

In addition the generator shall be able to accept emergency shutdown signals from the fire alarm system, local EPO and as such appropriate to the location.

The site and control configuration of a generator installation shall be agreed with the University Project Liaison Engineer

3.2 UPS

UPS systems shall be free standing. Integrated rack mounting systems are not normally acceptable

UPS systems shall be Three Phase IDMT transformer-less; Single Phase UPS systems shall only be acceptable where they are load specific. To avoid the possibility of floating neutrals during power outages the manufacturers' recommendations in relation to earthing etc. shall be followed.

In general the UPS shall be capable of being remotely monitored for condition and operational readiness. A number of manufacturers offer this facility; however agreement from the University Project Liaison Engineer shall be sought before any selective decision is made

Battery enclosures shall be fitted with a removable internal 'Makrolon' or similar transparent material to facilitate visual inspection of the batteries whilst providing a suitable barrier to the battery terminals.

4 Metering

The requirements for metering are set out in the 'Briefing Document for Automatic Metering - ES/021 '

5 Lighting

5.1 Luminaires

For general lighting installations please refer to the list of preferred manufacturers in Section 10. However, for high profile areas such as building entrances, atria, etc. designers may use luminaires by other manufacturers. Whatever is installed shall be readily maintainable and spares/replacements shall be easily sourced.

Energy efficiency shall be one of the primary concerns in the selection of luminaires.

Lighting installations shall be in compliance with the latest issues of CIBSE Lighting Guides.

Lighting circuits shall generally be protected by 10A devices.

Final connections between circuit wiring and internal luminaires shall be via 'Klick' style plug and socket.

All external lighting is to be designed to be fully compatible with and not detract from any new and existing CCTV installations.

5.2 Emergency lighting

Refer to Section 10 for a list of preferred manufacturers. It is strongly preferred that separate self-contained emergency luminaires are used.

System shall comply with BS5266, with minimum luminaire maintenance of 3 hours.

The University's preferred method of operation for emergency lighting systems is individual self-contained luminaire (self-test) with Email monitoring reporting via the Web.

LED luminaires shall be utilised for emergency lighting

In order to assist in the University's maintenance routines, combination service / emergency luminaries shall be fitted with a discretely visible 10mm diameter red dot.

5.3 Lighting controls

All lighting control systems shall be open protocol and be readily adjustable by University staff without the need to employ specialist contractors.

The University in general does not accept wireless control systems.

Where appropriate, presence and light level sensing luminaires shall be incorporated. Generally luminaires in corridors shall incorporate presence detection.

Luminaire switching shall be configured with respect to room / area configuration, i.e. the luminaires local to the windows shall be controlled separately from the main bulk of lighting and consideration shall be given to daylight harvesting where appropriate.

Maintenance secret key switches to override the presence / light level control shall be provided.

Crestron touchscreens are used in lecture benches to control A/V systems and lighting in lecture theatres. A Helvar interface is utilised to connect between the lighting controls and the Crestron touchscreen. A separate lighting controller shall be located adjacent the lectern in case of faults with the touchscreen. Please also refer to the separate CLS Lighting Specification. The Project Liaison Engineer will provide details.

6 Building Management Systems (BEMS)

The requirements for cabling to BEMS and heating and ventilation controls is set out in document ES/008 'Briefing Notes for BEMS HVAC Systems'. In summary, the electrical contractor is responsible for the provision of power supplies to the MCC panel; 'downstream' cabling is the responsibility of the BEMS sub-contractor.

7 Equipment and accessories

7.1 Induction loops

Responsibility for the provision of induction loops to assist the hearing impaired rests with iSolutions and their audio visual systems integrator. Reference should be made to iSolutions where induction loop provision may be required.

7.2 Electrical accessories

Refer to Section 10 for a list of preferred manufacturers.

Selection of accessories shall consider the decoration and environment of their location.

The University is now in the practice of installing twin switched outlets complete with twin integrated USB or USBC charger points. Their use is specific to project areas and as such agreement shall be sought from the University Project Liaison Engineer. The charger socket shall be isolated until a plug is inserted into the USB or USBC socket

Socket outlets and switches for plant and workshop type areas shall be of 'metal clad' construction.

All sockets and isolators to be labelled with circuit references in compliance with University labelling guidelines. An approved stick-on label with black lettering on a white background is adequate; see Section 2.18.

External sockets / switches shall generally be of weather sealed type located and installed with consideration to internal condensation.

7.3 Trunking and conduit

Galvanised Steel shall be used for all Plant Areas

Dado or skirting trunking shall generally be of white uPVC; size and compartment configuration will be dependent upon service being routed / installed.

Dado trunking shall be sized in consideration of power / data / telephone cabling to be routed.

Main trunking systems within risers, plant areas, ceiling voids, etc. are to be in galvanised steel with die cast turnbuckle fix lids.

Sizing of trunking shall consider not only the recommendations of BS7671IEE Regulations, but also the likelihood of the future increased cable installation.

8 Fire alarms

8.1 General design principles

The design, installation and commissioning of fire alarm systems shall comply with BS 5839 Part 1. Local interpretation and specific University requirements are set out in subsequent paragraphs of this section.

All components for fire alarm systems shall be open protocol and sourced from preferred manufacturers.

The fire alarm system panel shall incorporate communications card to allow a signal to be sent over the internet.

The fire alarm system design shall be such that it meets the requirements of the fire strategy in terms of its extent and category. In the absence of more specific classification, systems for academic buildings shall comply with BS 5839 Category L4/M, and systems for residential buildings with BS 5839 Category L2/M. The proposed system shall be submitted to the University Project Liaison Engineer and Insurers for agreement. A record of the fire strategy shall be retained and handed to the University on completion of the project. Any 'cause and effect' relationships shall be clearly stated in the strategy.

Wiring for fire alarm systems shall be taken from the origin of supply within a building via a double pole isolator.

Wiring shall be Fire Tuf or Pirelli FP 200 Gold with red over-sheath. The final selection of cabling shall be dependent upon the project. Particular care shall be taken where a new wiring installation adds to or amends an existing installation: guidance shall be sought from the University Project Liaison Engineer.

A legible wall-mounted zone plan shall be provided adjacent the fire alarm system control panel and any associated repeater / mimic panels.

Adjacent to the main fire alarm panel a suitable lockable enclosure shall be fitted to house the system logbook. (The University of Southampton has its own log book and enclosure standard and will be free issue).

Override key switches for ancillary services shall be provided at main control panel to permit normal system testing without closing down ancillary systems. Such ancillary systems include main gas valves, vent plant, fire curtains, smoke hatches etc. This function shall be achieved via I/O devices on the panel and shall be configured such that separate testing of the ancillary devices is possible.

Device bases shall be marked with their system address.

Automatic detectors shall be multi-sensor type incorporating optical smoke chamber. Ionisation detectors shall not be used.

The inclusion of 'Visual Alarm Devices' shall be dictated with reference to the fire strategy and shall be installed in accordance with BS EN 54-23:2010.

Fire alarm panels shall be complete with event printer.

To reduce false alarms detectors utilising a 'double sampling' system shall be used causing the detector to activate an alarm signal only if 'smoke' is detected for two successive sampling periods.

Electronic multi-tone sounders or bell sounders may be used, although only one type of sounder shall be used in a given building to avoid confusion.

Alarm and loops shall have at least 25% spare capacity on installation to allow for future expansion.

8.2 Wireless – Radio linked fire alarm systems

Generally these are not considered appropriate for the University of Southampton.

Should circumstances indicate that this type of system offers benefits over and above wired systems, i.e. listed buildings or short term / temporary locations, the circumstance shall be discussed with and agreement sought from the University Project Liaison Engineer.

8.3 Aspirated systems

Aspirated systems shall be considered for high risk and difficult to access areas where standard surface point detectors are not acceptable.

All aspirated ('VESDA') systems shall be compatible with the local fire alarm system.

8.4 Radio linked emergency pagers

In halls of residence consideration shall be given to the inclusion of a radio pager system linked to and controlled via the fire alarm system.

The specific fire risk assessment shall be the basis for this consideration.

9 Commissioning and handover

9.1 Commissioning and compliance

Inspection, Testing and Commissioning shall be carried out as described below and certificates issued before handover of the installation. Concealed or buried work shall be inspected and tested before any permanent covering is applied.

Before commissioning can begin, all installations must have been completed and tested in all respects as called for in the Specification.

Commissioning shall mean the advancement of all the Building Services Systems from the state of static completion to full working order adjusted to the design requirements.

All test equipment and skilled supervision shall be provided.

Seven days' notice shall be given in writing of the time of inspection, testing and commissioning, including that of concealed or buried work, so that witnessing by others can be arranged if required.

For complex installations an approved checklist shall be compiled to record success of all tests, measured readings and adjustment settings.

Where witnessing is arranged, prior tests shall be carried out to ensure that the witnessed testing and commissioning is not prolonged by fault finding and rectification.

The cost of providing all instruments and associated equipment, attendance of the specialists as required shall be included in the Tender. A recent calibration certificate for each instrument shall be available for inspection and included in the 'As Built Documentation'.

A schedule of the instruments to be used shall be submitted to the Engineer for approval prior to the commencement for commissioning and testing.

Inspection and testing shall be carried out in accordance with the current revision of IET Regulations (BS 7671) and CIBSE commissioning codes both during and after erection.

Certificates and schedules for all systems shall be issued and included in the 'As Built Documentation'.

9.2 Witness testing

As part of the compliance for certain equipment for any given project a representative from the University will require attendance to Factory Acceptance Tests (F.A.T.) and Site Acceptance Tests (S.A.T.), the University Project Liaison Engineer will advise who will attend

In order to ensure that the attendance of the University representative(s) is included the costs associated with the attendance shall be included within any tender invitation. The inclusion shall cover relevant transportation, accommodation and sustenance to the location of the F.A.T.

During the construction of the works there will be a requirement by the University to attend site to witness test such installations and equipment as appropriate. An agreed program of attendances shall be agreed with the University Project Liaison Engineer

9.3 Asset register

The University has a standard approach for identifying and capturing asset information. This is set out in the document ES/022 "M & E equipment responsibility matrix and asset labelling". Engagement with the asset identification process shall begin at the design and specification stage.

The University Project Liaison Engineer will provide such guidance as required to assist in the initial configuration of this register

9.4 As-built documentation

The University of Southampton, Engineering Design Section, has a specific specification for 'As Built Documentation', ES / 013, which is available on the Estates & Facilities website.

10 List of Preferred Manufacturers

Item	Manufacturer	Notes
Contractors	From University preferred supplier list on Planon database	
Primary High Voltage Equipment	Hawker Siddeley; Schneider	
Secondary HV Equipment	Schneider Ringmaster	
HV Protection Relay IDMT	Schneider MICOM 140 Series	
Transformers	Wilson Power Solutions ABB Brush	
Main Switchboard	GR Electrical AF Switchgear Mardix	
Submain & Final Distribution Boards	Schneider	Merlin Gerin range only
TP & SP isolators, switch fuses, etc.	Eaton Schneider Dorman Smith	
Luminaires	ASD Dextra Felio Sylvania Hacel Holophane Illuma JCC Thorlux Whitecroft	For high profile and feature spaces such as entrance foyers, atriums, etc. alternative manufacturers may be considered with the agreement of the Liaison Engineer.
Lighting Controls	CP Electronics; Helvar	Typically Helvar systems are used in lecture theatres and other CLS rooms. In other areas, where DALI based controls are needed the CP Electronics Vitesse Plus system is strongly preferred

Item	Manufacturer	Notes
Emergency Lighting	P4 Fastel; Thorlux Smartscan	On smaller projects where self-test E/L's may not be suitable emergency luminaires are to be sourced from the preferred luminaire manufacturers list.
Electrical accessories: sockets, fused spurs, control switches, etc.	Crabtree; MK	
Dado Trunking	Crabtree; MK; Marshall Tufflex Mita; Eaton	
Automatic Presence Sensing Controls	Danlers; B.E.G.	
Cables	BASEC Approved	LSOH cabling is strongly preferred, where appropriate.
Fire Alarm Equipment - Panels	Advanced	
Fire Alarm Equipment	Apollo	
Fire Alarm Equipment - Commissioning	Fire alarm term maintenance contractor	
Aspirated Fire Detection Systems	Vesda	Where installed, Vesda systems are to be fully compatible with the local fire alarm system.
UPS Systems	Vertiv	
Copper Busbar Systems	Siemens (Barduct) Schneider	