



Department  
for Education

# **School output specification**

**Technical annex 2G: electrical services,  
communications, fire and security  
systems**

**December 2023**

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## Summary

Technical Annex 2G provides the minimum requirements for electrical services, communications, fire systems, distribution and security systems. It is to be read in conjunction with the Generic Design Brief (GDB) and the School-specific Brief (SSB).

## Who is this publication for?

This document is for technical professionals involved in the design and construction of school premises, as part of the Employer's Requirements of the DfE Construction Frameworks (the DfE Construction Framework 2021 and the Offsite Schools Framework (incorporating Modular and MMC delivery) (MMC)). It may also be used as the basis of similar documentation for other procurement routes using the Output Specification.

## Uniclass codes

This document captures Uniclass codes for the management of exchange of information. To access all codes and associated titles reference should be made to [Uniclass 2015 | NBS \(thenbs.com\)](#).

## Revision history

This table lists the key changes in each update.

ISO revision code	ISO status code	Date	Amendment
C01-C10	A	2016-2020	Previous OS 2017 versions
C11	A	2021-11-23	Amended issue of publication
C12	A	2022-05-27	Amended issue of publication
C13	A	2022-11-25	Amendments made at: 2.1.6, 2.3.3.1 i), j) & k), 2.3.3.8, 2.3.5.1 g), 2.3.8, 2.3.8.1, 4.1.1. 6.4.3
C14	A	2023-12-18	Amendments made at: 2.2.2.14, 2.3.5.1 e), 3.4.1 a), 4.1.3, 4.1.11, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.7

# 1 Introduction

## 1.1 Overview

1.1.1 This document is one of the Technical Annexes that forms part of the Generic Design Brief (GDB). [PM\_10\_20]

1.1.2 The definitions listed in GDB shall apply to this Technical Annex and all other parts of the Output Specification. [PM\_10\_20]

1.1.3 This document shall be read in conjunction with the GDB and all other Technical Annexes as well as the School-specific Brief (SSB), including the School-specific Annexes. [PM\_10\_20]

1.1.4 This document sets out the required technical standards and performance criteria for electrical services, communications, fire and security systems. [PM\_10\_20]

1.1.5 The information exchange required at each stage of the design, build and completion process is detailed in the DfE's Exchange Information Requirements (EIR). [PM\_10\_20\_28]

1.1.6 The requirements in this Technical Annex shall apply to all parts of the works; New or Refurbished. [PM\_10\_20]

## 1.2 Refurbishment

1.2.1 Work required to Refurbished Buildings shall be as defined in the Refurbishment Scope of Works (RSoW), under the headings of architectural elements (including FF&E) and M&E elements (including ICT Infrastructure). [Ac\_10\_70\_70]

1.2.2 The work shall be categorised as Renewed, Replaced, Repaired, Retained or have 'No Work'.

- a) Renewed electrical elements or services provided shall be designed to satisfy the relevant outputs of the GDB and this Technical Annex (and by code in the ADS where relevant). [Ac\_10\_70\_70]
- b) Replaced electrical elements or services provided shall satisfy the relevant outputs of the GDB and this Technical Annex (and by code in the ADS where relevant), as far as possible within the constraints of the location, the adjacent elements and the sub-structure. [Ac\_10\_70\_70]
- c) Repaired electrical elements or services shall comply with the specifications in any project-specific drawing issued as part of the SSB. The overall performance after repair shall be at least as good as that of the existing provision. [Ac\_10\_70\_70]
- d) Retained electrical elements or services with minimal work required shall be left as existing 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. [Ac\_10\_70\_70]

- e) Electrical elements or services requiring 'No Work' shall be left as existing. [Ac\_10\_70\_70]

1.2.3 The Works shall be undertaken in line with all relevant standards and guidance documents in accordance with the system type. [PM\_35\_10]

1.2.4 In respect of Refurbished Works, the required level of compliance with this Technical Annex is set out in the RSoW. [Ac\_10\_70\_70]

1.2.5 In the case of refurbishment work to Existing Buildings:

- a) the existing electrical earthing and bonding arrangements shall be suitable to ensure safety for the whole Building and correct operation of all protective devices [PM\_40\_30\_52]
- b) the rating and condition of the existing electrical equipment shall be suitable to ensure safety for the whole Building and correct operation of all protective devices, including all grading and discrimination checks. [PM\_40\_30\_52]

## **2 Electrical Services Requirement**

### **2.1 Incoming Electrical Supplies**

2.1.1 Incoming electricity supplies shall be established in consultation with the distribution network operator (DNO). [PM\_40\_30\_52]

2.1.2 It shall be determined if the supply should be at high voltage or low voltage. [PM\_40\_30\_52]

2.1.3 The rating of the DNO overcurrent device at the point of supply shall be established. [PM\_40\_30\_52]

2.1.4 The DNO with all characteristics of the load which the DNO may request (for example harmonic content and characteristics of large loads) shall be provided. [PM\_40\_30\_52]

2.1.5 The location of DNO equipment shall be established, and if necessary, make allowance for it to be located on the Site. [PM\_40\_30\_52]

2.1.6 Drawings shall be submitted 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. [PM\_40\_40\_88]

2.1.7 The characteristics of the supply, including prospective short-circuit current, external earth fault loop impedance and earthing arrangements shall be established and taken into account. [PM\_40\_30\_52]

2.1.8 Connections to a low voltage (LV) supply shall be designed in accordance with BS 7671 IET Wiring Regulations. [PM\_10\_20\_90]

2.1.9 Electrical supplies shall be 3 phase, 400V, 50Hz. [PM\_40\_30\_52]

2.1.10 The power factor shall be no less than 0.95 lagging and the power factor correction equipment to achieve this power factor shall be provided on incoming electrical supplies as well as on low voltage distribution systems. [PM\_40\_30\_52]

### **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. [PM\_35\_30\_30]



## 2.2.2 Photovoltaic Systems

2.2.2.1 Where photovoltaic (PV) systems are required, the following requirements shall be met:

- a) the complete design, supply, installation, testing and commissioning of roof PV installation shall be undertaken, forming part of the building electrical systems and suitable for installation on any roof type e.g., flat or pitched roofs using felt, asphalt, single ply membrane, green roof, profiled metal decking or similar waterproof coverings [PM\_10\_20\_82]
- b) installations shall be installed and certified either through the Microgeneration Certification Scheme (MCS) or equivalent (accredited in accordance with EN 45011 or EN ISO/IEC 17065:2012) to ensure that the PV installation is suitable for Smart Export Guarantee (SMG) or Feed in Tariffs (FIT) [PM\_70\_15]
- c) the system shall be designed and installed to:
  - i) BS 7671 IET Wiring Regulations [FI\_70\_85]
  - ii) IET Code of Practice for Grid Connected Solar Photovoltaic Systems [FI\_70\_85]
  - iii) BS EN 62124 [FI\_70\_85]
  - iv) ENA G99 (systems over 50kW, 3 phase) or ENA G98 (17kW, single phase) [FI\_70\_85]
  - v) BS EN 61427-1 [FI\_70\_85]
- d) calculations shall be produced showing the estimated annual energy yield (kWh per kWpeak) and Total kWh output from the PV array for each month of the year [PM\_40\_30\_20]
- e) the design shall:
  - i) take account of the roof structure and location of the PV array [PM\_40\_30\_52]
  - ii) take account of local wind loadings on the roof and the PV array mounting system [PM\_40\_30\_52]
  - iii) allow rainwater outlets to function correctly without obstruction [PM\_40\_30\_52]
  - iv) provide access for cleaning and maintenance for the panels [PM\_40\_30\_52]
  - v) coordinate with other roof plant and equipment [PM\_40\_30\_52]
  - vi) take account of the additional weight and loading of the roof structure from the panels/ballast and mounting system/fixings [PM\_40\_30\_52]
  - vii) avoid shading from adjacent buildings and vegetation [PM\_40\_30\_52]
- f) the mode of operation shall be grid connected, with suitable export meters and licences in place and undertake all necessary liaison and negotiations with the DNO [Ss\_70\_10\_70\_35]
- g) the photovoltaic panels shall only be mounted on the roof of the Building in positions that face between south-east and south-west and shall not be subject to

overshading (e.g., from trees or other buildings' parapet) for most of the day to maximise output [PM\_10\_20\_82]

- h) the panels shall be integrated with the building lightning protection system. [PM\_10\_20\_82]

2.2.2.2 The PV array sizing and performance shall be sized to achieve net zero carbon in operation at handover as defined in Technical Annex 2J. [PM\_10\_20\_90]

2.2.2.3 The PV panels shall meet or exceed the minimum performance criteria detailed in Table 1: [PM\_10\_20\_90]

<b>Panel Type</b>	<b>Monocrystalline Silicon Cells</b>
Minimum Efficiency	19%
Type	Single or bifacial
Cell Size	Any
Solar Cell Arrangements	In series
Max Weight / panel	25 kg
Max Degradation Output	87% of initial output or better (maximum 0.52% degradation per year or better)
Linear Power Output Warranty	25 years or better, in line with the Max degradation output
Surface Material	Tempered Glass
Impact Resistance	25mm hail
Temperature Range	- 40 to 90°C
Humidity Resistance	85%
Panel Warranty	25 years
Inverter Warranty	10 years
Inverter Protection	IP68

**Table 1 PV Panel Requirements**

2.2.2.4 Amorphous silicon (thin film) panels and those that present an end-of-life disposal issue (e.g., containing Cadmium Telluride Solar Cells (CdTe)) shall not be used. [PM\_10\_20\_82]

2.2.2.5 Inverters shall:

- a) be selected to match the output from the PV panels, optimise output and to minimise losses [Pr\_65\_72\_43\_42]
- b) be located as close as possible to the PV array to minimise losses and be housed within IP68 enclosures [Pr\_65\_72\_43\_42]
- c) where shading cannot be avoided the use of micro inverters can be used [Pr\_65\_72\_43\_42]
- d) have a minimum 10 year warranty. [Pr\_65\_72\_43\_42]

2.2.2.6 Where the installation of the PVs does not form part of the Project Brief, the Contractor shall make provision so that any other parties can retrospectively mount PVs without the need for structural or fabric alteration, minimising disruption to the School's day to day operation. [PM\_10\_20\_82]

2.2.2.7 The necessary riser allocation and trunking to allow for retrospective installation of PV systems shall be provided. [PM\_10\_20\_82]

2.2.2.8 A monitoring system shall be fitted which provides the following:

- a) inverter and string level monitoring information [Ac\_05\_50\_54]
- b) daily, weekly, monthly, annual totals for peak power generated by the PV array in kW [Ac\_05\_50\_54]
- c) daily, weekly, monthly, annual totals for electricity generated by the PV array in kWhrs [Ac\_05\_50\_54]
- d) electricity exported to grid in kWhrs. [Ac\_05\_50\_54]
- e) performance ratio, including weather correction. [Ac\_05\_50\_54]

2.2.2.9 Sub-metering shall be fitted that allows the monitoring of performance of the Solar PV Installation on a daily basis through the Building Management System (BMS) energy monitoring. [Ac\_05\_50\_54]

2.2.2.10 The BMS reporting shall include the Solar PV Installation energy data in the ISERV reporting for the Building. [FI\_30]

2.2.2.11 All items of the PV system that require regular access for maintenance, such as inverters, shall be located on designated walkways. [PM\_80\_10\_50]

2.2.2.12 Commissioning tests and inspection as described in BS EN 62446 Grid Connected Photovoltaic systems and MCS testing certificate shall be completed and documented. [PM\_70]

2.2.2.13 Inspection and testing of the completed system to the requirements of BS 7671 and IET Code of Practice for Grid Connected Solar Photovoltaic Systems shall be carried out and documented. Inspection and testing documentation for the ac side shall comprise the following as a minimum:

- a) electrical installation certificate [PM\_70\_15]
- b) schedule of items inspected [PM\_70\_85\_30]

c) schedule of test results. [PM\_70\_15\_27]

2.2.2.14 The inspection and testing of the dc side of the PV system shall be in accordance with the requirements of BS 7671 and also BS EN 62446 - 'Photovoltaic (PV) systems. Requirements for testing, documentation, and maintenance'. [PM\_70]

2.2.2.15 Testing shall include Witness Testing of the G98 or G99 Mains Protection for the DNO and include confirmation of the correct functioning of the export meter. [PM\_70]

## 2.2.3 Mounting Systems for PV Arrays

### 2.2.3.1 General Requirements:

- a) PV arrays shall be frame mounted on proprietary corrosion resistant fixing frames forming an integral part of the PV installation which require no penetrations to the waterproof roof membrane, generally using ballasted systems [Ss\_70\_10\_70\_35]
- b) mounting frames shall allow positioning the PV panels at the optimum angle to maximise output, generally between 15 - 40 degrees [Ss\_70\_10\_70\_35]
- c) the roof structure and the PV mounting system employed shall be assessed for suitability by a structural engineer with confirmation that the static loading imposed and wind loading are appropriate and sufficient to ensure safety of the installation at all times [PM\_35\_20]
- d) the mounting structure shall include the wind and snow loads to be expected and calculated in accordance with Eurocode-1 (BSEN 1991-1), for UK and Europe [PM\_35\_20]
- e) pressing, lifting and friction force test calculations shall be produced by a structural engineer [PM\_35\_20]
- f) mounting systems shall allow for the spread of load across the roof rather than any point or line loading [PM\_35\_20]
- g) mounting heights for the PV panels shall vary depending on the PV system adopted but allow clear rainwater run-off from the panels and allow general roof access and inspection of the roof membrane below the panels [Ss\_70\_10\_70\_35]
- h) for green roofs mounting heights shall be minimum 300mm above the soil level at the lowest point to prevent any shading from the green roof vegetation [Ss\_70\_10\_70\_35]
- i) all PV panels shall be accessible for cleaning and maintenance activities with sufficient walkways between the panels to prevent any overreaching [PM\_80\_10\_50]
- j) PV panels shall not be mounted within 1.5m of the roof edge or any roof protrusion, building, plant or equipment [PM\_10\_20\_82]
- k) the contractor shall advise the School or responsible body of any available financial incentives for relating to energy generation or exports. [PM\_10\_20\_82]

### 2.2.3.2 Ballasted Systems:

- a) non penetrative ballasted PV mounting systems shall be used wherever the structural engineer has confirmed that the additional weight and wind load can be accepted by the design [PM\_35\_20]
- b) different formats for ballast are acceptable providing that they are approved by the panel manufacturer and form part of an integrated fixing solution [PM\_10\_20\_82]
- c) the static load created by the ballast shall be appropriate and sufficient in accordance with the wind load calculation [PM\_35\_20]
- d) for green roof installations integrated mounting frames shall hold the substrate and vegetation and provide the ballast to secure the array on the roof. Mounting heights for the PV panels shall be minimum 300mm above the soil level at the lowest point to prevent any shading from the green roof vegetation. [PM\_10\_20\_82]

#### 2.2.3.3 Mechanically Fixed Systems:

- a) shall only be used where ballasted systems are not suitable due to the additional imposed load on existing roof structures or high wind loading is present [PM\_35\_20]
- b) Non-Penetrative Mechanical Fixing shall be used where the roof membrane is suitable using mounting system substructures that are held onto the roof through mounting plates and welding overlying membrane sleeves to the uppermost layer of the waterproof covering. Large and stable attachment footprints with fixing tolerances that allow for levels of movement to occur without detriment to the entire stability of the PV array or damage to the roof membrane integrity shall be used [PM\_35\_20]
- c) Penetrative Mechanical Fixings shall be used only where all other non-penetrative fixing methods have been shown to be unsuitable. The creation of plinths or proprietary fixing posts shall not impact the safe waterproofing or thermal conductivity of the roof structure. [PM\_10\_20\_82]

### 2.2.4 Small Scale Wind Generating Systems

2.2.4.1 Where small scale wind generating systems are required as part of a strategy to meet AD L or planning conditions, complete design of the system shall be undertaken. [Ss\_70\_10\_70\_98]

2.2.4.2 The system shall be designed and installed to BS EN 61400-2 and Renewable UK 'Small Wind Turbine Standard' as well as BS 7671 IET Wiring Regulations. [PM\_10\_20\_90]

2.2.4.3 The mode of operation shall be grid connected for which all necessary liaison and negotiations shall be undertaken with the DNO. [PM\_40\_30\_52]

2.2.4.4 The design life of the system shall be 20 years. [PM\_35\_10\_25]

2.2.4.5 The specialist designer and installer shall be Microgeneration Certification Scheme accredited. [PM\_10\_20\_82]

2.2.4.6 Details of the proposed type of wind turbine, its mounting axis, support structure and foundations, electronic and electrical components, cabling and cable containment shall be submitted to the Employer. [Ss\_70\_10\_70\_98]

## **2.3 Electrical Distribution Systems**

### **2.3.1 Earthing and Bonding Systems**

2.3.1.1 The following requirements shall be met:

- a) the earthing and bonding installation shall be in accordance with BS 7671 and BS 7430 [Ss\_70\_30\_25\_25]
- b) liaise with the DNO to determine the type of earthing system required and to establish the demarcation of responsibilities [Ss\_70\_30\_25\_25]
- c) 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) shall be provided [Ss\_70\_30\_25\_25]
- d) the design of standby generator earthing shall ensure that sufficient earth fault current is generated to operate protective devices, only where generators are required. [Ss\_70\_30\_25\_25]

### **2.3.2 Inspection and Testing of Low Voltage Electrical Installations**

2.3.2.1 Test equipment shall be calibrated annually. [PM\_10\_20\_82]

2.3.2.2 The inspection and testing of electrical installations shall be in accordance with BS 7671 and IET Guidance Note 3. [PM\_10\_20\_90]

2.3.2.3 All materials shall comply with the relevant standards. [PM\_10\_20\_82]

2.3.2.4 Confirmation shall be provided that the installation is erected correctly, and that the installation is free from defects. The electrical continuity of cable containment shall be measured. [PM\_70]

### **2.3.3 Low Voltage Distribution System**

2.3.3.1 The following requirements shall be met for Low Voltage Distribution Systems:

- a) the design of the low voltage distribution systems is in accordance with the requirements of BS 7671 IET Wiring Regulations [Ss\_70\_30\_45\_45]

- b) electrical services in Practical Teaching Spaces are fitted with sufficient local master controls, as specified in Section 3.6 on Electrical Services Controls in Technical Annex 2I, to control services in lessons and for cutting off supplies in an emergency [Ss\_70\_30\_45\_45]
- c) master controls in Practical Teaching Spaces do not isolate fridges, freezers, ICT equipment and 13A sockets provided for cleaners [Ss\_70\_30\_45\_45]
- d) the design allows for 10% physical and electrical spare capacity throughout the LV distribution system including all switchboards and distribution boards in sub-mains and final circuit cable capacities, in protective device capacities, and in all cable containment systems [Ss\_70\_30\_45\_45]
- e) switchboards and distribution boards are provided with 10% representative of selected devices, spare protective devices and along with 10% unequipped space ready to accept protective devices and fitted with blanking plates [Pr\_60\_70\_22]
- f) the main LV Switchboards allow for expansion to one side by one further cubicle without impact on access requirements within the switch room [Pr\_60\_70\_22]
- g) automatic power factor correction is provided where necessary to achieve a power factor of at least 0.95 as outlined in the section on [Incoming Electrical Supplies](#) [Ss\_70\_30\_45\_45]
- h) the system achieves the required disconnection times under fault [Ss\_70\_30\_45\_45]
- i) the system to achieve total or partial selectivity between all upstream and downstream protection devices [Ss\_70\_30\_45\_45]
- j) the selectivity of the system is demonstrated using time-current coordination curves in a study report [Ss\_70\_30\_45\_45]
- k) new low voltage switchgear and control gear conform to the relevant part of BS EN or BS EN IEC 61439 series and are third party certified. [Pr\_60\_70\_48]

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. [Pr\_60\_70\_22]

2.3.3.3 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 [Ss\_70\_30\_45\_45]
- b) Form 4b type 7 where cables may need to be terminated adjacent to live cables, most likely to occur in refurbishment schemes. [Ss\_70\_30\_45\_45]

2.3.3.4 All conductive parts of new low voltage switchgear and control gear assemblies which are accessible when a lid or door is opened shall be behind an insulating barrier with a minimum ingress protection rating of IP2X. [Pr\_60\_70\_48]

2.3.3.5 New low voltage switchgear assemblies shall be fitted with anti-condensation heaters. [Pr\_60\_70\_48]

2.3.3.6 New low voltage switchgear shall be selected for appropriate service conditions including ambient air temperature, indoor / outdoor location, degree of pollution, protection against ingress of solids and liquids. [Pr\_60\_70\_48]

2.3.3.7 New protective devices shall be provided as circuit breakers and wherever possible are supplied from the same manufacturer. [Pr\_65\_72\_27]

2.3.3.8 Moulded case circuit breakers shall be 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. [Pr\_65\_72\_27\_53]

2.3.3.9 The impulse withstand voltage rating of devices shall be appropriate for the point of use of the device. [Pr\_65\_72\_27]

2.3.3.10 The following rooms and spaces shall be fed by dedicated distribution boards: server rooms, kitchens and stage lighting rigs (except where LED lighting is used). [Pr\_60\_70\_22\_22]

2.3.3.11 The equipment shall be provided with a durable label marked with the equipment's function and unique reference. [Pr\_40\_10\_57]

2.3.3.12 The main switchgear shall be located as close to the centre of the load as is practicable to minimise cable lengths and I<sup>2</sup>R losses. [PM\_10\_20\_82]

2.3.3.13 The sub switchboards and final distribution boards shall be strategically located to minimise the quantity and lengths of cables and cable containment. [PM\_10\_20\_82]

2.3.3.14 The main low voltage (LV) switchboards shall be located in dedicated electrical riser cupboards and sub switchboards and final distribution boards are also located in dedicated electrical riser cupboards. [PM\_10\_20\_82]

2.3.3.15 The electrical rooms and cable routes shall be determined to ensure that adequate floor space and horizontal and vertical distribution zones are provided. [PM\_10\_20\_82]

2.3.3.16 The main low voltage switch rooms shall be located where they are readily accessible for equipment and personnel, ideally at ground level with direct access from outside. [SL\_90\_90\_85]

2.3.3.17 The switch rooms access shall allow for the moving of electrical equipment using lifting equipment. [SL\_90\_90\_85]

2.3.3.18 The construction of switch rooms shall provide appropriate fire protection as required by the Project's Fire Strategy and the Building Regulations. [PM\_35\_30\_28]



2.3.3.19 The construction of the switch room shall be robust, allowing for wall mounted electrical equipment, and can withstand the effects of an electrical explosion.

[PM\_35\_10\_25]

2.3.3.20 The switch rooms prevent the ingress of water and underground cable entries are watertight. [PM\_35\_10\_96]

2.3.3.21 The switchgear shall not be 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. [PM\_35\_10\_96]

2.3.3.22 The layout of switch rooms shall allow 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 switch room allows for expansion of switchgear.

[SL\_90\_90\_85]

2.3.3.23 The switch room shall allow for all switchgear to be located in the room including power factor correction, harmonic filters and battery chargers where specified.

[SL\_90\_90\_85]

2.3.3.24 The height of the room shall allow for adequate space for top entry cabling where the switchgear is used. [SL\_90\_90\_85]

2.3.3.25 Notices shall be provided in the switch room including a framed wall mounted low voltage (LV) schematic diagram, statutory signage and posters, details of the earthing system and rubber mats. [Pr\_40\_10\_57]

2.3.3.26 The following requirements shall be met:

- a) sub-mains and final circuit cables have copper conductors [Pr\_65\_70]
- b) the outer sheath of sub-mains cables is black and cable core colours are as defined by BS 7671 [Pr\_65\_70]
- c) 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) [Pr\_65\_70]
- d) the armour of cables is used as a circuit protective conductor [Pr\_65\_70]
- e) where required to reduce the earth fault loop impedance to achieve disconnection times, a supplementary circuit protective conductor shall be run with the cable [Pr\_65\_70]
- f) the cable routes allow sufficient space for the bending radius of the cables [Pr\_65\_70]

- g) 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 [Pr\_65\_70]
- h) local distribution boards are provided strategically located around the Building, housed in dedicated electrical cupboards, risers or plant rooms [Pr\_60\_70\_22]
- i) distribution boards shall be fitted with a lockable door [Pr\_60\_70\_22]
- j) 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 [Pr\_65\_72\_27]
- k) In accordance with BS7671 final circuits requiring overload, short circuit and earth leakage protection shall utilise RCBOs provided in the local distribution boards. [Pr\_65\_72\_27\_73]

## 2.3.4 Cable Containment

2.3.4.1 The following requirements shall be met:

- a) sub-mains distribution cables are generally fixed to cable containment, buried underground, laid in trenches or run in underground ducts [Ss\_70\_30\_10]
- b) the underground cable sheaths are not porous. Vertically routed cables are secured by cleats [Pr\_65\_70]
- c) 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 [Pr\_65\_70]
- d) cable runs in ducts are fixed to cable containment within the duct and are not laid on the bottom of the duct [Pr\_65\_70\_11\_62]
- e) the ducts are laid to falls and drained and allow for maintenance access [Pr\_65\_70\_11\_62]
- f) cable containment is selected and arranged taking into account Electro Magnetic Compatibility (EMC) considerations [Ss\_70\_30\_10]
- g) cable baskets, trays and ladders are compliant with BS EN 61537, and cable trunking with BS EN 50085 [Pr\_65\_70\_11]
- h) cable baskets are high sided and cable trays are medium duty with a return flange [Pr\_65\_70\_11]
- i) 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 [Pr\_65\_70\_11\_14]
- j) steel cable trays, baskets, ladders and trunking have a galvanised finish [Pr\_65\_70\_11]
- k) metallic cable containment is electrically continuous and fire barriers are provided wherever cable containment penetrates a fire compartment [PM\_35\_30]
- l) cable containment is not suspended from other services [Pr\_65\_70\_11]
- m) cable trunking has a minimum ingress protection rating of IP4X [Pr\_65\_70\_11\_96]

- n) 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 [Ss\_70\_30\_10]
- o) all external cabling is contained within galvanised steel metal conduit and complies with the section on [Small Power Systems](#). [Ss\_70\_30\_10]
- p) all fire stopping is installed, as required, in line with the fire strategy and is to be documented (e.g., using photographic records) and included in the H&S file. [PM\_70\_15\_31]

## 2.3.5 Small Power Systems

2.3.5.1 The following requirements shall be met:

- a) socket outlets are on a 32A ring or 20A radial circuits as defined by BS 7671. Small power accessories comply with BS 1363 [Ss\_70\_30\_80]
- b) fused connection units and socket outlets have an Ingress Protection (IP) rating suitable for the environment [Pr\_65\_72\_97]
- c) fused connection units are provided for tea points, hand driers, fridges, freezers, and other similar equipment [Pr\_65\_72\_97\_31]
- d) socket outlet circuits are protected against overload, short circuit and earth leakage currents by RCBOs at the local distribution board [Ss\_70\_30\_80]
- e) the quantities of small power outlets are as detailed in School-specific Annex SS1 and as detailed in the School-specific Brief (SSB). Each outlet comprises a double socket. Where agreed with the Employer, a single socket or a fused spur may be provided. The total number of outlets provided shall be:

For Whole School Projects (new buildings and refurbished schools):

Mainstream primary schools - up to 1.0 per pupil place

Mainstream secondary schools - up to 1.2 per pupil place

Ambulant SEN schools - up to 2.0 per pupil place

Non-ambulant SEN schools - up to 3.0 per pupil place

Alternative Provision/PRU - up to 2.0 per pupil place

For Partial School Projects (block replacement) refer to School-specific Annex SS1 and the SSB.

The above total number of outlets do not include power requirements for any building system need or the requirement for cleaners' sockets. [PM\_10\_20\_90]

- f) desk mounted socket outlets and wiring to desks shall comply with BS 6396 - 'Electrical systems in furniture. Specification' [Ss\_70\_30\_80]
- g) small power supplies are provided as appropriate for building services equipment e.g., control and instrumentation panels for fire detection and alarm systems,

security systems, building management systems and other specialist systems including thermostatically controlled cabinets for externally accessible defibrillators, fan coil units, hand dryers, water heaters, and specialist equipment such as bleacher seating. [Ss\_70\_30\_80]

2.3.5.2 The number of sockets on a circuit shall be assessed. It is anticipated that this shall vary depending on location and anticipated loading. The likely earth leakage carried on each circuit shall be assessed to prevent the unwanted tripping of RCDs. The number of socket outlets per circuit shall be limited according to the likely equipment to be supplied. Consideration shall be given to using 20A radial circuits in lieu of 32A rings if the anticipated load is low (e.g., in areas of high density 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). The Diversity shall be assessed in accordance with IET Guidance note 1. [Ss\_70\_30\_80]

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 accordance with the desired aesthetic. [Ss\_70\_30\_80]

2.3.5.4 The 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 [Ss\_70\_30\_80]
- b) flat twin and earth cabling (LSZH, 6242B) to BS7211. [Ss\_70\_30\_80]

2.3.5.5 For either wiring methods listed above:

- a) CPC sizes shall be sufficient to ensure that the fault current generated operates the protective devices within safe time limits [Ss\_70\_30\_80]
- 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. [Ss\_70\_30\_80]

2.3.5.6 Prefabricated wiring systems may also be proposed having cables which 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. [Ss\_70\_30\_80\_45]

2.3.5.7 The following requirements shall be met:

- a) the grade of rigid steel conduit is appropriate for the environment in which it is to be installed [Pr\_65\_70\_11\_71]
- b) conduit installed externally and in plant spaces and risers is galvanised [Pr\_65\_70\_11\_71]

- c) flush mounted wiring accessories and concealed wiring are used generally [Pr\_65\_72\_97]
- d) final run outs of final circuit cables are contained in wall mounted plastic multicompartment trunking accommodating small power accessories [Ss\_70\_30\_80]
- e) 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 [PM\_10\_20\_90]
- f) all small power outlets in a room are on the same electrical phase [Ss\_70\_30\_80]
- g) 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 [PM\_10\_20\_90]
- h) in server rooms BS EN 60309 socket outlets are provided for server racks of ratings appropriate to the load. [Pr\_65\_72\_97]

2.3.5.8 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. [Pr\_65\_72\_97\_31]

2.3.5.9 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 65 dBA, at 1m. [Pr\_40\_70\_62\_37]

2.3.5.10 An assessment shall be made by an acoustician of whether the location and noise rating of the hand driers shall cause problems to the School. The acoustic measures such as quieter hand driers or a different method of hand drying may be required. [PM\_35\_60]

2.3.5.11 The choice of hand drier or paper towel dispenser shall be as indicated in the SSB. A hand drier shall be provided for each run of up to 5 WC cubicles. [PM\_10\_20\_90]

2.3.5.12 Contrast accessory plates shall be provided throughout the Building in compliance with AD M with a LRV 30 point difference to the surrounding background décor. [PM\_10\_20\_90]

## **2.3.6 Uninterruptible Power Supplies (UPS)**

2.3.6.1 The following requirements shall be met:

- a) UPS are provided in the form of a rack-mounted battery system that shall provide the servers, core switches and wireless controllers with 30 minutes autonomy [Pr\_60\_70\_64\_93]
- b) the remainder of the Building is not provided with UPS unless stipulated by regulations, for example for safety systems [PM\_10\_20\_82]
- c) UPS comply with BS EN 62040-1 and BS EN 62040-3 and the mode of operation is on-line [Pr\_60\_70\_64\_93]
- d) the UPS is compatible with the load [Pr\_60\_70\_64\_93]
- e) 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. [Pr\_60\_70\_64\_93]

## 2.3.7 Lightning Protection

2.3.7.1 The class of the lightning protection system shall be determined by means of a risk assessment carried out in accordance with BS EN 62305. [PM\_35\_50\_47]

2.3.7.2 The design of lightning protection systems shall be in accordance with the class of system. [PM\_35\_50\_47]

2.3.7.3 Transient overvoltage surge suppression devices shall be provided for mains power, data, and telecom lines as appropriate to the required class of system as determined by the risk assessment. [Pr\_65\_72\_27\_88]

2.3.7.4 Surge suppression devices shall be provided in server rooms and any other vulnerable critical systems as determined by risk assessment. [Pr\_65\_72\_27\_88]

2.3.7.5 The surge suppression device alarms shall be linked to the BMS where one is installed. [Pr\_65\_72\_27\_88]

2.3.7.6 The lightning protection systems shall be tamper-proof with earth electrodes accessible for regular testing. [PM\_35\_50\_47]

## 2.3.8 Electrical Car Charging Vehicle Points

2.3.8.1 Electrical Vehicle (EV) charging points shall meet the following performance criteria:

- a) charging points to be type 2 IEC 62196 AC outlets within the range 7-22kW for fast-charging outlets or within the range 3-6kW for slow-charging outlets [Pr\_65\_72\_97\_29]
- b) simultaneous charging of vehicles at all the EV charging points [Pr\_65\_72\_97\_29]
- c) total loading of all EV charging points to not add more than 10% to the predicted maximum demand for the School Building [Pr\_65\_72\_97\_29]
- d) charging points to be suitable for bollard mounting adjacent to the designated EV charging parking bays [Pr\_65\_72\_97\_29]

- e) debris protection to be IP44 as a minimum [Pr\_65\_72\_97\_29]
- f) water ingress protection to be IP44 as a minimum [Pr\_65\_72\_97\_29]
- g) protection against impact by positioning the EV charging bollard away from any foreseeable impact and by installing local or general impact protection bars on the parking bay's side [Pr\_65\_72\_97\_29]
- h) provision for a method of taking payment at the EV charging point for electricity used to charge the vehicle [Pr\_65\_72\_97\_29]
- i) charging points to comply with BS7671 (including amendment 1), IET code of practice for EV charging equipment and BS EN IEC 61851 for EV charging points [PM\_10\_20\_90]
- j) charging points to input to and output from the School Building with connectivity to smart grids [Pr\_65\_72\_97\_29]
- k) the charging mechanism, how the EC chargers are to be powered, the maintenance and management strategy shall be agreed with the Employer [PM\_10\_20\_82]
- l) all EV charging points shall be sub-metered with a European Measuring Instruments Directive (MID) 2004/22/EC approved meter [PM\_10\_20\_90]
- m) supply to be through the School's main switch panel where five or less 7kW outlets are required [PM\_10\_20\_82]
- n) a designated supply with separate switch gear to be installed where more than five 7kW EV points are required [PM\_10\_20\_82]
- o) earthing requirements to be separate from the School's protective multiple earthing (PME) system where there are more than five 7kW charging points and the total EV charging load is in excess of 10% of the School's electrical demand [PM\_10\_20\_82]
- p) energy consumption for EV charging to be excluded from the energy calculated for net zero carbon in operation compliance. [PM\_10\_20\_82]

## 2.3.9 Reference Standards

2.3.9.1 The design and installation of the electrical systems shall comply with the relevant parts of the following standards (or updated documents if relevant): [PM\_10\_20\_90]

- a) BS 7671 IET Wiring Regulations: 2018 incorporating amendment 1:2020 [FI\_70\_85]
- b) BS EN 62446-1:2016 incorporating amendment 1:2018 'Photovoltaic (PV) systems. Requirements for testing, documentation and maintenance' [FI\_70\_85]
- c) ENA G99 'Recommendations for the Connection of Generating Plant to the Distribution Systems of Licensed Distribution Network Operators' [FI\_70]
- d) ENA G98 'Recommendations for the Connection of Type Tested Smallscale Embedded Generators (Up to 16A per Phase) in Parallel with Low Voltage Distribution Systems' [FI\_70]

- e) BS EN 61427-1: 2013 'Secondary cells and batteries for renewable energy storage. General requirements and methods of test. Photovoltaic off-grid application' [FI\_70\_85]
- f) BS EN 61400-2: 2014 'Wind turbines Part 2: Small wind turbines' [FI\_70\_85]
- g) Renewable UK 'Small Wind Turbine Standard', 2014 [FI\_70\_85]
- h) BS EN 61537: 2007 'Cable management - Cable tray systems and cable ladder systems' [FI\_70\_85]
- i) BS EN 50085 'Cable trunking systems and cable ducting systems for electrical installations' [FI\_70\_85]
- j) BS EN 62040-1: 2008 'Uninterruptible power systems (UPS) - Part 1: General and safety requirements for UPS' [FI\_70\_85]
- k) BS EN 62040-3: 2011 'Uninterruptible power systems (UPS) Part 3: Method of specifying the performance and test requirements' [FI\_70\_85]



## 3 Communication Systems

### 3.1 Public Address and 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, lockdown etc.) as part of planned emergency strategies, the following requirements shall be met:

- a) Voice Alarm system complies with BS 5839-8:2013 [Ss\_75\_50\_28\_95]
- b) 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) [Ss\_75\_10\_68\_68]
- c) the reverberation time of key spaces shall be minimised to improve intelligibility with coordination across all relevant disciplines. 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 [PM\_35\_60]
- 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 [PM\_35\_60]
- e) the public address central equipment is located in a secure room such as a server or hub room to avoid unauthorised access, and that the microphones are also in restricted areas such as offices and staff rooms. [Ss\_75\_10\_68\_68]

### 3.2 Period Bell

3.2.1 The following requirements shall be 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 [Ss\_75\_10\_68\_07]
- b) the class change tones/bells are easily distinguishable from the tones/bells used for raising the fire or security alarm [Ss\_75\_10\_68\_07]
- c) the class change systems have pre-set timings with manual override and can cater for hearing impaired building users. [Ss\_75\_10\_68\_07]

### 3.3 Audio Systems

3.3.1 The audio amplification systems provided by the School shall be installed in drama, dance, halls, music and performance spaces where required in the School-specific ADS and the SSB. [PM\_10\_20\_90]

3.3.2 The audio cabling (and appropriate power) shall be 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. [PM\_10\_20\_82]

3.3.3 Sound field systems shall be installed where specified within the SSB. [PM\_10\_20\_90]

## **3.4 Emergency Voice Communications**

3.4.1 The following requirements shall be met:

- a) where emergency voice communications are required, the system is compliant with BS 5839-9:2021 [Ss\_75\_50\_11\_27]
- b) an emergency voice communication system is provided at each fire refuge point to enable occupants of each refuge to alert others that they need assistance and to receive communications. [Ss\_75\_50\_11\_27]

## **3.5 ICT Infrastructure**

3.5.1 ICT Infrastructure shall meet the requirements set out in Section 4 on ICT Design Requirements in the GDB. [PM\_10\_20\_90]

3.5.2 The design shall allow for the specific circumstances of each School, as specified in the SSB. [PM\_10\_20\_90]

3.5.3 The scope of the provision shall include 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. [Ss\_75\_10]

## **3.6 Installations for Pupils with SEND**

3.6.1 Additional installations specific to pupils with SEND that are stated as required in the SSB shall be provided. This can include sound-field systems, intercom, assistance alarms and access control systems. It may also be required to provide attack alarms and/or staff-call systems, where staff need to call for rapid assistance on, and CCTV systems, subject to risk assessment. [PM\_10\_20\_82]

## **3.7 Induction Loops (AFILS)**

3.7.1 Induction loops shall be provided in line with the requirements of the Equality Act 2010. [Ss\_75\_10\_46\_05]

3.7.2 The induction loops shall align with the code of practice for AFILS, BS 7594:2011. [Ss\_75\_10\_46\_05]

3.7.3 A mobile induction loop shall be provided for use in classrooms and induction loop facilities in larger areas such as performance spaces. [Ss\_75\_10\_46\_05]

# 4 Fire Detection and Fire Alarm Systems

## 4.1 General Requirements

4.1.1 Alternative warning systems to fire alarm sounders shall be provided in accommodation specifically designed for pupils with SEND, within accessible visitor/community use WCs and 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 [Pr\_70\_75\_94\_73]
- b) vibrating paging systems for hearing impaired and other disabled people. [Pr\_75\_80\_30\_96]

4.1.2 The fire alarm systems provided shall comply with the requirements of BS 5839-1:2017 - 'Fire detection and alarm systems'. New systems shall be intelligent and addressable. [Ss\_75\_50\_28\_29]

4.1.3 The type (L1, L2, L3 etc) of fire alarm system shall be as stated in the Project's Fire Strategy and as agreed with building control. The minimum level of automatic fire detection and alarm systems coverage for all school buildings shall be L2/P2. [Ss\_75\_50\_28\_29]

4.1.4 Where a P2 fire alarm system is installed, it shall be monitored by a permanently manned alarm receiving centre (ARC) unless the Building is continuously occupied. The ARC will call the Fire and Rescue Service (FRS) immediately unless a filtering procedure has been agreed with the School. As schools are generally unoccupied for extensive periods of time, all schools shall have in place arrangements for remote monitoring even if they only have a category L fire alarm system installed. [Ac\_05\_50\_54]

4.1.5 It shall be determined if the fire alarm cabling is a standard or enhanced type. [Ss\_75\_50\_28\_29]

4.1.6 The wiring shall be 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. [PM\_40\_20\_30]

4.1.7 A cause-and-effect matrix shall be developed 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. [PM\_40\_20\_30]

4.1.8 Where there is an existing site-wide fire alarm system this system shall be 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. [PM\_10\_20\_82]

4.1.9 There are two categories of manual call points:

- a) Type A - direct action (one action sets off the alarm) [Pr\_75\_80\_30\_50]
- b) 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). [Pr\_75\_80\_30\_50]

4.1.10 The type of call points shall be provided in consultation with the Employer. [Pr\_75\_80\_30\_50]

4.1.11 Multi-sensor detectors shall be provided to reduce the risk of false alarms and to enhance fire safety. Generally, these will be two-sensor detectors (heat and smoke), but in areas that present a high false alarm risk, as identified in a fire risk assessment, may need to be three-sensor detectors (e.g., optical-heat-carbon monoxide detectors in kitchens). [Pr\_75\_80\_30\_64]

## **4.2 Safety Supplies for Lifesaving and Firefighting Activities**

4.2.1 Safety electrical supplies for lifesaving and firefighting activities shall be provided 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. [PM\_10\_20\_90]

4.2.2 Life safety and firefighting activities 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. [PM\_10\_20\_82]

## **4.3 Automatic Fire Suppression Systems**

4.3.1 Where a sprinkler system is to be provided, it shall be designed, installed and maintained in accordance with BS EN 12845. In BS EN 12845 schools are generally classified as Ordinary Hazard Group 1 (OH1). [PM\_10\_20\_82]

4.3.2 An enhanced availability sprinkler system is one where the additional measures to improve reliability and availability outlined in Annex F of BS EN 12845 are provided. Such a system shall only be provided where sprinklers are installed as a compensatory

measure for a relaxation in fire safety standards, such as enabling a larger maximum fire compartment size than standard. [PM\_10\_20\_82]

4.3.3 Where a sprinkler system is specified, the sprinkler protection shall be provided throughout the building, except in the following cases, see BS EN 12845: 2015 + A1:2019:

- a) enclosed staircases and enclosed vertical shafts (i.e., those areas that cannot contain combustibles) [PM\_10\_20\_82]
- b) selected concealed spaces and voids as agreed by the Employer [PM\_10\_20\_82]
- c) rooms protected by other automatic extinguishing systems (designed, installed and maintained to recognised British/European standards) [PM\_10\_20\_82]
- d) server and hub rooms and rooms containing electrical power distribution apparatus, such as switchgear and transformers, where the walls, ceilings and floors are constructed to at least 60 minutes of fire resistance [PM\_10\_20\_82]
- e) where science chemical stores are constructed to 60 minutes of fire resistance [PM\_10\_20\_82]
- f) communicating buildings or storeys separated from the sprinklered building by walls of appropriate fire resistance [PM\_10\_20\_82]
- g) outbuildings, such as sheds, separated from the sprinklered building by at least 10m. [PM\_10\_20\_82]

4.3.4 Water mist design standards do not contain prescriptive design rules but provide a generic design methodology and performance requirements. Where a water mist system is to be provided, it shall comply with BS 8489-7, which provides the fire test protocols for the protection of low hazard occupancies, such as schools. [PM\_10\_20\_82]

4.3.5 The local water company and Building Control shall be consulted to determine whether the fire suppression system requires a tanked water supply or not. [Ss\_55\_30\_98]

4.3.6 Water tanks and associated pumps provided shall be suitably protected against frost and vandalism. [Ss\_55\_30\_98]

4.3.7 Sprinkler or water mist 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. [PM\_10\_20\_82]

## 5 Security Systems

### 5.1 Overview

5.1.1 The following sections describe the normal provision of security systems for a School. [PM\_80\_50\_80]

5.1.2 The SSB shall indicate where more complex systems are required for higher risk Schools as a result of a Security Risk Assessment. [PM\_80\_50\_80]

### 5.2 Access Control

5.2.1 Door entry systems operated by staff shall be provided at the main entrance and as required for out of hours use. [Ss\_75\_40\_02]

5.2.2 The following requirements shall be met:

- a) access control systems are designed and installed to BS EN 60839 11 1: 2015 [Ss\_75\_40\_02]
- b) the design shall adhere to the guidelines for access control systems BS EN 60839 11 2: 2015' [Ss\_75\_40\_02]
- c) the system is designed such that in event of a fire alarm the access control system does not inhibit escape [Ss\_75\_40\_02]
- d) stand-alone door entry systems to main entrances are not required to be integrated with other systems. [Ss\_75\_40\_02]

### 5.3 Intruder Detection Systems

#### 5.3.1 General Requirements

5.3.1.1 The intruder alarm system provided shall be integrated with access controls, which complements the Building's functions and operations. [Ss\_75\_40\_75\_40]

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 for schools operating extended hours. [Ss\_75\_40\_75\_40]

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. [Ss\_75\_40\_75\_40]

5.3.1.4 The following requirements shall be met:

- a) systems meet the requirements of BS EN 50131 [Ss\_75\_40\_75\_40]

- b) control panels are located in secure areas that are themselves intruder alarm protected or the approach to them is intruder alarm protected. [Ss\_75\_40\_75\_40]

5.3.1.5 The alarm system shall meet the requirements of BS EN 50131: 2006 and National Approval Council for Security Systems (NACOSS) and:

- a) be capable of remote monitoring [Ac\_05\_50\_54]
- b) utilise a monitored path to the Alarm Receiving Centre (ARC) if remote signalling is used [Ac\_05\_50\_54]
- 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 [PM\_10\_20\_82]
- d) the Authorities are consulted to ensure the system is aligned with local requirements. [PM\_10\_20\_82]

5.3.1.6 The SSB shall 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 shall 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 shall require the addition of confirmation technology before Level 1 is reinstated.

[Ss\_75\_40\_75\_40]

## **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 [Ss\_75\_40\_75\_40]
- b) the panel shall be tamperproof and shall provide a standby battery to enable continued operation in the event of a mains power failure for a required period [Ss\_75\_40\_75\_40]
- c) one or more remote keypads with display shall be provided at specific entry/exit locations to enable the system to be set and unset [Ss\_75\_40\_75\_40]
- d) the panel shall incorporate a communicator to enable offsite signalling to an Alarm Receiving Centre (ARC) via an associated telephone line [Ss\_75\_40\_75\_40]
- e) 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 [Ss\_75\_40\_75\_40]
- f) additional detection technologies shall be provided where required, including but not limited to vibration sensors and break-glass detectors [Ss\_75\_40\_75\_40]
- g) internal and external audible alarm devices shall be provided to indicate that an alarm has been activated [Ss\_75\_40\_75\_40]



- h) all cabling and detection devices shall incorporate an alarm circuit and a 24hr tamper circuit. [Ss\_75\_40\_75\_40]

### **5.3.3 Reference Standards**

5.3.3.1 The design and installation of intruder detection systems shall comply with the relevant parts of the following standards (or updated documents if relevant):  
[PM\_10\_20\_90]

- a) BS EN 50132-1:2006 + Amendments - 'Alarm systems. Intrusion and hold up systems. System requirements' [FI\_70\_85]
- b) PD 6662:2010 - 'Scheme for the application of European standards for intrusion and hold up alarm systems' [FI\_70\_85]
- c) BS 8473:2006 + amendment 1:2009 - 'Intruder and hold up alarm systems. Management of false alarms. Code of practice' [FI\_70\_85]
- d) BS 8243:2010 - 'Association of Chief Police Officers (ACPO) code of practice' [FI\_70\_85]

## **5.4 Closed Circuit Television (CCTV) Systems**

### **5.4.1 General Requirements**

5.4.1.1 A complete IP-based CCTV system shall be supplied, installed and commissioned to the specification detailed in the GDB. [Ss\_75\_40\_53\_86]

5.4.1.2 The number of cameras to be included shall be:

- a) at the reception entrance to the School and the main entrance through the Secure Line [Ss\_75\_40\_53\_86]
- b) further external or internal cameras as indicated in the SSB. [Ss\_75\_40\_53\_86]

5.4.1.3 CCTV systems shall be:

- a) integrated into the design of the School and surrounding grounds [Ss\_75\_40\_53\_86]
- b) sympathetic to the adjacent land and neighbours and avoid intrusion into private activities not associated with the School. [Ss\_75\_40\_53\_86]

5.4.1.4 All hardware connected with CCTV, including fixings, brackets, power, data and cables (containment, routing, termination and presentation) shall be provided.  
[Ss\_75\_40\_53\_86]

# 6 Handover Requirements

## 6.1 Overview

6.1.1 The handover requirements are set out in the DfE's EIR. [PM\_10\_20\_28]

6.1.2 The following section outlines the handover requirements in relation to the electrical services and communications systems. [PM\_70\_85\_35]

6.1.3 A 7 day period of 'soak testing' shall follow on from the successful commissioning and testing activities. [PM\_70\_15\_82]

## 6.2 Soak Testing

6.2.1 A soak test of all the electrical services in their normal/auto operation mode shall be carried out, prior to Completion, as if the Building were occupied and in use. [PM\_70\_15\_82]

6.2.2 The soak test shall be programmed to occur after completion of all setting to work, commissioning and testing of the electrical services. This is to prove their reliability and correct calibrations over a continuous period of 7 days. [PM\_70\_85\_35]

6.2.3 Practical Completion shall not be granted until a successful soak test as described here has been achieved. [PM\_70\_15\_82]

6.2.4 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. [PM\_10\_20\_82]

6.2.5 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 [Ss\_70]
- b) small power [Ss\_70]
- c) lighting and emergency lighting [Ss\_70]
- d) fire alarm system [Ss\_70]
- e) lift [Ss\_70]
- f) all other alarm and communication systems [Ss\_70]
- g) control systems [Ss\_70]
- h) energy metering and monitoring systems [Ac\_05\_50\_54]
- i) electrical heating, ventilating and cooling systems [Ss\_70]
- j) renewable energy and CHP electrical generation systems. [Ss\_70]

6.2.6 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 [PM\_70\_15\_82]
- b) monitor all functions (lighting switching/levels, starts per hour/energy and water use) and log the trends using the microprocessor controls equipment where installed [Ac\_05\_50\_54]
- 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 [Ac\_05\_50\_54]
- d) specified noise performance surveys shall be carried out during this period [Ac\_15\_55\_04]
- e) all data and monitoring results shall be provided to the Employer in Excel spreadsheet format (electronic and hard copy) along with details of any faults arising and corrective action taken [Ac\_05\_50\_54]
- 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 [PM\_70\_15\_82]
- g) all costs associated with the soak test, such as test equipment, attendance and supervision shall be at the Contractor's expense [PM\_70\_15\_82]
- h) costs incurred as a result of or a consequence of having to restart the soak test shall be at the Contractor's expense [PM\_70\_15\_82]
- i) the soak test results shall be included in the Operation and Maintenance (O&M) Manual and Health and Safety (H&S) File. [PM\_70\_15\_82]

6.2.7 Where the fire alarm system(s) incorporate(s) more than 50 automatic fire detectors, a soak test period of at least one week (with the Building/area occupied) shall be provided by the fire alarm specialist in strict accordance with BS 5839 after inspection, testing and commissioning. [Ac\_75\_60\_30]

6.2.8 This period shall be determined by the fire alarm specialist responsible for the design of the fire alarm system(s). [Ac\_75\_60\_30]

6.2.9 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. [Ac\_75\_60\_30]

6.2.10 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. [PM\_10\_20\_82]

6.2.11 The soak test shall only be regarded as successfully completed if either:

- a) no false alarms occurred occur during the soak test period, or [PM\_70\_15\_82]
- 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.  
[PM\_70\_15\_82]

## 6.3 Documentation

6.3.1 Documentation shall be provided as set out in the DfE's EIR which includes a simple user-friendly Building User Guide including details of all user controls to be provided. [PM\_10\_20\_28]

6.3.2 Schematics of each electrical and alarm system shall be provided adjacent to the main panels. [PM\_40\_40\_75]

## 6.4 Commissioning and Building Performance Evaluation

6.4.1 A programme for commissioning shall be provided as set out in the DfE's EIR.  
[PM\_10\_20\_28]

6.4.2 The systems installed shall be fully tested and commissioned in line with all appropriate current regulations and standards. [PM\_10\_20\_82]

6.4.3 Post occupancy Building Performance Evaluations (BPE) shall be carried out during the 12 month rectification period in accordance with Section 4.8 on Building Performance Evaluation (BPE), Energy and Carbon Monitoring in [Employer's Requirements Part A: General Conditions](#). [PM\_40\_60\_62]

6.4.4 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. [PM\_70]

6.4.5 Seasonal commissioning shall be undertaken during the 12 months defects period in order to fine-tune the systems for optimum performance and energy consumption.  
[PM\_40\_20\_15]

6.4.6 All electrical systems shall be tested, witnessed and certified. [PM\_70]

6.4.7 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.  
[Ac\_70\_65\_46]

6.4.8 Electrical testing shall be fully in accordance with BS 7671 and certificates supplied.  
[PM\_10\_20\_90]

6.4.9 Emergency lighting and audibility of fire alarms systems shall be fully tested and certified. [PM\_70]

6.4.10 Operation of RCDs and emergency shut off for electrical systems shall be tested and certified. [PM\_70]

6.4.11 Pre-commissioning, commissioning and seasonal commissioning shall be undertaken on all aspects of the systems in line with CIBSE commissioning codes and BS 7671. [PM\_10\_20\_90]

6.4.12 A notice period of 1 week shall be provided to the Employer for witnessing. [PM\_10\_20\_82]

## **6.5 Demonstration and Training**

6.5.1 Demonstration and training shall be provided as set out in the DfE's EIR. [PM\_10\_20\_28]

6.5.2 The Employer shall appoint and/or nominate an appropriate candidate(s) to receive training by the Contractor on the systems within the proposed development. [PM\_70\_85\_55]

6.5.3 All systems, controls adjustment procedures, optimum settings and maintenance procedures shall be demonstrated to the appointed representative(s). [PM\_70\_85\_55]

6.5.4 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 Technical Annex 2H for further details of iSERV. [PM\_10\_20\_90]

6.5.5 Training and demonstration shall be provided for the appointed Employer/School for the energy monitoring system. [PM\_70\_85\_55]

6.5.6 The automatic uploading of data collected by the energy monitoring equipment to iSERV shall be collected. [FI\_30]

6.5.7 The Operation and Maintenance (O&M) Manual shall be available during the training and demonstration to ensure that the appropriate and correct documentation has been included. [PM\_70\_85\_55]

## 7 Demonstrating Compliance

### 7.1 Overview

7.1.1 The Contractor shall demonstrate compliance with the Employer's Requirements by use of protocols detailed in the Contractor's Quality Assurance procedures capturing evidence of both coordinated design and its implementation into the construction of the School Building(s) with photographic evidence and/or third-party accreditation.

[PM\_70\_15]

## 8 References

### 8.1 Overview

8.1.1 A specific list of compliance standards is included at the end of each section of this document. [PM\_10\_20\_90]

8.1.2 In addition, the design and installation shall take into account the following general references:

- a) CIBSE Guides and Technical Memorandums (TMs) [FI\_70]
- b) Relevant British Standards [FI\_70\_85]
- c) BS 7671: IET Wiring Regulations and guidance [FI\_70]
- d) Building Bulletin 100 'Fire safety' (BB100) [FI\_70]



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