

MLM

Dame Alice Owen's School

Potters Bar

produced for

Barkers Associates

Stage 2 Mechanical, Electrical and Public Health Technical Report



Project Revision Sheet

Revision No	Date	Status	Changes	Prepared	Checked
00	29.09.2016	Stage 2	n/a	G Harden	M Sealby
01	13.10.2016	Stage 2	Architect comments incorporated	G Harden	M Sealby

Document Ref: MDSE/714811/001R/GH
Revision: 01
Date: 13 October 2016

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1 Introduction

This report provides an introduction to the proposed building services systems associated with the new Education Block at Dame Alice Owen's School, Potters Bar, Hertfordshire.

This document has been compiled to identify the scope of services to be provided and a technical summary for each service. The report may be used as the basis of the services specification, however is not intended to replace a detailed specification document.

Standards

The buildings and their services will comply with all relevant and applicable Laws, Rules, Regulations and Standards – European, national, local and specific standards as required.

The buildings and their services will comply with all relevant and applicable guidance and guidelines as required, in particular the specific documents recorded in this report.

Generally

- British Standards or European Equivalents;
- CIBSE Codes and Technical Memoranda;
- The Building Regulations;
- Acts of Parliament;
- Local Authority Regulations and By-Laws;
- The specific requirements of service providers.

2 Purpose of the Document

- Concept Design Criteria;
- The Works Associated with mechanical & Public Health services installation;
- The Works Associated with electrical services installation;
- Safety in Design.

Standards

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Generally

- British Standards or European Equivalents;
- The Building Regulations;
- Acts of Parliament;
- Local Authority Regulations and By-Laws;
- The specific requirements of Service Providers.

Particularly

- Non-Domestic Building Services Compliance Guide 2010;
- BS: 7671 Requirements for Electrical Installations, including all amendments;
- Guidance notes to BS: 7671, together with all published supplements;
- British Standard Codes of Practice for Building Services Systems;
- Institute of Plumbing, Plumbing Services Design Guide;
- The Factories, Shops and Offices Act 1990;
- The Environmental Protection Act;
- The Electricity At Work Regulations 1989;
- The Electricity Supply Regulations 1988;
- The Gas Safety Regulations 1990;
- The Health and Safety at Work Act;
- The Construction (Design and Management) Regulations 2007;
- Control of Substance Hazardous to Health Regulations 1992;
- The Workplace (Health, Safety and Welfare) Regulations 1992;
- The EMC Directive 89/336/EEC;
- CENELEC Low Voltage Harmonisation HD 472 S1;
- ANSI EIA/TIA 568b Data cabling requirements;
- British Telecom and Mercury Communications Installation Guides;
- REC requirements (including guidance notes for PME installations);
- Water Regulations;
- CIBSE TM52;
- BB93 Acoustic Design for Schools;
- BB 90 Lighting Design for Schools;
- CIBSE TM57.

Abbreviations

BS – British Standard
BT – British Telecom
CCTV – Closed Circuit Television
CFD – Computational Fluid Dynamics
CO₂ – Carbon Dioxide
HDPE – High Density Polyethylene
HSG – Health Standard Guidance
HV – High Voltage
LV – Low Voltage
Kg – Kilogramme
m/s – Metres per Second
m³/s – Metres Cubed per Second
Wb – Wet Bulb
Db – Dry Bulb
W/m²K – Watts per metre square Kelvin

3 Sustainability/Energy Strategy

General Approach

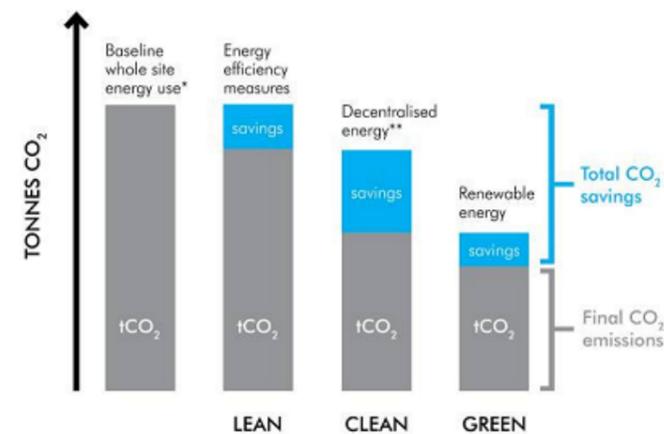
The design and construction of the new teaching Block at the Dame Alice Owen's School is intended to reflect the Client's vision for a new facility that should aspire to a high standard of sustainable design and operation. To meet this criteria the following key requirements have been identified:

- The environmental performance of the new building, particularly with regard to CO₂ emissions, will aspire to exceed the national standards set by the current Building Regulations. The building will achieve a carbon emission reduction improvement over and above the Building Regulations Approved Document L2A requirements;
- It is understood Hertfordshire County Council have no enhancement requirements over and above those of the current building regulations in regard to Carbon Emissions targets;

The key aspects of the proposed environmental strategy for the building can be summarised by the following points:

- Optimise the passive design of the building to enable generous daylight (without glare and overheating), natural ventilation and a high efficiency thermal fabric. The thermal fabric parameters adopted will be substantially better than the limiting values set out in the current Building Regulations;
- 100% low energy lighting throughout the development and LED lighting in communal spaces with intelligent daylight and occupancy regulated control where appropriate;
- Inclusion of a large array of roof mounted Photovoltaic panels to generate clean onsite renewable power where required to meet Part L requirements;
- A Building Management Control installation to ensure optimal and efficient operation of plant and the monitoring of energy consumption and brise soleil;
- Limiting overheating with solar control glass where appropriate;
- Minimise water usage with appropriate selection of sanitaryware;
- Efficient building services;
- Sustainable materials.

The CO₂ emissions reduction target will be achieved based on a staged approach as follows:



Stage 1 Passive Design Measures and Features. 'Be Lean'

The new building will adopt a 'Fabric First' approach and as such will benefit from - low U-values, high standards of air tightness, beneficial use of daylighting and high levels of insulation to initially reduce the energy demands and associated CO₂ emissions of the building.

Proposed target U-values:	External walls	0.18W/m ² k
	Ground floor	0.13W/m ² k
	Roof	0.12W/m ² k
	Glazing	1.4 W/m ² k + 'g' value 0.41
	Air Permeability	5m ³ /m ² hr

Stage 2 Passive and Active Energy Efficient Building Services. 'Be Clean'

In addition to passive measures, the building will include high standards of energy efficient building engineering services. These measures to include the following: high efficiency lighting design and associated controls, high efficiency fan motors, variable temperature and volume control of the heating systems.

Stage 3 LZC/Renewable Energy Provision 'Be Green'

Over and above passive and active measures to achieve further overall reduction in CO₂ emissions. Air source heat pumps and photovoltaic panelling will be provided.

To achieve 35% carbon reduction against Building Regulations Part L 2013 in line with the Hertsmere Local Plan Core Sheet, January 2013.

Daylight Modelling

Daylight to the pupil rooms will be optimised whilst meeting the overheating criteria set out in current Part L and TM57. Where external shading is required, this shall be in the form of brise soleil. Solar control glazing along with external and internal shading will be incorporated where required. The floor to ceiling heights will be optimised where possible to enable optimal daylight penetration and into the class bases.

Building Fabric properties to be used within the day lighting analysis will be:

Element	Light Transmittance	Reflectance
Floor (Cement Screed)	-	0.2
Walls	-	0.5
Ceiling (White Paint)	-	0.7
Window	0.65	0.1

The detailed building modelling will be carried out as the design progresses and the final daylight factors achieved will be confirmed upon conclusion of the building design.

4 Existing Site Services and Infrastructure

Existing utility supplies to the area adjacent to the site consist of electricity, gas, water and telecommunications.

Gas

It is envisaged the new teaching block will have no requirement for a gas service given the proposed heating and hot water strategy outlined elsewhere within this document.

Water

The building will be provided with a new separately metered potable cold water supply, which will derive from the existing utility infrastructure.

Electricity

A new electrical supply will be provided on site.

An LV connection to support a load in the region of 170kVA will be derived from the existing UK Power Networks supply from either the onsite substation or direct feed from their LV network in the adjacent road. An application will be lodged directly with UK Power Networks.

Data Services

Incoming service ducts will be provided to the new teaching block from the main campus allowing the client to procure telephony and data services for the building.

5 Design Concept Criteria

Mechanical Services

The design criteria for the building has been established to enable the future building energy model to be constructed to prove that the design principles work and meet the Building Regulations Part L requirements with regards to energy performance.

External Design Criteria

The following external design temperatures will be used for design purposes

Summer 28°C db 20°C wb
Winter -4°C db Saturated

Internal Design Criteria

Casual Heat Gains

Occupancy density and casual heat gains assumed are in accordance with CIBSE A Guide guidance and the following table:

Load Type	Density of Occupation	Sensible Heat Gain		
		People W	Lighting (when on) W/m ²	Equipment W/m ²
Office accommodation	1 per 10m ²	75	8	15
Circulation Spaces	1 per 12m ²	70	8	5
Classrooms	30	75	8	10 ¹

1 Assumes that only tablets are used within the classroom. Not fixed desktop computers.

Infiltration

The assumed infiltration rate is 0.5ac/h which is a recognised allowance and correlates to the allowable infiltration rates set out in Part L for a building of this shape and location, in all but extreme cold and windy conditions.

This means that the ability of the heating system to meet the peak loads relies strongly on whether the Part L requirements for air tightness are achieved.

Internal Environmental Conditions

Temperature

The following temperatures will be achieved within the building during the heating season:

Room Type	Temperature
Offices /Staff rooms	18°C
Reception	18°C
Toilets	Min 15°C
General Circulation	15°C
Stores	15°C
Plantroom	15°C
Classrooms	18°C
Staircases	15°C

- 1 Temperature and humidity tolerances quoted are control tolerances only. Plant and equipment to be designed to maintain specified temperatures.
- 2 Noise criteria are not listed, these to be detailed separately.

The minimum air temperature in the unoccupied hours should be 6°C.

The temperatures during the summer months will not be controlled other than via natural /mechanical ventilation.

Lighting

Internal Lighting

The illuminance levels in the following table are in accordance with the CIBSE Code for Lighting 2009.

Room Type	Illuminance (lux)	Switching	Daylight Dimming
Office Accommodation	300	Manual on/absence detection off	Yes
Reception	200	Manual on/absence detection off	Yes
General Circulation	100	Timed on/off with absence detection	Yes
Store/Cleaners cupboards	100	Manual on/off	No
Plantroom	150	Manual on/off	No
Classrooms	300	Manual on/Absence detection off	Yes
WC's	150	Auto on/Absence detection off	No
Staff Room	300	Manual on/absence detection off	Yes

The design has been developed to maximise the use of daylight within each space to create a well-lit and stimulating environment, as well as providing the opportunity for daylight dimming control and reduction in energy consumption.

Electric lamps with luminous efficacies greater than 65 luminaire lumens/watt will be selected to all communal areas and 55 luminaire lumens/circuit watt in pupil rooms.

The maximum glare index in the multi-function room and communal areas ground floor will be 19.

Where display screens will be used the lighting installation will comply with CIBSE LG7, 2005 sections 3.3 and 4.6-4.9.

The choice of ceiling material (exposed unfinished concrete or painted concrete) and wall colours can have a significant effect on the efficiency and performance of the lighting system as a whole. Therefore any decisions related to colour and texture finishes of surfaces will be carefully considered by the lighting designer.

Building Regulations & Building Energy Consumption

A design stage Dynamic Simulation Model (DSM) will be produced in accordance with CIBSE AM 11 methodology using the CIBSE Design Reference Year (DS7) weather data file orca.

The strategy is for the building to be predominantly naturally ventilated by the use of manually opening windows and passive ventilation stacks to roof level louvres. Mechanical ventilation will be provided to the W/C's and the like in accordance with the Building Regulation Approved Document part F, generally as indicated on the ventilation strategy drawings.

A hybrid mechanical ventilation solution will be provided to class rooms with single external walls to allow compliance with CIBSE TM52.

The results from the thermal model will demonstrate that the building will not overheat during the summer months.

CIBSE TM52 provides guidance with regard to summer time temperature. The criteria below are all defined in terms of ΔT the difference between the actual operative temperature in the room at any time (T_{op}) and T_{max} the limiting maximum acceptable temperature. ΔT is calculated as:

$$\Delta T = T_{op} - T_{max}$$

The maximum acceptable temperature can be calculated from the running mean of the outdoor temperature (T_{rm}) using the formula:

$$T_{max} = 0.33 T_{rm} + 21.8$$

Where T_{max} is the maximum acceptable temperature (°C)

The proposed development will be assessed against the following criteria:

Criterion 1: Hours of exceedance (H_e): The number of hours (H_e) during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours.

Criterion 2: Daily weighted exceedance (W_e): To allow for the severity of overheating the weighted exceedance (W_e) shall be less than or equal to 6 in any one day where:

$$W_e = (\sum h_e) \times WF$$

$$= (h_{e0} \times 0) + (h_{e1} \times 1) + (h_{e2} \times 2) + (h_{e3} \times 3)$$

Where the weighting factor $WF = 0$ if $\Delta T \leq 0$, otherwise $WF = \Delta T$, and h_{ey} is the time (h) when $wf = y$.

Criterion 3: Upper limit temperature (T_{upp}): To set an absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4 K.

The following comfort range is defined as:

	Explanation	Suggested Acceptable Range deg.K
I	High level of expectation only used for spaces occupied by very sensitive and fragile persons	± 2K
II	Normal expectation (for New Buildings and renovations)	± 3K
III	A moderate expectation (used for existing buildings)	± 4K
IV	Values outside the criteria for the above categories (only acceptable for a limited periods)	>4K

Noise Criteria

The mechanical services external plant will be selected to allow operation at any time. Sound power levels will be agreed with the local Planning Authority prior to commencement of the works.

Noise criteria, where specified are to be measured 1.0m outside the nearest operable window.

Unless previously defined, the mechanical and electrical services systems will be selected to ensure that when the accommodation is fully fitted out with finishes and furniture the following maximum internal noise levels are achieved.

Internal noise levels as defined by ISO R 1996, will apply at a distance of 1.5m from any grille/diffuser (at an angle of 45°) or any wall surface.

Health and Safety

The design of the mechanical and electrical services installation will be undertaken with due regard to Health & Safety Legislation.

Design reviews will be undertaken to ensure that risks associated with the building services are identified and where appropriate revisions are undertaken to minimise risks that would be carried to the construction phase of the project.

As designers we are obliged to inform you of the Client's Duties under the Construction (Design and Management) Regulations. For your convenience we have placed this information on our website (www.mlm.uk.com, select CDM: Client's Duties). Please let us know if we can be of further help with Regulations.

6 Mechanical, Electrical and Public Health Services

The following section provides a summary of the mechanical, electrical and public health installations proposed for the scheme.

This report should also be read in conjunction with the room data sheets and the Employers Requirements.

Sanitary Appliances/Fittings

Sanitary appliances and fittings will be scheduled by the Architect. To reduce water consumption dual flush WCs, non-percussive spray taps to wash hand basins and flow limiters to regulate the flow to outlets.

The current assumption is following these flow rates:

- 1 WC's: 4.5l/min (note that this will require a 6/3 litre dual flush cistern)
- 2 Wash hand basin taps: 4.5l/min
- 3 Assumed no commercial sized washing machines will be provided

Above Ground Drainage

A new system of above ground drainage will be provided from all sanitary appliances in accordance with the Building Regulations Approved Document part H and BS EN 12056.

Soil, waste and ventilated stacks will be located in common risers/boxing where possible to serve locally arranged sanitary appliances. The stacks will drop vertically throughout the building without offsets or diversions unless properly ventilated.

Accessible rodding facilities will be provided to each stack at the ground, first and second floor levels.

The internal soil, waste and ventilation system will be generally installed in PVC pipework and fittings, having solvent welded joints.

Calculations have been carried out in accordance with the demand unit method of BS EN 12056-2:2000 with a System III installation. Demand units assumed are as follows:

A frequency factor of 0.7 has been adopted consistent with frequent use.

The stacks will rise from the drain point connections at ground floor level and vent to atmosphere through the roof. Where PVC pipework (greater than 50mm diameter) penetrates a fire compartment floor or wall, the pipe will be fitted with a suitable intumescent collar, wrap or other device appropriate for the proposed method of floor or wall construction. Acoustic treatment will be applied to risers where required.

Hot and Cold Water Supply Systems

The building will be provided with a new separately metered cold water supply, which derives from the existing utility infrastructure.

Cold Water Service

A new metered potable mains cold water supply will be taken from the local utility infrastructure as supplied by Thames Water, this will supply a dedicated cold water break tank and booster set serving the new school building.

Cold water storage will be provided and located within the ground floor plantroom. The water tank will be of the sectional type to allow independent isolation of each section for draining down and cleaning.

The pre-insulated internally flanged cold water break tank will be provided with the necessary overflows, warning pipes, access ladder, raised ball valve chamber, fly screens and the like to comply with the Water Regulations. The tank will be provided with a self draining base.

The packaged booster pump set will comprise of inverter driven pumps (duty/standby), control panel, valves, hydraulic accumulator vessels, surge arrestors, pressure regulating valves and the like.

An electromagnetic water conditioner will be provided to limit the build up of scale within the system.

A system of copper pipework will distribute from the coldwater tank room to serve all items of sanitaryware.

An external wash down points will be provided to the bin stores complete with CAT 5 backflow protection. The CAT 5 back flow protection will comprise of a separate booster pump and break tank with a type A/AB type air gap in accordance with the Water Regulations.

Thermal insulation will be provided for frost protection and to guard against the build up of temperature to all cold water pipes and storage cisterns in accordance with British Standard 5422:2009 and TIMSA guidance.

The complete potable water system will be fully chlorinated in accordance with BS 6700.

The system will be designed to meet drinking water standards and in accordance with Water Supply Regulations, HSE L8, British Standards 6700, EN806, Building Bulletin 87, Building Regulations and CIBSE guidance.

Hot Water

Hot water will be generated by a high efficiency Air Source Heat pump located within the Roof. The hot water generators will have a minimum COP of 3.5.

The hot water generators will be sized to meet the maximum hot water demand of the new school building.

The packaged hot water generators will be provided with all necessary expansion vessels, pressure relive valves, control valves, temperature gauges and the like.

A system of copper pipework will distribute from the plantroom to serve all items of sanitaryware. The hot water service pipework will be arranged on a flow and pumped return basis. The potable grade hot water return pump will be of the bronze canned rota type.

The connections to sanitaryware will incorporate flow regulators to conserve water.

TMV 3 compliant thermostatic blending valves to limit the hot water temperature will be provided where required.

All hot water service pipework will be provided with Thermal Insulation in accordance with the Building Regulations and TIMSA compliance guide. The hot water service pipework will be designed to achieve a heat-loss of less than 7 w/m.

Thermal insulation and appropriate access boxes will be provided to all valves, flanges, bellows and the like within the plantroom.

The design will incorporate the requirements of HS(G) 70/HSE L8 for the Control of Legionellosis.

The complete potable water system will be fully chlorinated in accordance with BS 6700.

The system will be designed to meet drinking water standards and in accordance with Water Supply Regulations, HSE L8, British Standards 6700, EN806, Building Bulletin 87, Building Regulations and CIBSE guidance.

Sprinkler Systems

The fire strategy is being developed and we await confirmation of the requirement for a sprinkler system however at this stage we have presumed sprinklers will not be required.

Fire Hydrant System

An existing fire hydrant is located adjacent to the main entrance of the auditorium block which is within the permitted distance to the new teaching block entrance. This will therefore be utilised to provide coverage to the new building.

The location of the fire hydrant has been indicated on the architect's site plan drawings.

Low Temperature Hot Water

Space heating will be provided by high efficiency Air Source Heat Pumps. The condenser will be arranged to generate low temperature hot water (LTHW) and serve an underfloor system.

The ASHP will have a minimum COP of 3.20%.

The LTHW design will incorporate variable volume variable temperature weather compensation functionality to improve energy efficiency and control of internal space temperatures.

The heating system will be controlled via the Automatic Controls System.

LTHW pipework will distribute from the roof plantroom to serve underfloor heating throughout the school building; the pipework will be of steel construction.

Phonelic foam type thermal insulation will be provided to the entire LTHW pipework installation in accordance with British Standard 5422:2009 and TIMSA guidance.

Thermal insulation and appropriate access boxes will be provided to all valves, flanges, bellows and the like within the plantroom.

Each room will be provided with underfloor heating of sufficient capacity to overcome the building heatlosses. Local thermostatic control will be provided within each room.

The heating systems will be designed in accordance with the relevant Building Regulations, Health Technical Memorandum, British Standards and CIBSE guidance.

Ventilation Systems

The general strategy for the building is to adopt natural ventilation by the use of manually opening windows and louvers where possible.

The natural ventilation strategy has been modelled using the industry standard software. The ventilation model has been used to define the openings required in the building façade and to predict summer time internal temperatures.

The model has demonstrated compliance with the Building Regulations Approved Document Part F, TM52 and also demonstrated the building is not predicted to overheat using these assessment methods.

The TM52 provided guidance with regarding to summer time temperatures, which suggests the temperature should not exceed 28°C for more than 3% of the maximum exceedable hours per year, daily weighted exceedance shall be less than or equal to 6 in any one day and absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4 K.

The design stage model should demonstrate that at least two of the above three requirements are met.

The ventilation systems will be designed in accordance with relevant British Standards, CIBSE guidance and the Regulations Approved Document Part F.

The classroom natural ventilation strategy will incorporate double sided natural ventilation from the external wall glazing systems and louvers utilising manual openings in the external façades.

The natural ventilation strategy will require developing further once a site wide acoustic assessment has been carried out, this may require the introduction of attenuated louvers in the building façade or expanding the mechanical ventilation provision.

Solar control glazing will be provided to all southern, south east and south west elevations and shall assist with minimising solar heat gain through the windows.

All naturally ventilated rooms will be provided with stand alone CO2 sensors to monitor the room's air quality. An audible alarm will sound when elevated CO2 levels are detected to alert the occupants that the window needs need to be opened.

The ventilation strategy includes hybrid, natural and mechanical ventilation via specialist design.

The building ventilation and thermal modelling will continue through RIBA stage E & F and will be updated to reflect architectural and MEPH design development.

Ventilation Strategy

The general strategy has been based upon the following:

- **Classrooms** – Natural ventilation via manually opening windows and passive ventilation stacks to roof level louvres for additional summer time mechanical ventilation;
- **Plantroom** – Natural ventilation;
- **Toilets** – Mechanical extract ventilation;

Toilet/Vent

The toilet areas will be provided with mechanical extract ventilation systems, providing a minimum rate of six air changes per hour to avoid the build up of odours and maintain a fresh environment. Individual local extract fans will be provided. These fans units will be mounted within the ceiling void, and discharge to atmosphere via small wall terminal.

The fans will be controlled by PIR sensors to switch the unit from continuous trickle ventilation rate to boost ventilation rate. The make-up air to balance the mechanical extract from all toilet areas will be drawn from the surrounding areas by undercutting doors.

Comfort Cooling

At this stage it is assumed comfort cooling will not be provided. Subject to confirmation of the client's active equipment within the server room, a local split type DX comfort cooling system may be required; this will be developed further during the detailed design stage of the project.

7 Electrical Services

Electrical Connection

An LV connection to support a load of 120kVA will be derived from the onsite UK Power Networks substation to serve the new building. An application will be lodged directly with UK Power Networks.

Metering

An incoming electrical supply meter will be provided within a dedicated section of the new blocks LV switchpanel. The metering cubicle will be complete with supply company seals, CTs, etc and telephone connections to facilitate remote monitoring and metering.

Metering of the outgoing ways will be included to each substantial load as indicated on the electrical distribution schematic.

Earthing and Bonding Systems

The building will be provided with a Protective Multiple Earthing System, in compliance with BS 7671 and the requirements of the service provider.

A main earthbar will be provided within the LV switchroom, connected to the incoming Main Earthing Lead from the sub station.

Outgoing connections will be provided to the following services:

- Incoming water and gas services;
- The structural steelwork of the building;
- The lightning protection system;
- The mechanical services plant;
- Each set of lift guides;
- The telecoms framer room;
- Each main LV switchpanel.

LV Distribution

Preliminary load calculations indicate that a 120 kVA three phase supply will be required to service the site.

All distribution switchgear will be of the circuit breaker type, with adjustable trip thresholds. Switch panels will be constructed to BS 5486, Form 36, type 2.



Form 4 LV Panel board

The panels will be complete with electronic multi-function metering units to comply with the Building Regulations ADL2A requirements and a minimum of 25% spare outgoing ways.

The incoming supply will terminate within the plantroom and from here dedicated low voltage supplies will feed each sub distribution board.

This switchboard will supply the following services:

- Lighting and power distribution boards for all areas;
- Power supplies to all mechanical plant;
- Lift installation;
- Fire alarms installation;
- Security Installation.

A series of DB's will be located in service cupboards, store rooms, risers or other positions throughout the building. The design philosophy is to have three phase distribution boards for each area of the building. These DB's will be metered and connected to a central monitoring/management system.

All sub-mains will comprise XLPE/SWA/LSF cables on galvanised steel tray, generally routed via the electrical riser, running horizontally along predetermined co-ordinated service routes to serve the local MCB distribution boards.

Armouring will be used as the principal earth path, supplemented with additional conductors as required.

A transient surge protection device (SPD 1 and 2) will be provided within the main switch panel. This will be used to protect the electrical services from any voltage transients that could be introduced onto the supply that may damage sensitive equipment.

Small Power

General small power will be supplied from local dedicated distribution boards either via radial feeds to fixed equipment or on 32A single phase ring mains. Final circuits will be protected via MCB's/RCD's/RCBO's as appropriate suitable for the loads served.



Typical Distribution Board

Small power circuits will generally be LSF singles or multi-core run in conduit (PVC conduit in walls and galvanised where surface fixed) or installed in trunking (can be a dedicated compartment in multi compartment trunking), concealed in ceiling voids, under acoustic panelling, and in risers.

Small power accessories (finish to be confirmed) are to be provided to meet the requirements of the room data sheets and the design intent drawing.

Provision for dedicated cleaner's sockets will be made throughout the communal parts of the building to enable vacuuming making allowance for standard cleaner cable lengths.

Wiring to Mechanical Plant

Wiring will generally comprise XLPE/SWA/LSF cables on galvanised steel cable tray, basket or trunking. Local isolators to plant will be rotary type to appropriate IP rating and all devices, cables and cores will be labelled to an agreed scheme.

Controls wiring will be run via a dedicated cable tray, basket or trunking system, maintaining minimum segregation distances from power services.

70-80-25 External Lighting

The external lighting scheme will include perimeter exterior spaces which require artificial lighting for visual tasks. These include, circulation routes and, amenity areas.

Sufficient lighting will be provided for a safe environment whilst limiting light pollution and minimising lighting ingress to the surroundings.

The use of bollards will be avoided for the following reasons:

- Due to the height of the light source, good vertical illumination is usually unachievable;
- They are prone to vandalism;
- Wide spacing is not possible: resulting in more luminaires and associated cost.

External lighting systems will be designed in accordance with CIBSE Lighting Guide 6 and with the requirements for the limitations of Table 1 of ILE Guidance Notes for the Reduction of Obtrusive Light GN01. The lighting will cover, walkways, entrances and particular building features and security requirements.

General Lighting Systems

The lighting installation will be designed to provide a quality of light incorporating a balance between surface colours and textures, visual interest, light colour, uniformity and non-uniformity of light patterns.

The building will be provided with a complete artificial lighting installation to all internal areas of the building to the lighting levels identified within the following CIBSE Codes:

- Code for Interior Lighting;
- LG3 - The Visual Environment for Display Screen Use;
- LG5 - The Visual Environment in Lecture, Teaching & Conference Rooms;
- LG6 - The Outdoor Environment;
- LG7 - Office Lighting;
- Building Regulations.

Light levels will typically be calculated at 700mm AFFL (to reflect the working plane at desk height) apart from circulating spaces and plant rooms which will be calculated at floor level:

Lighting will be designed to suit specific tasks or controlled to provide variable levels for multiple tasks in areas where this is appropriate.

Illumination levels and luminaires are in accordance with CIBSE code for Lighting, Building Regulations current Approved Document Part L2A and in accordance with the prescribed standards. This includes a minimum lamp luminous efficacy will be 55 lumens/circuit Watt.

Teaching Spaces

Teaching spaces and offices will typically be illuminated by suspended direct/indirect fluorescent luminaires. Light will be directed downwards for task illumination and an upwards component will create a pleasant learning environment.

Suspended luminaires with the direct light distribution are used to provide the specified level of general illumination. An even illumination is provided across the horizontal working plane sufficient to see detailed visual tasks. The upwards component will provide illumination to the ceiling soffit, thus increasing the brightness of the ceiling, improving the perceived spaciousness of the room and the improving illumination uniformity on the working plane.

Where possible, illumination to white board surfaces will be provided by the general illumination within each room. These spaces will be controlled via a combination of absence detection and local manual switching.

Lighting will be designed to LG7 for display screen use.

Offices

Offices will typically be illuminated by suspended direct/indirect LED luminaires. Light will be directed downwards for task illumination and an upward component create a pleasant working environment.

These spaces will be controlled via a combination of dimming, absence detection and switching.

Lighting will be designed to LG7 for display screen use.

Corridors & Circulation

Compact fluorescent recessed downlighters or LED luminaires will provide general illumination for the circulation areas. Luminaires will be aligned centrally through out corridors providing an even wash of light.

Stairs

Surface mounted wall luminaires will provide lighting to the stairs. Wall mounted luminaires will prevent maintenance access problems and the risks associated with working at height.

Toilets

Compact fluorescent luminaires with diffuse distribution will be recessed into the ceiling, spaced at regular intervals, to provide even illumination. Luminaires will feature IP44 ingress protection.

Luminaires

Unless otherwise stated in the area by area description, the following luminaire types will typically be proposed:

- Offices – 'LG3/LG7' recessed modular luminaires;
- Teaching Spaces – Suspended direct/indirect continuous linear fluorescent compliant recessed luminaires;
- Stores – surface mounted linear fluorescent luminaires with prismatic diffusers;
- Corridor space/Toilets – suitably rated recessed downlights;
- Circulation Spaces – pendant luminaires.

Light fittings and lamp sources will be robust and suitably secured, and be suited for their purpose and location. Also, glare and reflections can also imbalance some hearing impaired pupils, and cause discomfort and visual confusion in general to those with any sight difficulties.

Lamps

For general lighting, lamps will typically be linear, LED or compact fluorescent type for good efficiency and colour rendering. Where linear fluorescent luminaires are provided efficient T5 lamps will be used. All lamps and tubes will be of the same colour in any given location so as to achieve uniformity throughout. Tungsten lamps will not be used except for display purposes.

Lighting Control

It has been proven that automatic controls can significantly reduce the overall building energy consumption. Automatic controls will include daylight linking which will reduce the light output of luminaires when sufficient daylight is available, passive infra red sensors which ensure luminaires are turned off when rooms are unoccupied. Certain areas may also have a time clock override facility. The control philosophy will be designed on a room by room basis in conjunction with the selection, configuration and choice of control gear for luminaires.

All rooms with automatic controls will be provided with local manual override switching installed in accordance with ADL requirements.

The following rooms will be provided with daylight linking luminaires to reduce the light output when sufficient daylight is available:

- Offices;
- Teaching spaces.

The day lighting controls will alter lighting levels of the outer most row adjacent the windows within the space in a smooth and even fashion so as to ensure that there are no discernable differences in individual luminaire outputs within individual rooms.

Emergency Lighting

An emergency lighting installation will be provided to meet BS5266 Part 1 to: all escape routes (not within the pupil rooms); back of house areas exceeding 60m², plant (including roof plant) and switch rooms. Self-contained emergency fittings will be used throughout with minimum 3 hour duration of escape lighting.

Data Distribution Systems

A comprehensive ICT infrastructure will be provided within the new block to meet the operation of the site in conjunction with the specific client/user and will be developed during the detailed design stages.

Copper cable from the ground floor hub to each final outlet location will be in accordance with the 90m rule, where 90m is exceeded an additional hub will be provided linked back to the main comms room via a fibre back bone connection.

The scope of the works shall be limited to "passive" equipment (i.e., the wiring faceplates, the wiring, the patching panels and the cabinet. All active equipment (i.e. the switches and servers) shall be provided by the client. The new cabinet shall be a minimum of 47u high and shall be located in the ground floor service area.

The cabinet shall be provided complete with full height power distribution units, one containing 13A rated BS 1361 outlets, and the other containing 10A rated C13 sockets. Both power distribution units shall be supplied via Commando plug and sockets wired from a dedicated circuit.

From the hub Cat 6 cabling will be taken and laid on to basket with protective matting within the designated distribution route, then enter into dado trunking within pupil rooms/teaching spaces to their final location to enable VoIP, IPTV and browsing capability.

The number of data points within the building will include for high level data points to enable the future installation of wireless routers to the building.

The requirements for the building are for a fully certified Structured Cabling System (SCS) which includes the following:

- Cat 6 Horizontal Cabling Outlets distributed throughout the building;;
- Network Racks (47U x 800mm x 800mm);
- Primary Fibre backbone Links (OM3, 16 core);
- Secondary Fibre backbone Links (OM3, 16 core);
- Cat 6a UTP backbone.

The final ICT solution will be coordinated with the client's specialist ICT adviser.

Applicable Standards

All data cabling works undertaken will be done so in accordance with the latest industry standards for the proposed structured cabling solution, meeting the industry standards applicable for this installation.

Horizontal Cabling Outlets (Cat6) - Data & Voice

The Cat B UTP cables will emanate from network racks housed within the service room and will be routed via the data/comms containment to each data outlet.

The RJ45 outlets for horizontal cabling are considered to be universal and can be used for data or voice applications.

Locations of remote hubs will be chosen as necessary to maintain compliance with the requirement to keep horizontal runs below 90m in length.

Containment and wiring provision will be included for a dedicated analogue link from the new passenger lifts back to the school reception desk. Additional lines will be required for public phones and fire and security remote receiving stations and for the BMS.

A dedicated Satellite and Cable TV installation is not envisaged.

All servers and core active infrastructure (switching and Wi-Fi controller) shall be provided with an integral suitable uninterruptible power supply (UPS), rated for a minimum 30 minutes and capable of providing transient over voltage protection. The UPS will be the Modular type with Static and manual bypass.

Induction Loop Systems

No requirement for induction loop is anticipated.

Access Control Systems

It is not anticipated Access Control will be required.

CCTV System

Where required to meet the engineers requirements, a CCTV system design will be provided to comply with the Data Protection Act and inform the Authority of any joint responsibilities as building users of such systems to comply with the Act. The CCTV system will comply with the requirements of BB75 and EN50132-7 Alarm systems, CCTV surveillance systems for use in security applications.

The systems will be sympathetic to the adjacent area and neighbours and avoid intrusion into the private activities not associated with the site. No areas off-site will be visible on the CCTV system and will typically be achieved through the positioning and orientation of cameras such that areas off-site are not monitored.

The CCTV installation will consist of an internal CCTV camera within the foyer, further external cameras will be provided, strategically located to provide limited coverage of the external perimeter of the building.

The central CCTV system will be IP based with Power over Ethernet to avoid the need for local fused spurs at the camera. A digital video recorder (DVR)/CPU will be sited within the ICT server room. The recorder will have a minimum of 1TB recording capacity and provide the following functions;

- 1 Simultaneous live playback, recording and back up;
- 2 Selection of live camera or multiple camera views on screen;
- 3 Control of image quality and frame rate of each individual camera/input;
- 4 USB mouse and keyboard control;
- 5 Digital zoom;
- 6 Live image relaying;
- 7 Schedule and event recording modes;
- 8 Self diagnosis of system status;
- 9 Multi-level security access management;
- 10 Direct VGA output to monitor;
- 11 Time and calendar relay and automatic update to suit BST and leap years;
- 12 Data network connection facility;
- 13 USB device connection for back up recording (HDD and memory stick);
- 14 DVD-RW facility to allow back up recording.

An associated, dedicated flat panel screen will to be supplied and installed to the DVR output to relay live camera images and allow viewing of recorded images (dedicated flat screen panel will be supplied as detailed in the Harris ICT Matrix).

The system will support the creation of multiple camera views. The system will provide a pick list of all configured multiple camera views. When selected, the application will provide a page for display of the camera views. That page will also provide controls for zooming the cameras in and out, and for selecting pre-set positions on the camera.

Associated amplifiers and switch units will be installed as required to ensure sufficient signals are received from the cameras.

The power supply to the system will be secured such that it cannot be simply switched off.

Signage

Signage to alert building visitors that a CCTV installation is operational in the building will be provided.

Intruder Detection System

A comprehensive intruder detection and alarm system will be provided to monitor unauthorised access into the building.

The system will monitor an intruder's movement as they enter the building. This will typically include:

- Dual technology infra red and microwave occupancy sensors;
- Door contacts.

When an intruder is detected the alarm will be raised by means of a number of building mounted sounder/xenon beacon devices. The system will be setup as a confirmed activation before a call is sent to the police (2No. device activations before initiation of the alarm).

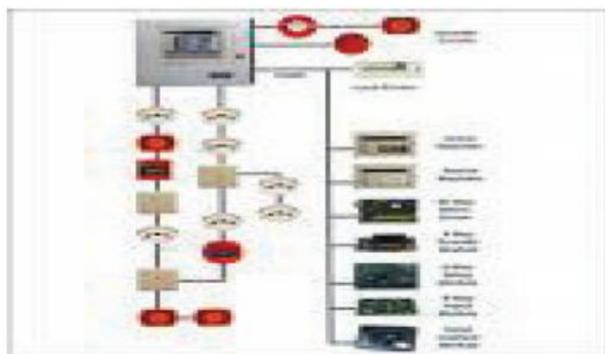
The installer will be certified by an UKAS, (United Kingdom Accreditation Service) accredited certification body and NACOSS Gold accredited.

All equipment will be approved by BSIA or SSAIB. The system will be in accordance with the requirements of BS4737, BS6799 and NACOSS.

The system will be zoned and configurable to allow out of hours areas to be disarmed whilst the detection and alarm to the rest of the building remains armed.

Fire Alarm

The fire alarm installation will comply with BS 5839 and Building Control/Fire Officers requirements and will be of the analogue addressable type.



Typical Fire Alarm Installation

The system will consist of a fire alarm control panel located at ground floor level within the main entrance. The panel fascia will be finished to coordinate with Architectural finishes.

The system will comprise smoke, heat and manual break glass units positioned throughout the building to give coverage in accordance with protection category L2, subject to the agreement of the Building Control Officer.

Alarms will be given by means of electronic sounders.

The system will be designed to provide a phased evacuation. This phased activation will be specified to operate that a primary detection system in each zone of the pupils' accommodation will trigger a secondary detection system that will activate alarms in an entire block.

- Activation of a smoke head in a cluster will sound the alarms in that cluster;
- The activation will report back to both a fire panel in the management suite to enable the team/security guard to identify which cluster the activation has occurred and make contact;
- The operations team will investigate (time to be agreed with local fire officer) to establish the reason for the activation and therefore decide if the secondary detection system in the building should be activated;
- Activation of the secondary alarm system will trigger a full evacuation of that building and the call log to the remote operator.

All system wiring will be in red LSF-sheathed soft skin fire retardant cable, fixed to the building or system of containment via metal fixings and will be concealed within all areas.

Assistance Call Alarms

Disabled Toilet Alarm

Disabled person's toilet alarms will be provided in accordance with BS8300-2009 to the disabled toilets that raises a local over door alarm via a ceiling pull cord switch. Disabled toilet alarms will signal back to a common indicator panel located within the General Office/Reception desk to alert reception staff to the need for assistance.

The indicator panel will enable the reception staff to know which WC alarm has been triggered.

Refuge Alarm

A disabled refuge alarm installation will be provided to all landings above ground floor to all fire escape stairwells. This will be a 2 way audio only unit which links back to speech point adjacent the fire panel. The installation will be wired in fire resistant cabling.

The remote unit is specifically designed for use by a disabled person within a refuge area.

The refuge units and are to be positioned on the first floor within designated areas adjacent to each stairwell.

General

The system will be a fully addressable emergency voice communication system that allows disabled refuge, fire telephones and disabled toilet alarm remote units to be connected to just one system, in accordance with BS5588 and BS8300:2001 (for the Disabled Toilet Alarm).

The system will also be fully compliant with BS5839 part 9 Fire detection and fire alarm systems for buildings which states that the system will be fully monitored. All faults are reported to the master control which enables building management to simply view any indicated faults.

The system is battery backed (for 72 hours quiescent and 3 hours at full power). This will ensure that the system is always available should the mains power supply fail - particularly in the event of an emergency.

The master control unit has a volt free contact which can be used to either trigger a beacon (not provided) to show an incoming call or report any faults to a Building Management System. It is also possible to listen in to any occupied refuge area to ensure that the occupant is okay.

The master control unit clearly indicates which refuge area is occupied via a zonal LED.

Lightning Protection System

A fully functional lightning protection system will be provided and will be based upon the Faraday cage principles in accordance with BS EN 62305:2006 Protection against Lightning, BS7671 and BS7430. The system will provide protection of the building, any exposed metalwork, contents and occupants from the effects of a lightning strike by discharging strikes to the general mass of earth.

The lightning protection system will comprise of the air termination network, down conductors (where necessary) and an earth termination network.

All lightning protection equipment which is accessible such as test points and earth rod inspection pits will be tamper proof.

Steel reinforcing in columns may be used subject to confirming there are sufficient vertical paths to earth to allow compliance with BS EN 62305 and sufficient metalwork enclosed within the structure so that touch voltages during a lightning strike will be below the maximum level given in BS EN 62305.

The materials for the component parts of the lightning protective system will be those detailed in BS EN 62305. Care will be taken in the selection of bonding clamps to prevent corrosion from the action of dissimilar metals.

The installer will take full account of the environmental conditions at the site and the materials used in the building construction to supply a lightning protection system that will provide trouble-free life of at least 25 years.

Where used Metallic roofing and cladding will be verified as being electrically continuous and bonded to the lightning protection system.

All metallic projections and plant or equipment on or above the main surface of the roof structure will either be bonded to the lightning protection system or provided with a secondary metallic structure mounted either adjacent or above the equipment which will then be connected to the lightning protection system. All bonding connections will be covered in grease to prevent corrosion.

On completion of the installation, the whole system will be tested in accordance with BS EN 62305.

The lightning protection system will also be connected to the main earthing system of the building.

Lifts

The new Building will be served by a Part M compliant electric Platform passenger lift.

Lift equipment as a minimum will be provided with the following communication system/alarms:

- Lift alarm;
- BMS alarm outputs (voltage free);
- Fire alarm interface;
- Analogue telephone connection.

The interior car finishes, lighting, etc, will be selected in conjunction with the architect to coordinate with the wider building finishes.

The lift will be selected to meet the requirements for Energy Efficiency and meet the requirements of Part M of the Building Regulations.

The lift will be in accordance with the Building Regulations part M and BS EN 81.