



Department
for Education

Technical Annex 2G: Electrical Services, Communications, Fire and Security Systems

Output Specification

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Contents

Contents	2
Summary	4
Review date	4
Who is this publication for?	4
Document Updates	4
1. Introduction	5
1.1 Overview	5
1.2. Refurbishment	5
2. Electrical Services Requirements	7
2.1. Incoming Electrical Supplies	7
2.1.1. The Contractor shall:	7
2.2. Power Generation Systems	7
2.2.1. Standby Generation	7
2.2.2 Photovoltaic Systems	7
2.2.3. Small Scale Wind Generating Systems	8
2.3. Electrical Distribution Systems	8
2.3.1. Earthing and Bonding Systems	8
2.3.2 Inspection and Testing of Low Voltage Electrical	9
2.3.3. Low Voltage Distribution Systems	9
2.3.4. Cable Containment	13
2.3.5. Small Power Systems	14
2.3.6. Uninterruptible Power Supplies (UPS)	16
2.3.7. Lightning Protection	17
2.3.8. Reference Standards	17
3. Communication Systems	19
3.1. Public Address & Voice Alarm (PAVA)	19
3.2. Period Bell	19
3.3. Audio Systems	20
3.4. Emergency Voice Communications	20
3.5. ICT Infrastructure	20
3.6. Installations for Pupils with SEND	20

3.7. Induction Loops (AFILS)	21
4. Fire Detection and Fire Alarm Systems	22
4.1. General Requirements	22
4.2. Safety Supplies for Life-saving and Fire-fighting Applications	23
4.3. Sprinkler Systems	23
5. Security Systems	25
5.1. Overview	25
5.2. Access Control	25
5.3. Intruder Detection Systems	25
5.3.1. General Requirements	25
5.3.2. System Requirements	26
5.3.3. Reference Standards	27
5.4. Closed Circuit Television (CCTV) Systems	27
5.4.1. General Requirements	27
6. Handover Requirements	29
6.1. Overview	29
6.2. Soak Testing	29
6.3. Documentation	31
6.4. Commissioning and Building Performance Evaluation	31
6.5. Demonstration and Training	32
7. References	33

Summary

This document is one of a number of Technical Annexes which form part of the Generic Design Brief (GDB)

Review date

The next planned review date for this document is November 2020.

Who is this publication for?

This document is for Technical professionals involved in the design and construction of school premises, to use as part of the Employer's Requirements of the DfE construction framework. It may also be used as the basis of similar documentation for other procurement routes using the Output Specification.

Document Updates

- **Version 9:** May 2020 – Amendments to fire alarms, low voltage distribution systems, cable containment and small power supply.
- **Version 8:** May 2019 - Revised to incorporate end user feedback, evidence collected and updates to applicable standards.
- **Version 7:** November 2017 - Issued as OS 2017.
- **Versions 1-6:** July 2016 – November 2017 - Includes initial working towards OS 2017.

1. Introduction

1.1 Overview

- 1.1.1. This document is one of a number of Technical Annexes which form part of the Generic Design Brief (GDB). It sets out the required technical standards and performance criteria for electrical services, communications, fire and security systems in schools and should be read in conjunction with Sections 2.10 and 2.14 of the GDB, as well as the School-Specific Brief (SSB), including the School-Specific Schedule of Accommodation (SoA), Area Data Sheets (ADS) and, where relevant, the Refurbishment Scope of Works (RSoW). The definitions in paragraph 1.3 of the GDB apply to this Technical Annex and all other parts of the OS.
- 1.1.2. The information exchange required at each stage of the procurement process is detailed in the Employer's Requirements Deliverables.
- 1.1.3. The requirements in this Technical Annex are in respect of Buildings, FF&E and ICT Infrastructure and shall apply to all parts of the Works in New Buildings constructed by the Contractor, as well as to any Building Elements or Building Services provided in Refurbished Building(s) which are designated Renewed or Replaced in the RSoW.
- 1.1.4. Where the requirements refers to an area, space or Suite of Spaces, this shall apply to all spaces in any New Building(s) or Remodelled Area. Any area or space within New Buildings or Remodelled Area shall conform to all relevant requirements in this Technical Annex.

1.2. Refurbishment

- 1.2.1. As described in the GDB, any work required to Refurbished Buildings shall be as defined in the RSoW, under the headings of architectural elements (including FF&E) and M&E elements (including ICT infrastructure). The work will be categorised as Renewed, Replaced, Repaired, Retained or have 'No work'.
 - a) Any **Renewed** electrical elements or services provided shall be designed to satisfy the relevant outputs of the GDB and this Technical Annex.
 - b) Any **Replaced** electrical elements or services provided shall satisfy the relevant outputs of the GDB and this Technical Annex, as far as possible within the constraints of the location, the adjacent elements and the sub-structure.

- c) Any **Repaired** electrical elements or services shall comply with the specifications in any project-specific drawing issued as part of the SSB, and the overall performance after repair shall be at least as good as that of the existing provision.
- d) Any **Retained** electrical elements or services shall be left as existing, with minimal work required unless needed in order to complete other Works that form part of the Project, and the overall performance shall be no worse than the existing performance;
- e) Any electrical elements or services requiring '**No work**' shall be left as existing.

1.2.2. The Contractor shall ensure that the works undertaken are in line with all relevant standards and guidance documents in accordance with the system type.

1.2.3. In the case of refurbishment work to Existing Buildings, the Contractor shall ensure that:

- a) the existing electrical earthing and bonding arrangements are suitable to ensure safety for the whole Building and correct operation of all protective devices
- b) the rating and condition of the existing electrical equipment will be suitable to ensure safety for the whole Building and correct operation of all protective devices, including all grading and discrimination checks

2. Electrical Services Requirements

2.1. Incoming Electrical Supplies

2.1.1. The Contractor shall:

- a) liaise with the distribution network operator (DNO) to establish the incoming electricity supply, and determine if the supply should be at high voltage or low voltage', establish the rating of the DNO overcurrent device at the point of supply, and provide the DNO with all characteristics of the load which the DNO may request (for example harmonic content and characteristics of large loads)
- b) establish the location of DNO equipment, make allowance for it to be located on the site if necessary, and submit drawings to the Employer showing the layout of the DNO equipment including high voltage switchgear, transformers, low voltage switchgear and space for metering following DNO guidelines
- c) establish and take into account the characteristics of the supply including prospective short-circuit current, external earth fault loop impedance and earthing arrangements
- d) ensure connections to a low voltage (LV) supply are designed in accordance with BS 7671 IET Wiring Regulations
- e) ensure electrical supplies are 3 phase, 400V, 50Hz
- f) ensure the power factor is no less than 0.95 lagging and provide power factor correction equipment to achieve this power factor, as necessary on incoming electrical supplies as well as on low voltage distribution systems

2.2. Power Generation Systems

2.2.1. Standby Generation

2.2.1.1 Generators shall only be provided where they are required to be installed by regulations, for example, for firefighting lifts and for life-safety and fire-fighting applications.

2.2.2 Photovoltaic Systems

2.2.2.1 Where photovoltaic systems are required as part of a strategy to meet AD L or planning conditions, the Contractor shall:

- a) undertake the complete design of the system
- b) ensure the system is designed and installed to BS EN 62124 and in accordance with ENA G59/3 and ENA G83/1 and to BS EN 61427-1, as well as BS 7671 IET Wiring Regulations
- c) produce calculations showing estimated annual energy yield
- d) ensure the mode of operation is grid connected and undertake all necessary liaison and negotiations with the DNO.

2.2.3. Small Scale Wind Generating Systems

2.2.3.1 Where small scale wind generating systems are required as part of a strategy to meet Building Regulations AD L or planning conditions, the Contractor shall:

- a) undertake the complete design of the system
- b) ensure the system is designed and installed to BS EN 61400-2 and RenewableUK 'Small Wind Turbine Standard' as well as BS 7671 IET Wiring Regulations
- c) ensure the mode of operation is grid connected and undertake all necessary liaison and negotiations with the DNO
- d) ensure that the design life of the system is 20 years
- e) ensure that the specialist designer and installer are Microgeneration Certification Scheme accredited
- f) submit details to the Employer of the proposed type of wind turbine, its mounting axis, support structure and foundations, electronic and electrical components, cabling and cable containment

2.3. Electrical Distribution Systems

2.3.1. Earthing and Bonding Systems

2.3.1.1. The Contractor shall:

- a) provide an earthing and bonding installation in accordance with BS 7671 and BS 7430

- b) liaise with the DNO to determine the type of earthing system required and to establish the demarcation of responsibilities
- c) provide all earthing and bonding including main incoming earthing, main earth electrode, main earth terminal (MET), main equipotential bonding, supplementary equipotential bonding, circuit protective conductors, clean earths where appropriate and functional earths where appropriate
- d) only where generators are required, ensure that the design of standby generator earthing ensures that sufficient earth fault current is generated to operate protective devices

2.3.2 Inspection and Testing of Low Voltage Electrical Installations

2.3.2.1 The Contractor shall:

- a) ensure that test equipment is calibrated annually and that inspection and testing of electrical installations are in accordance with BS 7671 and IET Guidance Note 3
- b) confirm that materials comply with the relevant standards, that the installation is erected correctly and that the installation is free from defects; and measure the electrical continuity of cable containment

2.3.3. Low Voltage Distribution Systems

2.3.3.1 The Contractor shall ensure that the following requirements are met.

- a) The design of the low voltage distribution systems is in accordance with the requirements of BS 7671 IET Wiring Regulations.
- b) Electrical services in practical teaching spaces are fitted with sufficient local master controls, as specified in Annex 21, Section 3.6 'Electrical Services Controls', to control services in lessons and for cutting off supplies in an emergency.
- c) Master controls in practical teaching spaces do not isolate fridges, freezers, ICT equipment and 13A sockets provided for cleaners.
- d) The design allows for 10% physical and electrical spare capacity throughout the LV distribution system including at all switchboards and distribution boards, in sub-mains and final circuit cable capacities, in protective device capacities, and in all cable containment systems.

- e) Switchboards and distribution boards are provided with 10% representative of selected devices, spare protective devices and a further 10% unequipped space ready to accept protective devices, and fitted with blanking plates.
- f) The main LV Switchboards allow for expansion to one side by one further cubicle without impact on access requirements within the switchroom.
- g) Automatic power factor correction is provided where necessary to achieve a power factor of at least 0.95 as outlined in Section 2.1 Incoming Electrical Supplies.
- h) The system achieves the required disconnection times under fault and is properly graded to achieve full discrimination / selectivity between upstream and downstream devices both on mains operation, and discrimination is demonstrated using time-current coordination curves in a study report.
- i) New low voltage switchgear and control gear assemblies are compliant with BS EN 61439 and are ASTA certified.

2.3.3.2. New switchboards shall have an appropriate form of separation taking into account the nature of the loads supplied and any requirements for continuity of supply. The minimum form of separation shall be:

- a) Form 4 type 2 or better where there isn't a requirement for cables to be terminated adjacent to live cables, or
- b) Form 4b type 7 where cables may need to be terminated adjacent to live cables, most likely to occur in refurbishment schemes.

2.3.3.3. The Contractor shall ensure that the following requirements are met.

- a) All conductive parts of new low voltage switchgear and control gear assemblies which are accessible when a lid or door is opened are behind an insulating barrier with a minimum ingress protection rating of IP2X.
- b) New low voltage switchgear assemblies are fitted with anti-condensation heaters.
- c) New low voltage switchgear is selected for appropriate service conditions including ambient air temperature, indoor / outdoor location, degree of pollution, protection against ingress of solids and liquids.
- d) New protective devices are provided as circuit breakers and wherever possible are supplied from the same manufacturer, moulded case circuit breakers are of the plug-in type and selected so that their service breaking

capacity (Ics) is not less than the prospective short circuit or earth fault current at the point of use, whichever is the greater.

- e) The impulse withstand voltage rating of devices is appropriate for the point of use of the device.
- f) The following rooms and spaces are fed by dedicated distribution boards: server rooms, kitchens and stage lighting rigs (except where LED lighting is used).
- g) Equipment is provided with a durable label marked with the equipment's function and unique reference.
- h) The main switchgear is located as close to the centre of the load as is practicable to minimise cable lengths and I²R losses; sub switchboards and final distribution boards are strategically located to minimise the quantity and lengths of cables and cable containment.
- i) Main low voltage (LV) switchboards are located in dedicated electrical riser cupboards and sub switchboards and final distribution boards are also located in dedicated electrical riser cupboards.
- j) Electrical rooms and cable routes are determined to ensure that adequate floor space and horizontal and vertical distribution zones are provided.
- k) Main low voltage switchrooms are located where they are readily accessible for equipment and personnel, ideally at ground level with direct access from outside. Switchrooms have good access for vehicles and lifting equipment. Door designs allow for the moving of electrical equipment using lifting equipment.
- l) The construction of switchrooms provides appropriate fire protection as required by the Project's Fire Safety Strategy and the Building Regulations. The construction of the switchroom is robust, allowing for wall mounted electrical equipment, and can withstand the effects of an electrical explosion.
- m) Switchrooms prevent the ingress of water and underground cable entries are water tight. Switchgear is not located below wet services such as water tanks, drainage, piped water services, toilets, and plant rooms containing wet services, and not within basement or rooms prone to flooding.
- n) The layout of switchrooms allows for adequate working space. In the case of withdrawable switchgear working space is allowed to the front of the

switchgear whilst in the withdrawn position. The switchroom allows for expansion of switchgear.

- o) The switchroom allows for all switchgear to be located in the room including power factor correction, harmonic filters and battery chargers where specified. The height of the room allows for adequate space for top entry cabling where this is used.
- p) Notices are provided in the switchroom including a framed wall mounted low voltage (LV) schematic diagram, statutory signage and posters, details of the earthing system and rubber mats.

2.3.3.4. The Contractor shall ensure that the following requirements are met.

- a) Sub-mains and final circuit cables have copper conductors. The outer sheath of sub-mains cables is black and cable core colours are as defined by BS 7671.
- b) Sub-mains cables are compliant with BS 6724: 'Electric cables. Thermosetting insulated, armoured cables of rated voltages of 600/1 000 V and 1 900/3 300 V for fixed installations, having low emission of smoke and corrosive gases (LSZH) when affected by fire' in accordance with BS EN50267-1: 'Common test methods for cables under fire conditions.' Cabling is of an approved type tested by British Approvals Service for Electrical Cables (BASEC).
- c) The armour of cables is used as a circuit protective conductor. Where required to reduce the earth fault loop impedance to achieve disconnection times, a supplementary circuit protective conductor shall be run with the cable.
- d) The cable routes allow sufficient space for the bending radius of the cables.
- e) Busbar systems, both vertical and horizontal, are considered acceptable as a cost effective and space efficient alternative to multiple runs of cable. Busbar systems are compliant with BS EN 61439-6.
- f) Local distribution boards are provided strategically located around the building, housed in dedicated electrical cupboards, risers or plant rooms. Distribution boards shall be fitted with a lockable door.
- g) Arc fault detection devices (AFFDs) conforming to BS EN 62606 shall be provided as a means of additional protection against fire caused by arc faults in all ac circuits where school buildings have residential accommodation.

- h) In accordance with BS7671 final circuits requiring overload, short circuit and earth leakage protection shall utilise RCBO's provided in the local distribution boards.

2.3.4. Cable Containment

2.3.4.1. The Contractor shall ensure that the following requirements are met.

- a) Sub-mains distribution cables are generally fixed to cable containment, buried underground, laid in trenches or run in underground ducts. Underground cable sheaths are not be porous. Vertically routed cables are secured by cleats.
- b) Where run externally, sub-mains cables are buried directly in the ground. Where sub-mains cables run below hard standing, the cables are run in cable ducts to allow alterations and additions in the future. Warning tapes and protection tiles are laid above buried cables.
- c) Cable runs in ducts are fixed to cable containment within the duct and are not be laid on the bottom of the duct. Ducts are laid to falls and drained and allow for maintenance access.
- d) Cable containment is selected and arranged taking into account Electro Magnetic Compatibility (EMC) considerations.
- e) Cable baskets, trays and ladders are compliant with BS EN 61537, and cable trunking with BS EN 50085. Cable baskets are high sided and cable trays are medium duty with a return flange.
- f) Cable ladders are used over switchboards and where cables run vertically, for example in risers, the cables are fixed to horizontal channel supports. Cables are not fixed to vertically running cable trays.
- g) Steel cable trays, baskets, ladders and trunking have a galvanised finish. Metallic cable containment is electrically continuous and fire barriers are provided wherever cable containment penetrates a fire compartment.
- h) Cable containment is not suspended from other services. Cable trunking has a minimum ingress protection rating of IP4X.
- i) In accordance with BS7671, clause 522.10.202, all wiring systems are required to be supported to prevent premature collapse in the event of fire. For School Buildings this shall be using steel conduit, steel trunking,

suspended steel cable tray or basket with steel fixings with all cables laid onto the tray/basket. The use of inverted cable tray is not acceptable.

- j) All external cabling is contained within galvanised steel metal conduit and complies with paragraph 2.3.5.6 a.

2.3.5. Small Power Systems

2.3.5.1. The Contractor shall ensure that the following requirements are met.

- a) Socket outlets are on 32A ring or 20A radial circuits as defined by BS 7671. Small power accessories comply with BS 1363.
- b) Fused connection units and socket outlets have an Ingress Protection (IP) rating suitable for the environment.
- c) Fused connection units are provided for tea points, hand driers, fridges, freezers, and other similar equipment.
- d) Socket outlet circuits are protected against overload, short circuit and earth leakage currents by RCBOs at the local distribution board.
- e) The quantities of small power outlets are as detailed on the School-Specific SoA and ADS. Typically, the total number of outlets provided shall be up to 1.2 per pupil place. Generally, each outlet comprises a double socket, however for cleaners' sockets, or where agreed with the employer, a single socket or a fused spur may be provided in place of a double socket outlet.
- f) Desk mounted socket outlets and wiring to desks shall comply with BS 6396: Electrical systems in office furniture and screens.
- g) Small power supplies are provided as appropriate for building services equipment e.g. wireless routers, control and instrumentation panels for fire detection and alarm systems, security systems, building management systems and other specialist systems, fan coil units, hand dryers, water heaters, and specialist equipment such as bleacher seating.

2.3.5.2. The Contractor shall ensure that the number of sockets on a circuit is assessed. It is anticipated that this will vary depending on location and anticipated loading. The likely earth leakage carried on each circuit is assessed to prevent the unwanted tripping of RCDs. The number of socket outlets per circuit is limited according to the likely equipment to be supplied. The Contractor shall consider using 20A radial circuits in lieu of 32A rings if the anticipated load is low (e.g. in areas of high density of computer use,

limiting the number of sockets such that the earth leakage current is controlled to acceptable limits may mean that the current drawn flowing on a circuit is only a few Amperes, in which case 20A radial circuits would be appropriate). Diversity shall be assessed in accordance with IET Guidance note 1.

2.3.5.3. Wiring methods selected shall be compliant with BS 7671, robust, suitable for the environment, accessible, rewirable and, where visible, neat and tidy and in accord with the desired aesthetic. Preferred wiring methods for final circuits are:

- a) rigid thermosetting insulated single core cables (LSZH singles, H07Z) to BS 7211 table 3a, run in rigid steel trunking and conduit
- b) flat twin and earth cabling (LSZH, 6242B) to BS7211.

2.3.5.4. For either wiring methods listed in paragraph 2.3.5.3:

- a) CPC sizes shall be sufficient to ensure that the fault current generated operates the protective devices within safe time limits
- b) mechanical protection using galvanised steel conduit shall be provided where wiring is concealed within the building fabric to serve flush mounted accessories; RCBO/RCD circuit protection in accordance with BS7671 does not negate the need to provide this mechanical protection.

2.3.5.5. Prefabricated wiring systems may also be proposed, in which case cables shall be either rigid thermosetting insulated single core cables (LSZH singles, 6491B, H07Z-R or flat twin and earth cabling (LSZH, 6242B) to BS7211 run in armoured flexible conduits fixed to cable trays or baskets.

2.3.5.6. The Contractor shall ensure that the following requirements are met.

- a) The grade of rigid steel conduit is appropriate for the environment in which it is to be installed. Conduit installed externally and in plant spaces and risers is galvanised.
- b) Flush mounted wiring accessories and concealed wiring are used generally.
- c) Final run outs of final circuit cables are contained in wall mounted plastic multicompartment trunking accommodating small power accessories.
- d) Where specified in the School-Specific ADS, spaces - including science laboratories, prep rooms, design technology practical teaching rooms and

kitchens - are fitted with a facility to isolate supplies in an emergency; such facilities do not isolate refrigerators, freezers, ICT equipment and 13A sockets provided for cleaners.

- e) All small power outlets in a room are on the same electrical phase.
- f) SEND and medical spaces such as medical / therapy rooms, sick bays, physiotherapy, soft play, calming room, multi-purpose therapy, sensory room, medical / nurse's office, hydrotherapy pool are designed in accordance with Health Technical Memorandum 06-01 'Electrical Services Supply and Distribution' and Sections 702 and 710 of BS 7671 IET Wiring Regulations.
- g) In server rooms BS EN 60309 socket outlets are provided for server racks of ratings appropriate to the load.

2.3.5.7. A flush-mounted electrical fused spur shall be provided at high level connected via concealed conduit to a flush flex outlet plate adjacent to each hand drier. If a towel dispenser is installed, conduit shall be run to a position suitable for later connection of a hand drier. This allows for future installation of hand driers or automatic towel dispensers. Electric hand driers shall have: a drying time of less than 30 seconds; infra-red control for no contact start; auto-off; and a noise level of less than 85 dBA, and preferably less than 80dBA, at 1m.

2.3.5.8. An assessment shall be made by an acoustician of whether the location and noise rating of the hand driers will cause problems to the school; acoustic measures such as quieter hand driers or a different method of hand drying may be required. The choice of hand drier or paper towel dispenser will be as indicated in the SSB. A hand drier shall be provided for each run of up to 5 WC cubicles.

2.3.5.9. Contrast switch plates shall be provided throughout the Building in compliance with ADM with a LRV 30 points different to the surrounding background décor.

2.3.6. Uninterruptible Power Supplies (UPS)

2.3.6.1. The Contractor shall ensure that the following requirements are met.

- a) UPS are provided in the form of a rack-mounted battery system that will provide the servers, core switches and wireless controllers with 30 minutes

autonomy. The remainder of the Building is not provided with UPS unless stipulated by regulations, for example for safety systems.

- b) UPS comply with BS EN 62040-1 and BS EN 62040-3; and the mode of operation is on-line.
- c) The UPS is compatible with the load.
- d) Batteries are integral to the UPS enclosure, have an autonomy of 30 minutes, are lead-acid valve regulated (VRLA) to BS EN 60896-21 and BS EN 610561, and have a minimum service life of 8 years.

2.3.7. Lightning Protection

2.3.7.1. The Contractor shall:

- a) determine the class of the lightning protection system by means of a risk assessment carried out in accordance with BS EN 62305
- b) design a lightning protection system in accordance with the class of system
- c) ensure that transient overvoltage surge suppression devices are provided for mains power, data, and telecom lines as appropriate to the required class of system as determined by the risk assessment
- d) ensure that surge suppression devices are provided in server rooms and any other vulnerable critical systems as determined by risk assessment
- e) ensure that surge suppression device alarms are linked to the BMS where one is installed
- f) ensure the lightning protection systems are tamper proof with earth electrodes accessible for regular testing

2.3.8. Reference Standards

2.3.8.1. In addition to the requirements set out within this section, the Contractor shall ensure that the design and installation of the electrical systems complies with the relevant parts of the following standards (or updated documents if relevant).

1. BS 7671 IET Wiring Regulations: 2008 incorporating amendment 3:2015

2. BS EN 62124: 2005 'Photovoltaic (PV) stand-alone systems. Design verification'
3. ENA G59/3 'Recommendations for the Connection of Generating Plant to the Distribution Systems of Licensed Distribution Network Operators'
4. ENA G83/1 'Recommendations for the Connection of Type Tested Small-scale Embedded Generators (Up to 16A per Phase) in Parallel with Low Voltage Distribution Systems'
5. BS EN 61427-1: 2013 'Secondary cells and batteries for renewable energy storage. General requirements and methods of test. Photovoltaic off-grid application'
6. BS EN 61400-2: 2014 'Wind turbines Part 2: Small wind turbines'
7. RenewableUK 'Small Wind Turbine Standard', 2014
8. BS EN 61537: 2007 'Cable management - Cable tray systems and cable ladder systems'
9. BS EN 50085 'Cable trunking systems and cable ducting systems for electrical installations'
10. BS EN 62040-1: 2008 'Uninterruptible power systems (UPS) - Part 1: General and safety requirements for UPS'
11. BS EN 62040-3: 2011 'Uninterruptible power systems (UPS) Part 3: Method of specifying the performance and test requirements'

3. Communication Systems

3.1. Public Address & Voice Alarm (PAVA)

3.1.1. Where the SSB requires a combined Public Address and Voice Alarm system to be used for broadcasting announcements and voice instructions in response to fire and security incidents (i.e. evacuation, inevacuation, lockdown etc.) as part of planned emergency strategies, the Contractor shall:

- a) ensure that the Voice Alarm system complies with BS 5839-8:2013
- b) ensure the public address systems are zoned appropriately to enable announcements to be broadcast to specific zones as required (typical zones would be classrooms, sports halls, and dining hall)
- c) liaise with the other design disciplines to, where possible, ensure that the reverberation time of key spaces is minimised to improve intelligibility. This may be through the introduction of acoustic absorption materials in highly reverberant spaces such as sports halls. In areas with large variations in background noise, ambient noise sensors should be used
- d) undertake an acoustic design to determine optimal speaker layouts and sound pressure levels and, where possible, produce a design that has a speech intelligibility of at least 0.5 STI
- e) ensure that the public address central equipment is located in a secure room such as the ICT server room to avoid unauthorised access, and that the microphones are also in restricted areas such as offices and staff rooms

3.2. Period Bell

3.2.1. The Contractor shall ensure that the following requirements are met.

- a) Where bell systems are specified in the SSB to denote the start of the daily school session and to identify the end of various periods, they are flexible enough to deal with changes to the timetable.
- b) The class change tones/bells are easily distinguishable from the tones/bells used for raising the fire or security alarm.
- c) The class change systems have pre-set timings with manual override, and can cater for hearing impaired building users.

3.3. Audio Systems

3.3.1. The Contractor shall:

- a) ensure that audio amplification systems provided by the school are installed in drama, dance, halls, music and performance spaces where required in the School-Specific ADS and the SSB
- b) ensure that audio cabling (and appropriate power) is provided for connecting equipment supplied by the School including speakers and amplification systems in halls, equipment in control rooms and halls and other performance spaces
- c) install sound field systems where specified within the SSB

3.4. Emergency Voice Communications

3.4.1. The Contractor shall ensure that the following requirements are met.

- a) Where emergency voice communications are required, the system is compliant with BS 5839-9:2011.
- b) An emergency voice communication system is provided at each fire refuge point to enable occupants of each refuge to alert others that they are in need of assistance and to receive communications.

3.5. ICT Infrastructure

3.5.1. The Contractor shall:

- a) provide an ICT infrastructure to meet the requirements set out in GDB Section 4: ICT Design Requirements. The Contractor shall ensure that the design allows for the specific circumstances of each School, as specified in the SSB
- b) ensure that the scope of the provision includes the Whole School Site and all ICT data and telecommunications equipment, cabling systems and containment, from core patching to connection point for the School's equipment

3.6. Installations for Pupils with SEND

3.6.1. The Contractor shall provide any additional installations specific to pupils with SEND that are stated as required in the SSB. This can include sound-field systems, intercom, assistance alarms and access control systems. Subject to risk

assessment, the Contractor may also be required to provide attack alarms and/or staff-call systems where staff need to call for rapid assistance.

3.7. Induction Loops (AFILS)

3.7.1. The Contractor shall:

1. ensure that induction loops are provided in line with the requirements of the Equality Act 2010 and ensure that they align with the code of practice for AFILS, BS 7594:2011
2. provide a mobile induction loop for use in classrooms and induction loop facilities in larger areas such as performance spaces

4. Fire Detection and Fire Alarm Systems

4.1. General Requirements

4.1.1. The Contractor shall provide alternative warning systems to fire alarm sounders in accommodation specifically designed for pupils with SEND where required and also where specified in the SSB. Examples are given below.

- a) Visual (fixed beacon) alarms in certain areas. Suitable visual alarms shall be provided in areas where a person may be alone, such as a toilet. Where full height doors are specified for WC and shower cubicles, deaf alarm beacons shall be fitted in each cubicle rather than a single beacon in the WC suite/changing room.
- b) Vibrating paging systems for hearing impaired and other disabled people.

4.1.2. The Contractor shall:

- a) ensure that fire alarm systems are provided that comply with the requirements of BS 5839-1:2017: 'Fire detection and alarm systems', and that new systems are intelligent addressable
- b) ensure that the type (L1, L2, L3, etc.) of fire alarm system is as stated in the Project fire strategy and is agreed with building control
- c) determine if the fire alarm cabling is a standard or enhanced type
- d) ensure that wiring is fixed to the top of cable containment and where fixed to vertically mounted containment or directly to the building fabric, cabling is fixed by means of metallic clips
- e) develop a cause and effect matrix which shall set out the actions to be automatically taken in the case of an event such as the operation of a manual call point, the operation of a smoke detector or the operation of sprinklers
- f) ensure that where there is an existing site-wide fire alarm system, this system is extended to include the new or refurbished building(s) such that all fire alarms are indicated on the main site-wide fire alarm panel. Where this is not possible, due to age/obsolescence of the site-wide system, a standalone fire alarm system may be provided in the new or refurbished buildings with a repeater panel provided adjacent to the main (site-wide) fire alarm panel. All aspects of

the revised arrangements for fire alarms should be included in the school's fire safety management plan, as well as in the Operation and Maintenance (O&M) information contained in the Health and Safety (H&S) file.

4.1.3. There are two categories of manual call points:

- **Type A** – direct action (one action sets off the alarm)
- **Type B** – indirect operation (two actions set off the alarm – double knock), which may be suitable where tamper-proof installations are required (subject to Building Control agreement)

4.1.4. The Contractor shall provide the type of call points in consultation with the Employer. Anti-vandal type manual call points shall be provided.

4.2. Safety Supplies for Life-saving and Fire-fighting Applications

4.2.1. The Contractor shall provide safety electrical supplies for life-saving and firefighting applications in accordance with Chapter 56 of BS 7671 and BS 8519 including, but not limited to: emergency lighting, sprinkler systems, fire rescue service and evacuation lifts, fire detection and alarm systems, smoke ventilation systems, fire services communications systems.

4.2.2. Life safety and fire-fighting applications require safety sources which may take various forms, typically a standby generator, a Central Battery System (CBS), Uninterruptible Power Supplies (UPS), a mixture of all three or sometimes a second independent mains supply if appropriate, available and affordable.

4.3. Sprinkler Systems

4.3.1. Where a sprinkler system is specified in the SSB, the Contractor shall ensure that sprinkler protection is provided throughout the building, except in the following cases, see BS EN 12845¹ and TB 221².

¹ BS EN 12845: 2004 + A2:2009, 'Fixed firefighting systems. Automatic sprinkler systems. Design, installation and maintenance'.

² Technical Bulletin 221, 'Sprinkler Protection of Schools'.

- a) Enclosed staircases and enclosed vertical shafts (i.e. those areas that cannot contain combustible materials).
- b) Selected concealed spaces and voids as agreed by the Employer.
- c) Rooms protected by other automatic extinguishing systems (designed, installed and maintained to recognised British/European standards).
- d) Server rooms and rooms containing electrical power distribution apparatus, such as switchgear and transformers, where the walls, ceilings and floors are constructed to at least 120 minutes of fire resistance.
- e) Where science chemical stores are constructed to 120 minutes of fire resistance.
- f) Communicating buildings or storeys separated from the sprinklered Building by walls of appropriate fire resistance.
- g) Outbuildings, such as sheds, separated from the sprinklered Building by at least 10m.

4.3.2. The Contractor shall check with the local water company and Building Control whether the system requires a tanked water supply.

4.3.3. The Contractor shall ensure that any water tanks and associated pumps provided are suitably protected against frost and vandalism.

4.3.4. Sprinkler heads in any rooms with electrical distribution boards, switchgear or ICT servers or hubs shall be fitted with impact proof cages and pipework shall not be positioned over the equipment.

5. Security Systems

5.1. Overview

5.1.1. The following sections describe the normal provision of security systems for a School. The SSB will indicate where more complex systems are required for higher risk Schools as a result of a security risk assessment.

5.2. Access Control

5.2.1. Door entry systems operated by the staff shall be provided at the main entrance and as required for out of hours use.

5.2.2. The Contractor shall ensure that the following requirements are met.

- a) Access control systems are designed and installed to BS EN 60839 11 1: 2015. 'The design shall adhere to the guidelines for access control systems BS EN 60839 11 2: 2015'.
- b) The system is designed such that in event of a fire alarm the access control system does not inhibit escape.
- c) Stand-alone door entry systems to main entrances are not required to be integrated with other systems.

5.3. Intruder Detection Systems

5.3.1. General Requirements

5.3.1.1. The Contractor shall ensure that an intruder alarm system is provided, integrated with access controls, which complements the Building's functions and operations.

5.3.1.2. Alarm systems should be zoned to allow parts of the School to be used outside of the School day without affecting security elsewhere. This is especially important with schools operating extended hours.

5.3.1.3. Where Existing Buildings also have an intruder alarm system, the new and existing areas should function as one system, where practicable.

5.3.1.4. The Contractor shall ensure that the following requirements are met:

- a) Systems meet the requirements of BS EN 50131.

- b) Control panels are located in secure areas that are themselves intruder alarm protected or the approach to them is intruder alarm protected.

5.3.1.5. The alarm system shall meet the requirements of BS EN 50131³ and NACOSS⁴ and:

- a) be capable of remote monitoring
- b) utilise some form of monitored path to the alarm receiving centre, if remote signalling is used
- c) be installed by an installer certified by an UKAS, (United Kingdom Accreditation Service) accredited certification body, with detectors to cover all accessible perimeter areas
- d) the Authorities are consulted to ensure the system is aligned with local requirements

5.3.1.6. The SSB will indicate where the intruder alarm system needs to be enhanced in higher risk schools as a result of a security risk assessment. It is likely that any new systems will require confirmation technology (the ability to confirm that alarm activation is actually due to an intruder) before being granted Level 1 Police response. Further, any systems that lose Level 1 response due to the number of false alarm activations will require the addition of confirmation technology before Level 1 is reinstated.

5.3.2. System Requirements

5.3.2.1. The requirements for the intruder detection system are listed below.

- a) A fully programmable control panel shall be provided which shall enable sufficient zones, user levels and alarm types to be configured via the integral keypad and display. The panel shall be tamper proof and shall provide a standby battery to enable continued operation in the event of a mains power failure for a required period.

³ BS EN 50131: 2006: Alarm systems. Intrusion and hold-up systems.

⁴ NACOSS – national Approval Council for Security Systems.

- b) One or more remote keypads with display shall be provided at specific entry/exit locations to enable the system to be set and unset.
- c) The panel shall incorporate a communicator to enable offsite signalling to an Alarm Receiving Centre (ARC) via an associated telephone line.
- d) Passive Infrared (PIR) and dual technology detectors shall be situated at strategic locations throughout the School and depending on door type, either concealed or surface mounted magnetic contacts shall be provided at required doors. Additional detection technologies shall be provided where required, including but not limited to vibration sensors and break-glass detectors.
- e) Internal and external audible alarm devices shall be provided to indicate that an alarm has been activated.
- f) All cabling and detection devices shall incorporate an alarm circuit and a 24hr tamper circuit.

5.3.3. Reference Standards

5.3.3.1. In addition to the requirements set out within this section, the Contractor shall ensure that the design and installation of intruder detection systems complies with the relevant parts of the following standards (or updated documents if relevant).

1. BS EN 50132 – 1:2006 + Amendments – ‘Alarm systems. Intrusion and hold up systems. System requirements’
2. PD 6662:2010 – ‘Scheme for the application of European standards for intrusion and hold up alarm systems’
3. BS 8473:2006 + amendment 1:2009 – ‘Intruder and hold up alarm systems. Management of false alarms. Code of practice’
4. BS 8243:2010 – ‘Association of Chief Police Officers (ACPO) code of practice’

5.4. Closed Circuit Television (CCTV) Systems

5.4.1. General Requirements

5.4.1.1. Intercom systems with integral CCTV cameras shall be provided at the main entrance to the School and at the secure line.

- 5.4.1.2. The SSB will indicate where more comprehensive CCTV systems are required for security purposes following a security risk assessment.
- 5.4.1.3. The Contractor shall ensure that any CCTV systems are:
- a) integrated into the design of the School and surrounding grounds
 - b) sympathetic to the adjacent land and neighbours and avoid intrusion into private activities not associated with the Schools
- 5.4.1.4 The Contractor shall provide all hardware connected with CCTV, including fixings, brackets, power and cables (containment, routing, termination and presentation).
- 5.4.1.5 Where the School has legacy internal CCTV systems for behaviour management or administration purposes the Contractor shall relocate these to the New Buildings but no new system hardware or software will be provided by the Contractor. The Contractor shall decant, install, and test any Internal IP-based CCTV (equipment to be provided by others), that is included in the School-Specific Brief and the School-Specific ICT Equipment Summary, in accordance with paragraph 4.8.3.4 of the GDB.
- 5.4.1.6 Legacy external CCTV systems shall not be re-positioned unless the SSB requires external CCTV based on a security risk assessment that identifies the school as at higher risk requiring CCTV measures. This will be included in the School-Specific Brief and the School-Specific ICT Equipment Summary, in accordance with paragraph 4.8.3.5 of the GDB.
- 5.4.1.7 Data Protection Act assessments for internal CCTV for behaviour management or school administration purposes and for CCTV required for external or internal building security purposes are separate. Refer to The Information Commissioner's Office (ICO) advice.

6. Handover Requirements

6.1. Overview

6.1.1. The handover requirements are set out in the Employer's Requirements Deliverables. The following section outlines the handover requirements in relation to the electrical services and communications systems. A 7 day period of 'soak testing' shall follow on from the successful commissioning and testing activities.

6.2. Soak Testing

6.2.1. The Contractor, prior to Completion, shall carry out a soak test of all the electrical services in their normal/auto operation mode, as if the building were occupied and in use. This shall be programmed to occur after completion of all setting to work, commissioning and testing of the electrical services and is to prove their reliability and correct calibrations over a continuous period of 7 days. Practical Completion will not be granted until a successful soak test as described here has been achieved. It is not necessary to install additional dummy loads into rooms to prove system performance at the maximum design loads but window blinds shall be in the up position to prove that daylight dimming is working. All electrical systems shall be fully energised and placed in their normal/auto operation mode with all normal occupied time settings applying to:

- a) electrical distribution
- b) small power
- c) lighting and emergency lighting
- d) fire alarm system
- e) lift
- f) all other alarm and communication systems
- g) control systems
- h) energy metering and monitoring systems
- i) electrical heating, ventilating and cooling systems
- j) any renewable energy and chp electrical generation systems

6.2.2. The soak test shall meet the following requirements.

- a) The test shall be included in the programme for the Works and shall continue until seven continuous days of plant operation have occurred without fault or failure of any component / function.
- b) The Contractor shall monitor all functions (lighting switching/levels, starts per hour/energy and water use) and log the trends using the microprocessor controls equipment where installed.
- c) Each type of space served by the plant and equipment shall be monitored using data loggers (supplied by the Mechanical or Electrical Contractor) or the BMS system to verify the performance.
- d) Any specified noise performance surveys shall be carried out during this period.
- e) All data and monitoring results shall be provided to the Employer in Excel spreadsheet format (disc and hard copy) along with details of any faults arising and corrective action taken.
- f) Should the soak test fail for any reason, then the results shall be null and void and the test period shall re-commence upon rectification of the problem/failure.
- g) All costs associated with the soak test, such as test equipment, attendance and supervision, shall be at the Contractor's expense. Any costs incurred as a result of or a consequence of having to restart the soak test shall be at the Contractor's expense.
- h) The soak test results shall be included in the Health and Safety File.

6.2.3. Where the fire alarm system(s) incorporate(s) more than 50 automatic fire detectors, the Contractor and fire alarm specialist shall provide - after inspection, testing and commissioning - a soak test period of at least one week (with the Building/ area occupied) in strict accordance with BS 5839. This period shall be determined by the fire alarm specialist responsible for the design of the fire alarm system(s). During the soak test period 24/7 monitoring of the fire alarm system(s) shall be undertaken to identify any unwanted false alarms and each manual call point shall bear an indication that it is not to be used. Until successful completion of the soak test, the fire alarm system(s) shall not be regarded as fully operational and therefore all necessary building insurances shall be in place to cover the use

of the Building/ area. The soak test shall only be regarded as successfully completed if either:

- a) no false alarms occurred occur during the soak test period, or
- b) if false alarms did occur during the soak test period, the fire alarm specialist identified the cause of these false alarms and has undertaken measures to rectify or minimise the potential for similar false alarms occurring in the future. If any unwanted false alarms are not rectified by the fire alarm specialist during the soak test period, the soak test shall be repeated from the beginning for a period of one week, until the fire alarm system(s) function accurately and correctly.

6.3. Documentation

- 6.3.1. The Contractor shall provide documentation as set out in the Employer's Requirements Deliverables. This includes a simple user-friendly Building User Guide including details of all user controls to be provided.
- 6.3.2. Schematics of each electrical and alarm system shall be provided adjacent to the main panels.

6.4. Commissioning and Building Performance Evaluation

- 6.4.1. The Contractor shall provide programme and commissioning as set out in the Employer's Requirements Deliverables.
- 6.4.2. The Contractor shall ensure that the systems installed are fully tested and commissioned in line with all appropriate current regulations and standards.
- 6.4.3. The Contractor shall carry out post occupancy Building Performance Evaluation (BPE) during the 12 month defects period⁵
- 6.4.5. The building services systems shall be commissioned such that where systems interact with each other they are commissioned at the same time in order to simulate this interaction as accurately as possible.
- 6.4.6. The Contractor shall undertake seasonal commissioning during the 12 months defects period in order to fine-tune the systems for optimum performance and energy consumption. All electrical systems shall be tested, witnessed and

⁵ See GDB Section 2.15 Building Performance and Seasonal Commissioning

certified. Lighting controls shall be fine-tuned during the first 12 months of occupation as part of seasonal commissioning, calibration of electrical sub meters verified and witnessed. Electrical testing shall be fully in accordance with BS 7671 and certificates supplied. Emergency lighting and audibility of fire alarms systems shall be fully tested and certified. Operation of RCD's and emergency shut off for electrical systems shall be tested and certified.

6.4.7. The Contractor shall ensure that the systems installed are fully tested and commissioned in line with all appropriate current regulations and standards including those detailed in the references section of this document.

6.4.8. The Contractor shall conduct pre-commissioning, commissioning and seasonal commissioning on all aspects of the systems in line with CIBSE commissioning codes and BS 7671. The Contractor shall provide a notice period of 1 week to the Employer for witnessing.

6.5. Demonstration and Training

6.5.1. The Contractor shall provide demonstration and training as set out in the Employer's Requirements Deliverables.

6.5.2. The Employer will appoint and/or nominate an appropriate candidate(s) to receive training by the Contractor on the systems within the proposed development. The Contractor shall ensure that all systems, controls adjustment procedures, optimum settings and maintenance procedures shall be demonstrated to the appointed representative/s. The functioning/calibration of the installed energy sub metering shall be demonstrated along with the automatic uploading of data using the iSERV methodology to data collectors such as K2n or similar approved system. See Annex 2H: 'Energy' for further details of iSERV.

6.5.3. The Contractor shall provide training for the appointed Employer/School representative to receive training and demonstration on the energy monitoring system. The Contractor shall be responsible for the automatic uploading the data collected by the energy monitoring equipment to iSERV.

6.5.4. The Contractor shall ensure that the operation and maintenance manuals are available during the training and demonstration to ensure that the appropriate and correct documentation has been included.

7. References

7.1. This Technical Annex is intended for use in conjunction with the following documents.

1. The GDB
2. Annex 2E: 'Daylight and Electric Lighting'
3. Annex 2F: 'Mechanical Services and Public Health Engineering'
4. Annex 2H: 'Energy'
5. Annex 2I: 'Controls'

7.2. A specific list of compliance standards is included at the end of each section of this document. In addition, the Contractor shall ensure that the design and installation takes into account the following general references.

1. CIBSE Guides and Technical Memorandums (TMs)
2. Relevant British Standards
3. BS 7671: IET Wiring Regulations and guidance
4. Building Bulletin 100 'Fire safety' (BB100)



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