THE UNIVERSITY of EDINBURGH

Estates & Buildings

Section 6: Electrical Engineering Guidelines

Engineering Services Guidelines

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The University of Edinburgh
Estates and Buildings
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Engineering Guidelines

Contents

6.00 Electrical Engineering Guidelines

- Any design must, as a matter of statute, be compliant with the Health and Safety at Work etc. Act 1974, ANY relevant secondary legislation and associated Approved Codes of Practice (ACOP's)
- Examples of secondary legislation include the Provision and Use of Work Equipment Regulations 1998 (PUWER) the Workplace (Health, Safety and Welfare) Regulations 1992 the Electrical Safety at Work Regulations 1989 the Control of Major Accident Hazards Regulations 1999 the Confined Spaces Regulations 1997 and the Gas Safety (Installation and Use) Regulations 1998
- Your attention is drawn in particular to the legal duties placed on designers by the Construction (Design and Management) Regulations 2007
- Suitable and sufficient safe access for maintenance and repair must always be provided
- The following CIRIA guides should be used to inform your decisions, Construction work sector guidance for designers (C662) Workplace "in-use" guidance for designers (C663) and Construction work sector guidance for designers (C662D)

6.1 Design Criteria

The following design criteria are considered appropriate for the majority of projects.
The engineering services shall be designed in accordance with the following:-

- The requirements of the Project Brief.
- The needs of the occupiers/users.
- Flexibility in use.
- Compliance with an agreed set of technical criteria
- Systems reliability, maintainability and cost in use

Each project shall be assessed under the Building Research Establishment Environmental Assessment method – BREEAM.

If it is deemed impractical to pursue a BREEAM accreditation then the design team shall ensure that all relevant good practice design guides and procedures are followed as far as is reasonably practicable to achieve an energy efficient and sustainable development.

Designers must exercise care in ensuring that all operational requirements are met. Where the University considers that it has relevant experience for specific installations, these are detailed elsewhere in this specification.

The following information is primarily intended to provide guidance to those responsible for the design of electrical building services within the Estate of the University of Edinburgh. It is not intended to be exhaustive or definitive, and it will be necessary for users of the guidance to exercise their own professional judgement when deciding whether to abide by or depart from it. For this reason also, departure from the guidance contained in this document should not necessarily be regarded as a departure from best practice and should always have the written approval of the supervising officer.

The designer is encouraged to address all the issues relevant to energy efficiency in buildings and to adopt sensible integrated strategies. Whether designing new buildings or refurbishing existing buildings, designers should adopt an approach which recognises the need to:-

- Reduce the demand for energy and materials.
- Provide the residual requirements in an environmentally friendly way including, where practical, the use of renewable energy sources.
- Adopt tried and tested good practices to achieve energy consumption benchmarks such as the Building Research Establishment's (BRE) performance targets.

The design for the Electrical Building Services shall generally be deemed to include but shall not be limited to:-

- Incoming electrical supply
- Main switchboard and sub-mains distribution
- Small power installations
- Electrical supplies to mechanical services installations
- Electrical supplies to lifts
- Internal lighting installation and lighting controls system
- Emergency lighting installations
- External and car park lighting
- Containment and wiring systems for voice and data installations
- Lightning protection installations
- Fire alarm and detection installations
- Intruder detection and alarm installations
- Access control installations
- Public address installations
- Closed circuit television installations
- Audio-visual containment, cabling and accessories
- Emergency voice communications systems
- Electric vehicle charging points

6.2 Power Distribution Equipment and Power Quality

Switchgear General Requirements:-
High Voltage: All HV equipment shall meet with the current British/European standards. The HV design shall be carried out without prior agreement with the relevant University Estates Operations personnel.

HV Switchgear: HV Switchgear shall be Hawker Siddeley Switchgear "Eclipse" range or equal and approved vacuum type circuit breakers sized accordingly c/w In/Out Solkor protection relays as required. Switchgear shall also be c/w remote trip/close facility and auxiliary battery back-up system. All live conductors shall be of copper metal design and insulated accordingly.

Transformers: Cast resin or Midel oil filled or equal and approved 11 kV/415 volt delta / star transformers complete with Voltage tap changing where Midel oil transformers are installed. Transformers shall also be fitted with fully rated Air Circuit Breakers (ACB) complete with fault protection fitted on the LV output side of the transformer.

Thermal overheating trips to be installed to HV switchgear. All live conductors shall be of copper metal design and insulated accordingly. The Neutral conductor shall have the same cross sectional area as phase conductors.

HV Cabling: Shall be 3 core alternatively screened/LSF/AWA/LSF 6350-11000V BS7835 sized accordingly.
Single core XLPE / screened/ LSF /AWA / LSZH 6350-11000V BS7835 sized accordingly.
All live conductors to be of copper metal design and insulated accordingly.

No remote High Voltage switchgear tripping facility shall be installed on low voltage distribution boards or located within low voltage switchrooms without prior agreement of The University's Technical Services Group.

Earthing: to be designed and installed in accordance with current British Standards.

Main Switchboard: The main switchboard shall be manufactured to BS EN 60439-1 and shall be fully Type Tested Assembly in accordance with Table 7 BS EN 60439-1. The form of classification shall be Form 4 Type 2 as standard; however the consultant shall specify Form 4 Type 6 where cable sizes and board fabrication dictates a requirement. The board shall be IP 43 protected unless stated otherwise in the brief. Sleeved bus-bar boots are not acceptable and solid insulators must be used.

All switchgear shall be metal clad, totally enclosed, rated at 500 volts and be of unit or cubicle construction which shall comply with the following requirements:-

- Equipment to withstand 50 kA for 1 second
- Access to all internal parts for torque testing of all bus-bar connections shall be provided. Additionally, clear insulated cover panels shall be installed over all bus-bar chambers to allow thermal imaging of bus-bar connections and cable terminations.
- Switch heights not to be above 1800mm FFL.
- Bus-bars to be copper.
- Neutral bus-bar to have the same cross sectional area as phase bus-bars.
- Provide multi-function meter for the main supply and all outgoing ways, in accordance with section 4.5 of Engineering Guidelines Section 4: Controls, complete with metering connectivity capability for all meters.
- Meters and field terminals should be easily accessible, eg.by means of a hinged door and T-bar lock.
- Electrical meters shall be fitted with Modbus interfaces, and pre-wired to outgoing terminals accessed without having to power down the main board. Meters must be from the Socomec Diris range, A40 for main meters, A20 for sub-meters. Meters must be compatible with the Elcomponents system.
- Electrical boards shall be fitted with suitable fuses, shrouds, links and means of isolation so that meters can be replaced without having to power down the board or essential supplies.
- Provide suitably sized bare copper earth bar externally at the top rear and over the full length of the switchboard.
- Securely fix the switchboard to the floor.
- Provide space for future power factor correction and harmonic distortion filtering equipment shall be allowed for within the switchroom within a separate cubicle from the main switchboard. This equipment shall be sized and installed on a re-visit to site after the first 6 months and before 12 months of operation from meter-read values.

- Mounted on a 100mm minimum concrete plinth.
- The bus-bars shall be colour coded with phase identification at each cover plate.
- Protective devices/functional units shall be fused switches, fitted with HRC cartridge type fuses complying with BS 88 Part 1 c/w solid copper neutral links. MCCBs shall only be considered under special circumstances and subject to The University's Technical Services Group approval, which must be obtained before the detailed design phase.
- Where Programmable Logic Controllers (PLC's) are deemed necessary for the control of distribution equipment then system provision should be made for them to be maintained with minimum impact to the client/end user. Independent manual override facilities must be fitted to maintain all services under abnormal fault conditions. Where embedded power supplies are deemed necessary by UoE approval for the correct operation of electrical switchboards it is preferred that these take the form of a separate central power source such as a float charged battery system rather than distributed systems. All internal batteries must be installed with external identifiers, indicating location of batteries within the switchboard.
- All essential services boards to be coloured RAL 5017.
- Provide and fix to wall inside switchroom a framed schematic detailing equipment served, device sizes, cable dimensions and with reference to switchboard cubicle number.
- Provide rubber mat in front of the switchboard.

Labelling - the labels fitted to switchboards, distribution boards and separate items of switchgear shall be of ivorine, coloured black or with approved lettering and secured by round head brass or instrument screws. Self-adhesive labels are not acceptable. Labels on switchgear shall indicate:-

- Reference number of the switch
- The specified current rating and recommended fuse rating
- The part of the distribution network controlled

Distribution Boards TP&N and SP&N Consumer Units :-

- Sheet steel enclosure with hinged, lockable front access door and suitable for wall mounting and providing protection to IP 31 conforming to IEC 60439-3 with 250 amp rated fully shrouded copper bus-bar and fully rated neutral bar. Locks must be supplied with the same key for every board.
- Suitably rated integral isolator/switch disconnector.
- The number of ways indicated on the drawings/distribution schedules each provided with an "x" type MCB in accordance with IEC 60898 to 15kA
- Suitably sized dual earth terminal bar.
- All miniature circuit breakers shall be capable of accepting a full range of electrical accessories to allow their adaptation where specified or at a later date to have earth leakage protection, remote tripping facilities or electrical contacts which will signal the position of the main contacts and/or MCB mechanism (whether tripped or not).
- All miniature circuit breakers shall be capable of accepting a complete range of mechanical accessories, as a minimum this range shall include terminal shields, padlocking facility and an identification system.
- Each distribution board shall have a chart stating the location of all points controlled by each way with the rating of the fuse or MCB for that way. The charts shall be typewritten, pasted on stiff board and framed perspex fixed to the inside of the distribution board door.

Residual Current Devices (RCD's) shall be manufactured to BS EN 61008 and installed to meet the requirements of BS 7671 with a sensitivity of 30mA. RCD's shall be either single self-contained units enclosed in moulded casings of high dielectric strength or comprise a number of individual

components arranged to operate as a single unit. The classification of duty shall be AC, A or B or any combination of the same.

Labels on distribution boards shall indicate:-

- The board reference.
- The service e.g. lighting, sockets, small power etc and location.
- Reference number of controlling fuse switch/switch disconnector.

Transient Voltage Surge Suppression Equipment

The main electrical distribution network shall be fitted with strategically located surge suppression equipment/protection devices. Such devices shall be positioned as follows:-

- Main switchboard locations. Located at main supply to the building to protect against externally generated transients.
- Sub-Distribution equipment to protect against internally generated transients.
- Final distribution board locations deemed necessary where sensitive and critical load equipment is served e.g. dedicated telecom rooms, IT server rooms, intrinsically safe environments etc.
- Where there is a requirement for the installation of a lightning protection system, surge suppression devices must be fitted to satisfy the requirements of BS 62305 2011.

Power Factor Correction and Harmonic Filtering

To establish the requirements for Power factor correction and Harmonic filtering it will be necessary to carry out a site survey to establish the network characteristics and level of harmonic current flowing. For new developments PFC shall be sized and installed following a re-visit to site after the first 6 months and before 12 months of operation to accommodate meter-read values.

Where significant levels of harmonic distortion are present, these shall be reduced to those levels listed in Engineering Recommendations G5/3 of the Scottish Distribution code, at 400V level and at the 11kV level, taking into account background levels. A firm price for a harmonic and power factor survey will be required at Tender stage. This shall include for a study of the loads and an analysis of the system and the recommendation for the reduction of the level of harmonics and/or system power factor improvement.

Once the results of a harmonic and power factor study are available then capacitor banks may be sized and/or harmonic filtering equipment implemented.

Provision shall also be made at Tender stage for Power factor correction equipment external to the primary LV switchboard. Equipment shall be housed within a dedicated ventilated cubicle with door interlocked isolator/fused switch. Capacitors shall generally be located in banks of 25kVAr and shall be automatically controlled.

Uninterruptible Power Supply

UPS systems shall comply fully with BS EN 62040-2:2006 and all designs must be approved by the University Engineer prior to tender.

The UPS systems shall be of the solid state type rated for continuous duty and consist of modules as required, i.e. rectifier/inverter/charger cabinet, input maintenance bypass and standby batteries. The unit will be at least of generation 3 specification providing minimal harmonic distortion back onto the network. A 12 pulse unit will not be acceptable.

Upon failure of the primary AC supply, input power for the inverter is automatically supplied from the batteries, with no interruption of supply to the critical load.

Agree with the University the required output of equipment before finalising the design and installation.

Provide equipment which will at all times:-
Maintain the batteries fully charged

- Stabilise the voltage
- Suppress spikes in the electricity supply
- Filter the supply to remove harmonic distortion
- Maintain the supply to the equipment served

UPS equipment shall form a packaged unit complete with indication panel to indicate status, output, alarms etc. and with all items mounted in a lockable rigid steel cabinet, with sealed maintenance free batteries located in a sealed ventilated compartment contained within the same housing as the other components.

The UPS shall have a constant duty, on-line inverter with sine-wave output and static bypass switch. The UPS shall also have a reserve input switch, if required. The UPS shall also have a maintenance bypass switch.

- The UPS power rating (VA) shall be calculated in conjunction with the University SO and the University Department end users. The load power factor shall be in the range of 0.7 to 0.9. The load crest factor shall be minimum 3:1. The overload capability shall typically be 125% for 10 minutes or 150% for 1 minute.
- The input/output voltage rating shall be 400V and/or 230V +/- 10%. The frequency must match the requirements of the load, but shall normally be 50/60 Hz.
- Transfer time shall be within ¼ cycle. Typically 5-6 milliseconds.
- Total Harmonic Distortion (THD) shall be <3% for non-linear loads (BS EN 62040-3)
- Transient Regulation shall be < +/- 5%

Batteries shall be sealed valve-regulated lead-acid, maintenance-free type (SVRLAs). Cognisance shall be taken of the need for recycling or proper disposal of batteries in accordance with EEC directives.

- Autonomy shall be calculated in conjunction with the University Engineer and the University Department end users. Autonomy shall typically be 20-30 minutes.
- Battery charge rate to be sufficient to restore the battery from discharged state to 95% duty (this applies to batteries sized for discharge periods of less than 30 minutes) within ten times the discharge period.

System operation shall be fully automatic with self-test and self-diagnostic facilities. The unit shall have a fully automatic bypass.

- User-interface shall be via RS232 port

Communications shall be one of the following:

- Network – via Ethernet or Token-Ring adaptor.
- Simple Network Management Protocol – via SNMP adaptor.
- Modem – via a modem adaptor.

The UPS units shall be fully factory tested to BS EN 62040-3:2011. The full test procedure to be agreed prior to carrying out the test, however a full type test to be assumed with the addition of tests relevant to the site and application of the UPS.

The factory test dates shall be agreed to allow attendance by the University and/or engineer as appropriate to the programme constraints.

Audible noise shall be typically <50dBA where situated within an office environment and <70dBA where situated within a machine room.

Operating temperature shall typically be 0-40 deg. C.

The UPS shall comply fully with CISPR 22, Class B for office environments and Class A for industrial environments with regard to EMC-Emissions. The UPS shall be Surge-Tested to ANSI C62.41. When serving IT equipment, UPS shall conform to BS EN 55022.

Emergency Generator and Controls

Where an emergency backup generator is to be installed, the design team must liaise with The University's Technical Services Group during early stages of the project to ascertain whether the generator is to be made STOR ready.

Stand-by electrical generators shall comply fully with BS 5514 and all designs must be approved by the University Engineer prior to tender.

Generators are to be supplied with enhanced maintenance capability for short circuit fault currents.

The system shall be fully automatic and shall function on a mains-fail basis. The main LV switchgear shall incorporate the necessary mechanical and electrical interlocked changeover controls.

Agree with the University the required output of equipment and the system configuration to be served as "essential services" before finalising the design and installation. The system shall also comply with local authority and SEPA requirements in regard to environmental pollution.

The stand-by generator system shall include for dedicated fuel storage tanks, appropriate weatherproof acoustic enclosure (for external locations), controls, silenced exhaust systems (max 75 dBA @ 1M), electrical starting systems and auxiliary power supplies.

Generator operating conditions: The generator shall comprise a diesel engine, close coupled to a fully rated rotating field alternator, and all associated equipment necessary to form a fully operational system capable of operating within ambient temperature conditions of -5°C to +40°C with a maximum relative humidity not exceeding 50% at 40°C or 90% at 20°C.
The diesel engine should be fitted with an electronic governor and should be capable of meeting all the constraints of the specification and design brief using diesel fuel oil to the latest standards.

Output of the set: Unless otherwise stated the set shall have an electrical output of nominal 230V single phase/400V 3 Phase 50Hz with a continuous kVA rating to suit the essential service full load for a period of 12 hours and shall operate at a power factor of not less than 0.8 lagging.

Alternator: The alternator shall be screen protected and drip proof to IP23 minimum with a continuously rated 400V, 50Hz 4 wire, star connected, alternating current machine of the brushless excitation, screen protected, fan ventilated, rotating field, separately excited type and shall be self-regulating direct coupled to the diesel engine prime mover.

The alternator shall be provided with a separate Permanent Magnet Generator (PMG) excitation system to enhance the short circuit maintenance capability of the machine to a minimum of 300% FLC for 5 seconds to facilitate operation of circuit protective devices.

The alternator and its associated excitation system shall have a minimum class H insulation throughout.

The alternator will be directly coupled to the engine and will include excitation system, automatic voltage regulator, voltage adjusting potentiometer and under speed protection.

The output voltage of the generator shall be automatically maintained within ± 2% of the declared nominal voltage from no load to full load inclusive of speed variation of ± 4% at any power factor between unity and 0.8 lagging by a suitable voltage regulator mounted in the alternator control box. Provision shall be made for adjusting the generator voltage within plus or minus 5%.
After any change of load the maximum transit voltage shall not vary by more than + 13% of the rated voltage and shall recover within ±3% within 0.2s
The frequency of the generator shall be maintained at ±1% inclusive of no load to full load speed variations of ± 4%.

A TP&N 4 pole ACB with fully adjustable over-current and earth fault protection shall be provided to isolate the generator supply from the generator fed section of the main LV switchboard. The ACB shall be complete with shunt trip and padlock arrangement. The main breaker shall be suitably rated and of a size suitable for termination of the main supply cabling.

A controls selector switch shall be incorporated as part of the set and shall include a suitable five position rotary selector switch giving “Automatic”, “Manual”, “Test off load”, “Test on load”, and “off” positions, with “Engine switched off” warning light in the latter position. With the switch in the “off” position it shall not be possible to start the engine in any way what so ever.

A services maintenance switch shall also be provided for use in conjunction with the generator control panel to enable works to be carried out on the control panel and LV switchboards. Means shall also be provided for automatically stopping the engine in the event of operation of any of the engine safety devices and prevent further starting until reset by hand.

Earthing: All generators, engine, acoustics, exhaust system, container and metal casings and other non-current carrying metalwork shall be bonded to the main framework of the unit and to an earthing terminal sited adjacent to the outgoing supply cable termination terminals. Such earthing terminals shall be clearly marked.

Control philosophy for Mains failure/Mains restoration: The Consulting Engineer shall obtain written agreement with the University representative of the controls logic for the operation of the emergency generator in terms of applied loading to the set and load shedding. A detailed mains failure/restoration operational document shall be prepared by the Consulting engineer and issued to the University representative for approval prior to issuing of tender documentation.

6.3 Cable Installations

Cabling installations general: All cabling installations shall comply with BS 7671 2008 as amended.

The Proposed method of Cabling installation shall be discussed and agreed with the UoE Engineer prior to tender and shall be suitable for its intended application. Cabling shall be installed with the appropriate mechanical protection. General wiring cables shall be manufactured to the appropriate British Standard and shall be carried out as follows:-

Cables Inside the Building.

a) Mains and Sub-Mains	Cu XLPE/SWA/LSZH
b) Small power circuit wiring	Cu LSZH singles
c) Lighting circuits	Cu LSZH singles
d) Fire detection and alarm	Cu MICS/Enhanced
e) Refuge Intercom	As per manufacturers' recommendations

Cables Outside the Building:
Use cables of the type listed for inside the areas but with PVC covering and not LSZH.

PVC/PVC flat twin and 3 core cable is not considered an acceptable means of cabling by UoE, therefore the designer shall have written acceptance from the Technical Services Group during design phase for the use of such cabling.

Full consideration shall be given to the current to be carried in the various sizes of cables when determining the number of cables to be installed in a containing system. The number of cables to be installed shall not exceed the space factor requirements as stipulated in BS 7671.

Cable routes should be planned thoroughly and only run parallel to the building structure, horizontally and vertically. Diagonal point to point wiring is not acceptable. All cables should be installed without joints.

Containment: Provide the following to contain and support cables:-

For lighting wiring in ceiling voids etc.	Galvanised mild steel trunking.
For small power wiring in floor voids to serve bus-bar	Galvanised mild steel trunking and rigid conduit or Cable tray and XLPE/SWA/LSZH cables.
For small power for general purposes.	Galvanised mild steel trunking and multi compartment trunking.
For final circuit wiring at switchgear in switchroom	Galvanised mild steel trunking.
For voice and data cables in ceiling void	Cable basket
For voice and data cables in floor voids	Cable basket
For drops to switches	BE or Galvanised conduit
For fire alarm installations	Cable tray
Sub mains cabling	Cable tray or ladder rack, depending on loading.

Cable Containment and Associated Fittings

Cable trunking shall be manufactured from Galvanised sheet steel and be of an approved manufacture.

Fire barriers in trunking in accordance with the relevant Regulations shall be provided at appropriate locations by binding the cables and filling the spaces with a non-combustible material.

PVC Trunkings and Multi Compartment PVC Trunkings.
Application: Dado and Skirting Trunkings.
All trunking shall comply with BS 4678 and be of an approved manufacturer.
PVC containments shall not be run within ceiling voids of escape routes and or circulation areas. PVC containments over the head of door frames shall also be avoided.
Trunking fittings and fixings shall be of the same manufacturer as the trunking.

Steel conduit and conduit fittings (general): Conduit installations shall comply fully with BS EN 61386-21:2004. Conduit shall be Class 'B' heavy gauge welded to BS 4568 for screwed conduit installations, solid drawn and screwed for flameproof installations.

Provide galvanised steel conduits, use conduits not less than 20mm diameter, provide conduits of the heavy gauge welded and screwed pattern to BS EN 61386-21:2004 unless otherwise indicated. Quick-fit galvanised steel conduit systems are considered acceptable if additional cpc is installed, so that the electrical continuity of conduit is not relied upon for an earth path. Additionally, saddles must be installed on all legs of conduit connections.

Ensure that conduits have adequate provision for draw-in boxes on straight conduit runs at not more than 9 metre intervals and not after more than two right angled bends.

PVC conduit and conduit fittings: Where specified PVC conduits shall be best quality, high impact, rigid heavy gauge complying with BS 4607. The PVC material shall have a high resistance to solutions of inorganic acids, alkalis, salts and organic chemicals.

Cable basket: Where cable basket is specified it shall be electroplated heavy duty cable basket made from high tensile strength 7mm diameter steel rod and shall generally be supplied in 3000mm lengths at widths from 50mm to 500mm and raised edge of 54mm.

Where cable basket is fitted in floor voids these should be mounted and fixed on Uni-strut type brackets at not more than 1m intervals with additional fixings at bends, tees and intersections.

Cable Tray: Specify perforated galvanised mild steel medium duty cable tray of an approved manufacture. Cable tray shall be in standard section of 2400mm lengths and in widths of 100mm to 600mm and a raised edge of 35mm. Cable tray shall be of a gauge to suit the application and structural loading but shall generally not less than 1.5mm for up to 300mm and 2mm over 300mm wide.

All cable containment systems within ceiling voids and floor voids shall be securely fixed by means of Unistrut bracket at not more than 1 metre intervals with provision for additional brackets/fixings at bends tees and interconnections. The installation of conduit boxes where access cannot be obtained after completion of the installation will not be accepted.

All containment bends, tees, fittings and fixings etc. shall be of the same manufacturer as the appropriate containment.

6.4 Lighting, Luminaires and Lamps

Design Objectives

All lighting products should be designed and manufactured to BS EN 60598.

All lighting installations shall meet the requirements of the current CIBSE lighting guidelines.
The choice of energy saving light fittings shall be paramount when undertaking the designing of university projects.

Cost effective energy savings should be considered at design stage, the use of PIR presence detectors, photo cells and time switches should be given consideration.

Wherever possible the use of natural daylight should be used to light the building however all buildings will require artificial lighting at night as well as during the day when natural light levels are too low. Designers should always choose the most efficient lamps and luminaries as indicated by their lumen output per watt and every effort should be made to standardise on lamp type and wattage during the detailed design stage.

Lighting design for Lecture Theatres shall be in accordance with CIBSE SLL lighting guide 5: Lecture, teaching and conference rooms. The lighting design shall be compatible for interface with the main equipment located within the teaching lectern. Reference must be made to LTSTS documentation for specific requirements.

The following illuminance levels listed for lighting design purposes relate to the average level on the horizontal working plane 700mm above floor level.

Space or Location	Average Illuminance (Lux)	Comments
Seminar Rooms	300-400	Dimmable and in accordance with CIBSE Lighting guide 5.
Lecture Theatres	500	Dimmable and in accordance with CIBSE Lighting guide 5
Cellular Office	300-400	In accordance with CIBSE Lighting guide 7
Open Plan Office	300-400	In accordance with CIBSE Lighting guide 7
Reception / Entrance Foyer	300	In accordance with CIBSE Lighting guide 7
Toilets	200	
Laboratories	500	In accordance with CIBSE Lighting guide 2
Conference Rooms	500	Dimmable and in accordance with CIBSE Lighting guide 5.
Stores	100	
Computer Equip. Room	300	
Computer Micro-lab	350-400	Dimmable and in accordance with CIBSE Lighting guide 3.
Staff Mess Room	200	
Plant Rooms	200	
Corridors	150-200	
Emergency lighting	As required but not less than 1	For licenced premises ensure that emergency light levels are achieved within toilet cubicles.
Emergency lighting in plant areas	Minimum of 5	
External pathways	20	
Car parks External Underground	30 100	Photocell/Time-clock controlled
Sports	As required per discipline and standard	In accordance with CIBSE Lighting guide 4

Luminaire Types
All Luminaires shall comply fully with the requirements of BS EN 60598.

All fittings shall be designed to BS EN 60598 and be suitably IP rated with an appropriate CE mark. Where fluorescent fittings are specified, high frequency electronic ballasts must be used. Consideration shall only be given to the use of alternative control gear options on projects where capital costs are severely restricted, after which formal approval shall be sought from The University's Technical Services Group.

Lamps
All lamps supplied within the contract shall fully comply with the relevant British Standards Institute requirements and shall be as per luminaire manufacturers' recommended lamp. They shall be suitable for use on a 230volt, 50Hz supply, and tested for temperature rise on the end caps to comply with BS EN 60360. Lamp colours shall be as defined in the current issue of the CIBSE guidelines. All lamps shall be of the low energy/high efficacy type.

All light units used in the lighting design shall comply with the Carbon Trust's Energy Capital allowance (ECA) scheme as outlined on the following web site.
https://etl.decc.gov.uk/etl/site/etl.html

Lighting Control Systems
Lighting controls should be designed to control, where appropriate, all the lighting in the building. Where projects are being assessed under BREEAM, cognisance of BREEAM requirements must be taken and control of luminaires shall be designed to meet the requirements of this scheme.

The lighting control system to be used shall be agreed with The University's representative during the design stage and prior to tender.

The lighting controls should be easily maintained and without the need for operatives to interrogate/access a centralised control unit or front end PC.
Provide for each group of luminaries equipment which includes:-

a) Passive infra-red presence/absence detectors to control banks or groups of fittings; the coverage of which should be designed in accordance with manufacturers' recommendations.
b) Local momentary override switch for each bank or group of fittings controlled by presence detectors.
c) Daylight sensors to control banks or groups of fittings along each elevation may be considered.

The mode of operation should be agreed with all relevant parties including user groups but typically shall be configured as follows:-

Circulation areas: Arrange the system in each section so that the luminaries served by the lighting control installation are switched on automatically when a person enters a circulation area and that the luminaries remain on until the accommodation served from the circulation area has been vacated or until the control installation senses that adequate light is being received from outside. Generally LED light sources shall be used in these areas. Arrange the system so that the time lapse between an area being vacated and the "off" signal being given can be set from 1-20 minutes.

Offices: Arrange the system in each section so that the luminaries serving a group of workstations will remain off until manually switched on at a wall mounted momentary switch. Arrange the installation to maintain the luminaries on until the area has been vacated or until the desired lighting level can be achieved with a luminaire or luminaries off or are manually switched off via the wall mounted momentary switch. Arrange the system such that the time lapse between an area being vacated and the "off" signal being given can be set from 1-20 minutes.

Arrange the system to automatically vary the output of the luminaries serving a group of workstations to maintain a constant lighting level on the working plane. Ensure that the level of illumination can be adjusted to suit a change of use.

Arrange the controls to allow manual override of the lighting level via a wall switch to allow increase or decrease in the level.

Arrange for the controls to revert to a set level each time the luminaries are switched on.

Arrange for the lighting controls to switch the row of luminaries adjacent to external elevations detecting a high daylight contribution internally.

Laboratories: Generally as offices above.

Toilets: Arrange the system to bring the luminaries into operation when a person is present and there is insufficient natural light. Arrange the system such that the time lapse between an area being vacated and the "off" signal being given can be set from 1-20 minutes.

Plant rooms and IT rooms: Provide manual switching.

Commissioning: Allow for the installation to be programmed, commissioned and demonstrated to the users by the lighting control manufacturer to the satisfaction of the University, both premises team and LTSTS. The engineering consultant must be present at the demonstration to confirm that the functionality of the lighting control systems meets the requirements of the design.

External Lighting

All wall or soffit mounted precinct fittings shall be designed in accordance with CIBSE LG6 and be photocell controlled with lamp type and colour rendering to meet BREEAM requirements. Lamp types shall be chosen to minimise power consumption, while meeting the requirements of LG6.
Special consideration should be given to the choice of light fittings and lamps when floodlighting university buildings, consideration to be given to photocell or time switch control.

Small Power Installation

The small power installation shall be designed in accordance with the Client's user group specific requirements and shall be carried out in accordance with BS 7671 IET Wiring Regulations. Room data sheets shall be produced by the design team for approval by The University Project Manager and building users, detailing all power and data requirements in each space. Delivery of power and data to desk positions shall be designed at on a case by case basis and approved by The University's Technical Services Group.

Offices, teaching and Laboratory accommodation shall be fitted with adequate power provision to suit the locations of workstations and furniture. Where appropriate the design team shall compile room data sheets for all necessary power requirements as requested by the client's and user group's representatives. Room data sheets should be approved by the client/user prior to finalising the design requirements of the small power installation.

6.5 Fire Detection and Alarms

Fire Alarms General

The fire alarm system shall be fully compliant with BS 5839 Part 1:2013 and all other statutory instruments all designs must be approved by the University Fire Safety Adviser and Engineer prior to tender.

The fire alarm system category shall be determined by the University Fire Safety Adviser on a risk assessed basis. The basis for this assessment is included within a Briefing Note as Appendix 1 Fire Detection and Alarm Systems within this guideline. This applies to hard wired and wire free systems. Provision shall be made for the hard of hearing and shall be subject to the approval of the University Fire Safety Officer and University of Edinburgh Project Manager prior to tender.

Where the project covers the design for HV sub stations then special consideration should be given to the requirements for automatic fire detection. Where sub stations are an integral part of the building then the fire alarm system shall be configured such that the substation shall have its own clearly identifiable fire alarm zone for operational purposes.

Mode of Operation

Shall be designed in accordance with the Fire Safety Officer's cause and effect requirements.
Manual System - In the event of a fire condition in any section of the building, the whole building shall be evacuated and the University of Edinburgh security shall be automatically signalled via dedicated University telephone line. Additionally, a fire alarm interface should be installed adjacent to each iStar unit. Where dedicated University telephone lines or data network are available, i.e. remote buildings, signalling will be undertaken via an auto-dialler utilising "BT Redcare".

Automatic Fire Detection - In the event of a fire condition in any section of the building, the system shall operate in the following manner.

- Full Evacuation (dependant on fire evacuation strategy).
- Phased Evacuation (dependant on fire evacuation strategy).
- Signal via University Telephone line to Security, Infirmary Street
- Signal to C-Cure network via fire alarm interface connected to iStar unit.
- If no University Telephone line or data network exist, fire alarm panels should signal via an auto-dialler to "BT Redcare" or equal and approved monitored telephone line.

Batteries - Suitably rated battery units are to be installed as necessary to power the system, having capacity to suit electronic sounders/bells. Sealed, fully charged lead acid batteries to be supplied as battery units complete with well-ventilated metal cabinets. The batteries shall be capable of maintaining the system in full normal operation for a period of 24 hours and at the end of the period, still have sufficient capacity to provide the evacuation alarm in all zones for a further 30 minutes.

Main Indicator Panel and System Devices

Control and Indicating Equipment - The control and indicating equipment (CIE) shall be of the fully "Open Protocol" central processing unit type. As manufactured by Morley Ltd or Advanced Electronics Ltd or any equivalent University approved control panel manufactured in accordance with BSEN54-2 and BSEN54-4. It shall incorporate the following;

- The CIE shall be modular in construction allowing for future extension of the system.
- The CIE shall be able to be easily configured to meet the exact detection zone and output mapping requirements of the building considered.

- The CIE shall be microprocessor based and operate under a multitasking software program. Operating programs and configuration data must be contained in easily up-datable non-volatile memory. (EEPROM).
- The CIE shall incorporate a real time clock to enable events to be referenced against time and date. This clock shall be accurate to within 1 minute per year under normal operating conditions.
- It shall be possible, for an Engineer to perform configuration upgrades on site by using the on-board keyboard or plugging into the CIE a portable personal computer. Configuration data shall be retained on a microfloppy disk.

The alarm company responsible for the installation shall operate an approved document control system for retention of configuration data.

The CIE shall meet the requirements of BSEN54-2 and shall be approved, together with associated ancillary equipment.

The CIE shall comprise separate processors, and cross monitoring of each other's correct operation for the major functions of the system. In particular, different processors must be used for the main control function, the detection input and alarm output functions and the display and control function.

No more than 500 addressable input or output points shall be controlled by a single processor.

The CIE shall prevent unauthorised use of the manual controls by using the on-board keyboard.

The CIE shall be capable of operating with any of the following type of automatic detection equipment:

- Analogue Addressable Detectors
- Analogue Addressable Manual Call Points
- Analogue Addressable Ancillary Devices

Addressable input and output devices shall be connected to addressable loops capable of accepting up to 126 devices. The CIE shall have a minimum capacity for operating 2 fully loaded addressable loops. This shall be extendible up to a maximum capacity of 5 addressable loops. Design of the fire alarm system shall make provision for a minimum of 25% spare capacity in each loop for future extension of the system.

The fire alarm panel shall have a pre-alarm warning facility, to ensure the earliest possible warning of a potential fire condition without raising the full alarm condition. The fire alarm panel shall automatically adjust the alarm and pre-alarm threshold levels to compensate for changes in detector sensitivity due to contamination and the CIE shall have a dirty detector fault warning facility.
Provision shall be made for each addressable loop to be sub-divided into a maximum of 8 geographical zones. The section of wiring corresponding to each zone circuit shall be protected from faults in other sections by short circuit isolator units.

In order to facilitate re-configuration and system extension, the allocation of addressable identities to devices shall be independent of their physical arrangement on the loops.

The CIE shall have provision for the connection, either locally via a parallel port or remotely via a serial port, of a 40 character line printer.

The main panel shall have the provision of semi-recessed wall mounted steel cabinets and lockable front access. The CIE shall have the provision to network with full repeater or text message repeaters via 485 modules. The communication shall be bi-directional and shall support verification.

The CIE shall incorporate all necessary electronic circuitry for the system and shall have the following panel controls and indicators:

- Power AC Healthy
- Common Fire
- Common Fault
- System/CPU Fault
- Charger Supply Fault
- Battery Supply Fault
- Alpha numeric displays giving alarm type, alarm address and zone, plus a user programmable 40 character English language descriptor.
- Paper printer giving time and details of every event (optional).

The panel shall incorporate the following features:

- An ability to precisely locate a detector in alarm and display in English a text message giving it's room/zone location
- Common sounder outputs.
- 1 to 5 loops of maximum 126 addressable points.
- Single or two stage alarm selectable for any silence able output.
- Push button switches for silence alarms, evacuate, reset, and accept event.
- Retain its memory in event of mains and battery failure.
- Status LED's for line fault, alarm, and system fault.
- 40 character alphanumeric display for event message.
- 40 character printer for hard copy of all events (optional).
- 24 hour clock for logging of events.
- 16 keypad for entering control commands to the system, such as test, isolate. On/off and override of outputs.
- Software defined zoning, with detector isolate and test by zone, or individual address.
- 500 event internal memory for incident investigation and maintenance purposes.
- The control key pad shall be fitted with a built in timing facility to deactivate access after a pre-set time, eg. 1-20 mins.
- Key switches to isolate devices in order to carry out weekly tests must be identified and agreed with The University's Project Manager and Fire officer. Consideration must be given to mechanical plant, access controlled doors and any other system that may be undesirable to include in fire alarm weekly tests.
- Include for an interface with emergency refuge call system.

Where phased evacuation is a requirement of the fire warning system, the design team shall seek clarification from the UoE representative as to the exact time delay between phases.

Automatic detectors - care must be taken when positioning any automatic detectors on ceilings, avoiding the occurrence of steam or cooking fumes i.e. At kitchens and bathrooms consultation with the Fire Safety Officer and U of E Project Manager should be sought to determine the type of detector used, e.g. multi-sensor optical smoke detector etc.

Configuration – Automatic fire detection devices shall be configured in groups so as to afford the facility to isolate AFDs within zones without isolation of manual call points. Alternatively, the CIE should be capable of isolation of fire zones without isolating MCPs.

AFD's within Accommodation blocks shall be able to facilitate timed control sensitivity.

All detectors must be of an "open protocol" as Apollo Ltd (Discovery Range): or any equivalent University approved unit.

The remote indicators shall be an LED mounted on a white face plate. The face plate shall be permanently inscribed "Fire-Remote Indicator". The complete unit will be suitable for both surface mounting or flush mounting on a standard switch type box.

All heat and smoke detectors shall be mounted on an addressable base, compatible with both the system and the detector.

Each sounder circuit shall be powered by a sounder control unit which shall provide control, monitoring and power. Each SCU shall have a monitored power supply. The unit shall be fitted with red LED to indicate operation of unit and shall allow for pulsing a continuous operation.

Each loop shall be arranged in multiple zonal sections with quantities of detectors and manual call points in each section. A short isolation base or unit shall be located between each section.

If a short circuit occurs, the SCI shall isolate only the section in which the short circuit occurs. The main fire alarm panel will record the event activate the fault indication and continue to monitor the sections unaffected by the short circuit.

Provision should be made available to shutdown mechanical plant, interface relays shall be provided by the fire alarm company to each of the items of plant that require to be shutdown. The fire alarm panel shall be fitted with a fire-mans' Plant Isolation Key-switches. The University Fire Officer should be consulted to agree which items of plant should remain operational under the control of the fire-mans' plant isolation key-switches. The activation of the key-switch would be at the disposal of the fire authority attending officer.

In the event of fire activation the services to boiler plant and the associate gas shutdown valve would only be interrupted by the activation of the of the local boiler room fire detection devices.

Similarly in the event of a fire activation an interface unit shall be provided to any audio visual equipment within lecture theatres and the like whereby lighting systems shall be restored to full output and any audio presentations will be switched off.

A non-latching key-switch to be fitted to or adjacent to the main fire alarm control panel. When the key-switch is operated and released this would initiate a time isolation relay, which would prevent any plant shutdown or remote signal occurring during any periodic testing. On a given time i.e. 30 minutes, the fire alarm will revert back to normal status. This key-switch will be fully monitored via a loop interface to allow indication of the key-switch status.

Operation of system - on initiation of a confirmed alarm signal in any area i.e. the sounders where detailed will sound throughout the building and the alarm type, zone device address and full description will indicate on the main control panel. Simultaneously, a printed copy of the event

shall be made of acceptance of the alarm, silencing of the alarm sounders or any other operator initiated event shall be recorded on the printer, including the time of the event.

Audible sounders operating at 24 volt DC shall be electronic sounders and produce warning within the specified areas as shown on the drawings. The decibel output of the sounders shall be so sized to give adequate audibility to comply with the Fire officer requirements. Audible sounders shall be the Banshee type or equal with internal connections set to warn 110DB at 1 metre output. Should loop powered sounders be specified, then the system shall facilitate a loop current capability of not less than 500 m. The design shall also allow for a 25% spare capacity in the loop power for future sounder additions.

The addressable manual call points shall monitor and signal to the control equipment the status of a switch operated by a "break glass" assembly. The call point shall be capable of being tested using a special key without the need for shattering the glass, and shall provide an integral red LED to indicate activation.

Visual alarm units shall be a Xenon flasher suitable for 24V DC 125mA operation. These should generally be sited but not restricted to circulation areas, toilets, lecture theatres and plant rooms.

The designer of the fire alarm system shall allow for all costs associated with the provision of maintenance of the system. This is in accordance with current legislations during the twelve months following the date of the practical completion of the system installation. Weekly test of the system – during the weekly test of the system the CIE shall facilitate the following function(s):

a) Initiation of the keypad by inserting a unique four digit pin number. NB the keypad shall time-out after 5 minutes from the last event.
b) A mechanical key switch shall be activated to override I/0 units controlling mechanical ventilation plant, gas shut-off valves or any other designated item of plant designed to shut down in the event of fire alarm activation.
c) Once the test point has been activated, the sounders shall be silenced then reset at the CIE. The key-switch shall be returned to its "normal" state.

Lift Interface: upon activation of the alarm system, an addressable input/output unit shall be located within the lift motor room to send a volt free signal to the lift controller. Thereafter, the lift shall return to a predetermined floor, the doors open and the lift shall be rendered "Out of Use". Overriding of the lift I/O device shall not apply during a weekly test.

Provision for the hard of hearing: - The designer shall make provision for the hard of hearing when designing the fire alarm installation. This shall take the form of a fully "Open Protocol" pager system interfaced with the fire alarm system or appropriate "alerter" system. The designer shall seek guidance from the University representative as to the preferred system to be employed.

6.6 Emergency Lighting

Standards - Emergency lighting shall be provided to comply with current legislation, Building Regulations, European Standards and British Standards including BS 5266 Pt. 1 2005 and Part 7 1999 BS 5499 Pts. 1 and 3 and The Health and Safety at Work Act. Luminaires should conform to the harmonised British and European Product Standard BSEN 60598-2-22 and also with the requirements of ICEL 1001 Part II.

Wherever possible emergency luminaries will be installed of the same type as those provided in the room space for normal use but with an "emergency" facility with suitable self-contained equipment as an integral part of the luminaire.

For refurbished buildings the design of the emergency lighting layout shall ensure that each circuit with emergency luminaries connected is capable of being tested via a local key operated switch.
For new buildings the emergency testing shall be by means of an addressable central test system which will allow automatic testing in accordance with BS5266 and EN50172. The system shall be open totally open protocol for maintenance purposes and shall be compatible for use with numerous lighting manufacturers' luminaries. The system shall be capable of automatically carrying out functionality and duration tests at frequencies that are equal to or exceed the requirements of current codes of practice.

Self-contained luminaries shall be fitted with integral nickel cadmium battery or nickel hydride packs giving a 3 hour duration in the event of mains failure. In addition luminaries shall be fitted with a red/green LED to give indication of the condition of the battery pack.

Emergency lighting circuits must de designed to allow key switch testing to be carried out without disruption to the general lighting in the area. Permanent live supplies must be wired via key switches installed adjacent to lighting distribution boards.

6.7 Lightning Protection

A risk assessment shall be carried in accordance with BS 62305 2011. Where required, lightning protection shall be designed in full compliance with BS 62305 2011 and installed by an approved specialist contractor.

Buildings with existing Lightning protection systems should be extended in accordance with BS 62305 2011 to cover the area of any new extension works.

The lightning protection design shall include for the bonding or isolation of all metallic services in accordance with BS62305 2011.

Installations shall be neat and unobtrusive particularly on listed building facades.

The installation shall be so constructed to facilitate routine inspection and test in accordance with current codes of practice.

6.8 Security and CCTV Installations

The designer shall consult with the University of Edinburgh's "in house" Security Department to determine the exact scope of work in respect of the extent and nature of the security system to be employed.
Outline details of the general requirements for University of Edinburgh security can be accessed via the following web site http://www.security.ed.ac.uk

Existing building: Agree with the University's Chief Security Officer a preferred installation for extending the existing security alarm system to new presence detectors, window contacts and door contact positions. Agree also the need for additional CCTV equipment linked to the University main control room as necessary.

6.9 Telephone and Access Control Installations

The designer shall consult with the University of Edinburgh's "in house" Information Technology Infrastructure Division of Information Services to determine the exact scope of work in respect of the extent and nature of the telephone system and access control systems to be employed.
Outline details of the general requirements for University of Edinburgh Telephone services can be accessed via the following web site http://www.phones.ed.ac.uk/phone.html

6.10 Data Installations

The designer shall consult with the University of Edinburgh's "in house" Information Technology Infrastructure Division of Information Services to determine the exact scope of work in respect of the extent and nature of the data system to be employed.

6.11 Vehicle Charging Points

The designer shall consult with the University of Edinburgh's project manager to ascertain whether or not vehicle charging points are required under the contract.

Funding streams shall be investigated by the consultant for the installation of twin, Type 2, 7kW charging points as standard.

13A socket outlets shall not be accepted as accessories for charging electric vehicles.

Engineering Services Guidelines
Section 6 – Electrical Services
Appendix 1.

FIRE SAFETY UNIT BRIEFING NOTE:
FIRE DETECTION AND ALARM SYSTEMS

1. Introduction.

i. This briefing note has been prepared to be used in conjunction with the Engineering Guidelines Section 6 – Electrical Services and seeks to confirm the approach undertaken by the Fire Safety Unit (FSU) in determining the appropriate fire detection and alarm category (AFD) required within estate premises

2. Regulations and Statutory Guidance.

i. Fire detection and alarm systems are installed within the estate to satisfy the primary objective of life protection. The principal regulations and statutory guidance for fire safety include:

- The Fire (Scotland) Act 2005 and related subordinate legislation
- The Building (Scotland) Regulations 2006 and supporting guidance document Technical Handbook 2013
- Sector Specific Guides
- Approved Codes of Practice:
  - BS 5839-1: Fire detection and alarm systems for buildings
  - BS 9999: Code of Practice for fire safety in the design, management and use of buildings
  - BS 7974: Application of fire safety engineering principles to the design of buildings.

ii. In general, the approach is to provide adequate warning of fire, to the extent that is appropriate. In deciding what is 'appropriate', consideration must be given to the following:

- Size, construction and use of the premises
- Equipment contained on the premises
- Physical and chemical properties of the substances likely to be present
- The occupancy characteristics including physical ability and maximum number of persons that may be present at any one time

3. Risk Based Approach.

i. The fire risk assessment inspection is a comprehensive and systematic evaluation of fire safety measures within the premises. A risk profile is established during this inspection, which influences the extent of measures to ensure fire safety and effective evacuation requirements.

ii. Factors influencing the risk profile include:

- Adequacy of means to prevent fire
- Early fire warning by AFD
- The standard of means of escape
- Adequacy of structure to resist effects of fire
- Degree of fire containment

Other considerations specifically within our estate include;

- Lone working arrangements
- Out of hours study
- Complex building structures
- Sleeping accommodation
- Disabled access/egress requirements
- In house fire safety management – out of hours limitations

iii. The mandatory requirement to alert occupants to the outbreak of fire is detailed within the current regulations, however, consideration of the building evacuation dynamics need to be assessed in order to specify the appropriate category of system, on a case for case basis.

iv. Where the current AFD is deemed inadequate, the appropriate Head of School and Estates and Buildings are informed via the Fire Risk Assessment form. Where the extent of remedial work is extensive, further discussion with Estates and Buildings is undertaken, to programme the works on a risk assessed basis.

v. In an engineered approach to fire safety provision in large or complex buildings, (combining AFD, fire suppression systems and smoke control), there is a general move by designers, away from prescriptive means, to more performance or output based solutions. Utilisation of an enhanced category of system, typically L1 may be proposed at the design stage, as a compensatory feature.

4. Evacuation Strategy

i. Any evacuation strategy, should seek to ensure the occupants can reach a place of ultimate safety, (outside the building), in the event of a fire, without relying on the assistance of the Fire and Rescue Service.

ii. The provision of an automatic fire alarm and detection system can significantly increase the time available to escape by providing early warning of fire so that occupants start to make their escape sooner. When considering the overall escape time from a building, occupant reaction to an alarm can be more important than the time it takes to physically reach an exit.

iii. Key occupant characteristics to be considered:

- **Sleeping risk** - if asleep, the occupants ability to detect fire and to escape quickly will be greatly impaired;
- **Numbers** - where there are large numbers of occupants, there may be problems of overcrowding, misinformation or confusion;
- **Impairment** - the occupants may suffer, mobility, visual, hearing or other impairments, which reduce their ability to escape quickly;
- **Familiarity** - if large numbers of the occupants are unfamiliar with the building, they may not necessarily use the nearest escape route;
- **Response –** in some situations the occupants may not recognise the fire alarm, may assume it is a false alarm, or may not respond appropriately

iv. Within the estate we utilise two main classifications of evacuation:

- **Simultaneous evacuation (**divided into two categories):
  - **Single stage**, activation of a detector or call point gives an instantaneous warning for an immediate evacuation
  - **Two – Staged**, there is an investigation period before the fire alarm sounders are activated

- **Phased evacuation**: initial evacuation of those directly affected by fire, the remaining floors are then evacuated two floors at a time at phased intervals
  - Alarm zone where fire situated, then adjoining zones if or when required initially

5. Disabled Evacuation

i. The difficulties in providing effective evacuation strategies for disabled persons, remains an issue. In particular, out of hour's arrangements, suitability of escape routes and evacuation lift accessibility. Early warning is a prime consideration to allow access to a place of safety.

ii. The provision of protected temporary waiting areas, evacuation lifts and comprehensive detection coverage will allow a risk based approach to support a "defend in place" use of temporary waiting areas and empower any disabled person to use the lift on a "single knock" condition.

6. **Appropriate Category of System.**

i. The choice of appropriate category of AFD to meet specific risks is provided within current codes of practice and is not intended however to constitute recommendations, but does provide information on custom and practice.

ii. Ultimately responsibility rests with the enforcing authorities responsible for enforcing legislation within the buildings (Scottish Fire and Rescue Service and Local Authority) regarding the appropriate category of system.

7. **Bibliography**

1. BS 9999: 2008 Code of Practice for fire safety in the design, management and use of buildings.

2. BS 5939:2013 Part 1: Fire Detection and Alarm Systems for Buildings .Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises.

3. The Building (Scotland) Regulations 2006 – Technical Handbook, Non Residential Premises.

4. Building Standards Division – A Simplified Approach To Alternative Fire Safety Strategies 2010