





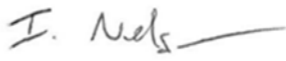
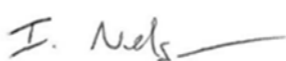
ROLTON GROUP
ENGINEERING THE FUTURE™

MECHANICAL AND ELECTRICAL BUILDING SERVICES
RIBA STAGE 3 SPECIFICATION

FOR

HEELANDS COMMUNITY CENTRE
MILTON KEYNES

PROJECT NUMBER:	20-0427 MEP
DOCUMENT REFERENCE:	200427-RGL-ZZ-XX-SP-U-95-0001
REVISION:	D2-P03

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REVISION

REVISION	ISSUE DATE	REASON FOR ISSUE
D2-P01	12.03.2021	Issued for Tender.
D2-P02	26.03.2021	Issued for Tender.
D2-P03	01.08.2022	Revised Project Scope.

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1.0 INTRODUCTION

1.1 PROCUREMENT METHOD

This project scope relates to RIBA Stage 3 and performance design for the scope of works in relation to the mechanical and electrical building services for tender in relation to the above project.

The project relates to the construction of the new build Heelands Community Centre in Milton Keynes.

The mechanical and electrical building services installations will be procured on a design and build tender with contractor design. The tender will be sought using RIBA Stage 3 documentation.

Rolton Group Ltd have prepared a performance design package up to and commensurate with RIBA Stage 3, the contractor will therefore be required to develop the design and complete with their supply chain specialists.

Final spatial coordination and coordinated working installation drawings for the mechanical & electrical building services installations shall be carried-out by the appointed contractor and his sub-contractors and supply chain members.



Figure 1 – Suffolk Punch CI Development Area – Aerial Plan¹.

1.1.1 Site Visit

Before tendering, the contractor shall ascertain the nature of the site, access thereto and all local conditions and restrictions likely to affect the execution of the Contract Works.

Inspect any existing installations relevant to the works and study any relevant existing records.

No claims will be allowed after submission of a tender for lack of information or other reasons which could have been resolved by such a visit to the site.

Arrangements for visiting the site must be made with prior agreement through the office issuing the tender documentation.

1.1.2 Engineering Proposals for CDP Elements

For all CDP elements, the contractor shall submit an engineering proposal detailing the design, drawing/layout, arrangement, manufacturer's details including confirmation of equipment duty, component materials, provision for offloading/installation, electrical general LV power supply requirements and any interface to Central Control/Building Management system(s).

CDP items shall be required to go through a Technical Submittal (TS) approval route whereby the contractor shall collate a full and complete design proposal and issue under the cover of TS to the client team for review and comment. The client team will require a minimum of ten working days to return comments. Responses in less than ten working days will not be guaranteed.

The contractor shall ensure as part of the information release element of the project programme that all TS are completed in sufficient time to allow the client team the full ten working day period for comment.

The contractor shall undertake the testing, commissioning and setting to work complete systems.

1.1.3 Tender Drawings

The details of the drawings which are to be included within the tender package are as detailed on the Rolton Group Ltd drawing issue report sheet issued with this documentation.

1.1.4 Design/Production/Installation/Scheme Drawings

The details of the drawings which are to be included within the tender package are as detailed on the Rolton Group Ltd drawing issue report sheet issued with this documentation.

These are to be prepared by the contractor and shall include co-ordinated details, dimensional information, plans elevations and sections to enable the works to be installed, including but not limited to:

- Design drawings for CDP elements of the project as stated within this specification.
- Production/Installation drawings comprising plans and sections of all parts of the works. Together with large scale plans and sections of all plant space, sections through ceiling voids, service ducts (elevations also) showing the arrangement of the works and co-ordination with other services.
- Plans and elevations showing positions and sizes of all pipework and ductwork, trunking, conduits, together with dimensions for positions and sizes of thermostats, diffusers, grilles, fused connection units and all items of control gear located on wall finishes.
- Plans and elevations showing positions and sizes of all cable ladder/tray, trunking, conduits together with all items of control gear located on wall finishes.

¹ Google® Maps November 2020.

The Design/Production/Installation drawings shall be based on the following information:

- Tender drawings indicating the general arrangement of the building and where applicable the design intent including any subsequent amendments made to the drawings by the Employer's Agent, during the course of the contract.
- The drawings provided by other supply chain suppliers and contractors and any subsequent amendments made during the course of the contract.
- General plans shall be at a minimum scale of 1:50 and all plant areas, sections and details etc. at a minimum of 1:20 scale.
- Diagrammatic and schematic details of distribution and controls arrangement.

1.2 STANDARDS

The Current Edition of the Chartered Institution of Building Services Engineers (CIBSE) and Building Services Research and Information Association (BSRIA) Commissioning Codes.

BSRIA Soft Landings Framework.

Current edition of British standards

The Current Edition of the Chartered Institution of Building Services Engineers (CIBSE) and Building Services Research and Information Association (BSRIA) Commissioning Codes.

The Current Edition of the Guide to Current Practice issued by CIBSE.

CIBSE publications, in particular (but not limited to):

CIBSE Application Manuals
CIBSE Commissioning Codes
CIBSE Guides
CIBSE Knowledge Series
CIBSE Lighting Guides and Manuals
CIBSE Technical Memoranda
CIBSE Weather Data Packages
CIBSE Guide A Environmental Design
CIBSE Guide B Designing Buildings
CIBSE Guide C Reference Data
CIBSE Guide F Energy Efficiency in Buildings
CIBSE Guide G Public Health and Plumbing
CIBSE Guide H Building Controls Systems
CIBSE Guide M Maintenance Engineering and Management
Commissioning Code A – Air Distribution Systems
Commissioning Code B – Boilers
Commissioning Code C - Automatic Controls
Commissioning Code L – Lighting
Commissioning Code M – Management

The Building Regulations, including Part L compliance and associated Acts

BS 7671 - Requirements for Electrical Installations. IET Wiring Regulations. Seventeenth Edition (generally referred to as the IET Regulations).

HSE Regulations & Guidance, in particular:

Construction (Design and Management) Regulations
Health And Safety (Display Screen Equipment) Regulations
Management Of Health & Safety At Work Regulations
Manual Handling Operations Regulations
Personal Protective Equipment Regulations

Provision And Use Of Work Equipment Regulations
The Electricity at Work Regulations
Workplace (Health Safety And Welfare) Regulations

BISRA:

BSRIA: Application Guide AG9/2001

BSRIA: Application guide 2/89 The Commissioning of Water Systems in Buildings.

BSRIA: 1/88 Commissioning of HVAC Systems - Division of Responsibilities.

The Building Engineering Services Association (BESA) guides, technical bulletins and recommendations

HSE Regulations & Guidance, in particular:

Construction (Design and Management) Regulations
Health And Safety (Display Screen Equipment) Regulations
Management Of Health & Safety At Work Regulations
Manual Handling Operations Regulations
Personal Protective Equipment Regulations
Provision And Use Of Work Equipment Regulations
The Electricity at Work Regulations
Workplace (Health Safety And Welfare) Regulations

British Standards issued by the British Standards Institute

Control of Substances Hazardous to Health (COSHH) Regulations

Disability Discrimination Act (DDA)

Factories Act

Fire Authority Regulations

Gas Supply Authority Regulations

Health & Safety at Work Act.

Local Authority Standards & Regulations

Local Laws & By-Laws

Offices, Shops and Railways Premises Act

Specifications and Codes of Practice of the British Standards Institution and European Community.

The Bye-Laws and Regulations of the Local Authority including the Fire Prevention Officer

The COSHH (Control of Substances Hazardous to Health) Regulations.

The Gas Safety (Installation and Use) Regulations

The Regulations under the Electricity Supply Factories Acts.

The Workmanship and Standard Clauses of the National Engineering Specification

Water Supply (Water Fittings) Regulations.

The ILP (Institute for Lighting Professionals) guidance note for the reduction of obtrusive light.

1.3 LIFE CYCLE

Analysis of Building Services Life Cycle shall be considered during the design and will have a direct bearing on the validity of the proposals.

The factors which will affect the life cycle replacement include the following:

- Configuration
- Cost of disposal
- Cost of replacement plant, materials, etc.
- Initial selection of components
- Intensity of use and hours of operation
- Planned preventative maintenance regime etc.

Expected life cycle of mechanical building services equipment shall be as detailed within CIBSE Guide M Maintenance Engineering and Management, Appendix 12.A1: Indicative economic life expectancy.

1.4 METERING

Good metering is a fundamental energy monitoring and targeting tool and an essential part of energy management.

Provision shall be made to ensure all of the plant shall be supplied via energy meters to enable at least 90% of the entire building's estimated annual energy consumption.

This shall use one or a combination of the following techniques:

- Direct metering
- Measuring of run hours for a piece of equipment
- Measuring of flow rates and temperature differences
- Estimating consumption by difference (not preferred)
- Estimation of non-constant small loads in accordance with CIBSE Guide F, chapter 11.

Sub-metering shall be provided to enable the energy for all fuels to be directly measured, as follows:

- Mains Cold Water
- General Lighting installations
- General LV Power installations
- External Lighting

1.5 DISRUPTION AND ISOLATION OF SERVICES

All of the areas outside of this project demise shall be considered to be operational throughout the entire duration of the contract works, including weekends and public holidays.

Building services to occupied areas adjacent to the contract works in use shall be maintained at all times during the works. The procedure for isolating existing services shall be agreed in advance with the site maintenance team.

A minimum of ten working days' notice will be required in advance to allow adequate resource to be allocated.

Temporary services and/or diversion of any existing services as required to maintain continuity of services to any existing areas in use during the works shall be allowed for within the contract sum.

Any electrical isolation including data communications and security system(s) and/or shut down works shall be advised ten working in advance and in the form of a detailed Risk Assessment and Method Statement (RAMS), detailing the works, areas to be isolated and detailed schedules with marked up general arrangement plans showing areas that shall be left without general LV power, comms or security provision for the duration of the shutdown proposed.

Timescales for electrical shutdown works in terms of commencement, duration and completion shall form part of these RAMS.

1.6 WORKING OUTSIDE SITE BOUNDARIES

The project is expected to take place entirely within the site boundary.

1.7 ENERGY STANDARDS

Energy consumption should be minimised by using latest and efficient equipment and appropriate control. All projects should aim to deliver an energy saving compared to the existing operation.

During construction, energy consumption is to be minimised wherever practicable.

1.8 LOW AND ZERO CARBON (LZC) TECHNOLOGIES AND SUSTAINABILITY MEASURES

Full guidance and requirements are to be determined following on from the Planning Application documentation and requirements required therein.

The client has an aspiration to omit gas use and provide the building with suitable LZC technologies to provide heating and hot water generation to the building and to offset any Carbon Footprint associated with their construction and operation.

All proposed systems will need to be confirmed by the Client and to comply with the requirements set out in the Planning guidance & Approved Documents.

In addition, all proposed systems shall take in to account spatial, aesthetic, structural and noise implications and shall be proposed to compliment the scheme. LZC technologies shall not be included for the sake of them and common sense shall be used in their selection.



Figure 2 – Typical Air Source Heat Pump for Heating and Hot Water Generation for Small Scale Applications².

All materials, building services equipment and plant shall be selected to operate to minimise energy use and final design shall be undertaken, to ensure systems are designed, constructed and commissioned to minimise energy use.

1.9 COMMISSIONING

Effective commissioning of buildings can reduce energy consumption by as much as 16% (According to BUILD UP: The European Portal for Energy Efficiency in Buildings). This will have a marked impact on profit margins for a negligible financial outlay.

The systems installed as part of this project shall be commissioned in accordance with CIBSE and BSRIA commissioning codes and in conjunction with a dedicated commissioning specialist.

A commissioning programme shall be provided, indicating time scales and responsibilities, for inclusion within the main programme of works.

Compile a detailed commissioning programme.

Compile and submit to the project supervisor the appropriate health and safety method statements and risk assessments.

Establish a means (such as checklists) of monitoring the progress of the commissioning.

Ensure that all parties involved on the commissioning process have documentation procedures for dealing with variations to contract. Ensure that a control mechanism is set up which includes documentary back-up of what has been changed, how and why.

Establish a consistent numbering system to identify work items.

Ensure the consistent use of mnemonics to identify all central control/building management components and devices.

Ensure regular database and configuration back-ups are made throughout all stages of the commissioning process.

² Mitsubishi Electric <https://es.mitsubishielectric.co.uk/>

Ensure attendance of all appropriate and responsible parties for interface pre-commissioning tests (interface between central control/building management and other plant items/systems).

All commissioning test results shall be presented on typed sheets that clearly identify the system being tested, the design criteria and the achieved criteria, to the Engineer for comment.

Systems that operate within a range of -5%/+10% of the design criteria shall be deemed acceptable.

Outwith this margin the systems should be assumed to be unacceptable and remedial work shall be required, though at the discretion of the Engineer the system may be accepted if the Engineer is content that the functional effectiveness and the efficiency is not compromised by so doing and that the system will operate within design margins.

Following any remedial works the full commissioning for the system affected shall be repeated and new test sheets issued for comment.

1.10 SEASONAL COMMISSIONING

There is growing recognition that not all aspects of the commissioning of a building and its engineering services systems can be carried out during the normal contract period. Some aspects, such as full load performance, can only be fully assessed when the external conditions represent the full load, or maximum design parameters.

All water and energy consuming systems shall be commissioned in accordance with CIBSE and BSRIA guidance including seasonal commissioning for the first Twelve [12] months of occupation and in conjunction with a dedicated commissioning specialist.

1.11 PURCHASING AND PROCUREMENT

All suppliers and installers will be ISO14001 accredited, or have an equivalent and acceptable practice in place.

1.12 WASTE

All contractors will provide a site waste management plan and comply with The Waste and Resources Action Plan (WRAP) policy of halving waste to landfill.

Additionally, using WRAP as a monitoring tool, contractors will ensure that a minimum of 60% of the overall site waste is recycled, including the enabling/strip out works.

For example, the use of prefabricated components, such as for the toilet facilities shall be maximised.

1.13 WATER CONSUMPTION

During construction, water consumption is to be minimised wherever practicable.

Appliance selection and systems design will target to achieve a potable water consumption of 25% or less than the requirements set by the Building Regulations, Part G.

1.14 EMISSIONS TO AIR AND WATER

Noxious emissions to atmosphere or to the drainage are not anticipated for this project.

Exhaust outlets from ventilation systems or heat rejection units shall be located at least five [5] metres away from any opening or intake point.

1.15 BIODIVERSITY

Please refer to the planning documents.

1.16 NOISE

Any potential plant noise shall be attenuated and plant and equipment set on anti-vibration mountings to ensure there is no increase in background noise levels to the adjacent occupied areas.

1.17 COMMUNITY ENGAGEMENT

Please refer to the planning documents.

1.18 TRAVEL AND TRANSPORT

Full guidance and requirements are to be determined following on from the planning documentation and requirements.

All suppliers and installers will be ISO14001 accredited, or have an equivalent and acceptable practice in place.

1.19 BREEAM RATING

Not applicable.

1.20 ARCHAEOLOGY

Full guidance and requirements are to be determined following on from the planning documentation and requirements.

1.21 MAINTENANCE ACCESS

All building services installations shall be installed in such a manner that will aid future maintenance and provide free and unrestricted access.

As part of the handover completion documentation RAMS shall be provided for each building services element to identify and clarify procedure required to both access and to maintain the completed installation(s).

1.22 DESIGN MARGINS

The design proposal shall provide a min. of 10% spare capacity is built into all Electrical installed systems.

It shall be noted that whilst the above shall be taken account of in the contractor's final equipment selection, unnecessary oversizing of plant and systems shall be avoided.

Where space is allowed for future extension, the contractor shall ensure that the equipment is positioned such that the anticipated growth can be accommodated.

As part of the design development process clear identification shall be provided within the design development package of all design margins applied to this project.

Design limits and/or operating limits shall also be clearly stated.

1.23 FUTURE NEEDS

The contractor shall prior to commencing his developed and technical design set up a specific design workshop with the client project team and the engineering consultant to review and agree any client aspirations and/or future needs, specific spare capacity and/or flexibility in respect of the MEP building services and the associated plant and equipment that form part of this scope of works.

Future needs shall cover the potential for future flexibility, change in operation and building use including any planned future expansion.

1.24 PLANT SPACE ALLOWANCE

Location of plant and equipment shall be reviewed prior to installation to ensure that the optimum position is considered and coordinated.

Allow adequate space for installation, access and potential plant and equipment replacement.

Outline external plant space allowances have been allocated as part of this RIBA Stage 3 report and are defined on the GA plans.

Allow adequate space for installation, access and potential plant and equipment replacement. Consider access for delivery and getting the plant and equipment onto the appropriate floor level and into the specific plant area, including where necessary, craneage.

1.25 SPATIAL COORDINATION

As part of the design development a fully coordinated set of drawings shall be prepared and issued to the Client project team for review and comment.

The successful contractor shall prepare the following coordinated installation drawings for review prior to first fix:

- Builders work in connection (BWIC) layouts
- Coordinated working drawings
- Details and sections /elevations as required
- Installation drawings
- Layout plans (general arrangement) at 1:50 scale
- Manufacturers/factory-built assembly drawings
- Phasing drawings
- Schematic diagrams

Identification of potential clash points shall be completed early in the project design programme to allow sufficient time for review and resolution and input if necessary from the Client project team.

Any services that pass-through fire compartments/fire barriers shall be appropriately fire sealed/stopped and coordinated with the building fire strategy. Fire stopping shall be installed to maintain the integrity of the fire compartment for which the associated services penetrate. All fire stopping shall be installed in compliance with manufacturers/suppliers recommendations and guidance.

Fire board/fire batt shall be provided throughout – foam is not acceptable.

All access doors, hatches and access to services for maintenance shall be left unhindered on completion, this includes services that may fall outside this scope of works, for example services such as (but not limited to) mechanical services ventilation and the like, smoke ventilation, sprinklers, general LV power, general lighting, emergency lighting, data communications, fire detection and alarm, security, closed circuit television and building management systems.

1.25.1 Covering Up

Ensure no section of the Works are covered, concealed or insulated until completion of a witnessed satisfactory test.

Give notice when Works which are to be covered or concealed are ready for examination and/or measurement, not less than ten working days.

Give notice to:

- EA/CA.
- (Services) Engineering Site Staff.

1.26 COMPLIANCE WITH HEALTH AND SAFETY (H&S) REGULATIONS

The contractor shall provide appropriate documentation for all mechanical & electrical services requiring isolation, diversions, temporary installations and permanent installations to demonstrate full compliance with all current H&S legislation.

Documentation shall be submitted in accordance with the Employers Requirements and shall be submitted and comments returned by the Client team in advance of commencing the work.

1.27 MANUAL HANDLING

The design process to date has considered the effects of manual handling associated with the building services installation, equipment and plant.

Where practical the risks have been mitigated and equipment specified which can be installed in accordance with the manufacturers' recommendations, Construction Design and Management (CDM) Regulations and Health & Safety Executive (HSE) Guidance.

The following shall be considered:

- Ensuring the design allows for enough space/"acces contr for mechanical handling
- Ensuring the design information includes where applicable equipment and plant weights
- Lifting points where necessary
- Specifying reduced weight material(s)

Where manual handling cannot be avoided the contractor shall undertake appropriate risk assessment and produce specific method statements for submission to the Principal Designer for approval.

1.28 PROGRAMME, PHASING & MONITORING INSTALLATION WORKS

The appointed contractor will be responsible for programming design development, procurement, installation, commissioning and handover of building services installations in accordance with the employer's requirements and associated specifications and procedures.

Refer to the Employers Agent/Contract Administrators information for details of the proposed project phasing.

All works shall account for the phased handover of the project and including for interaction, interface and coordination with the planned sectional completion should it be required.

Provide detailed sub-programmes to aid the production of a Master Programme for the Contract Works.

Due allowance is to be made in the programme(s) for the Works for, but not limited to, the following:

- Ordering and installation periods.
- The completion of drawing, etc. including the minimum working days for comment, ten working days.
- Work resulting from instructions issued in respect to the expenditure of provisional sums.
- Concurrent work by other trades.
- Any temporary works necessary for the completion of the engineering services installations.
- Pre-commissioning, commissioning and performance testing of the engineering services installations.
- Preparation and provision of Record Drawings and Operating and Maintenance Manuals.

Provide programme information as:

- Critical path network.

Provide a separate and detailed commissioning programme for agreement with the EA/CA. Make due allowance for the following:

- Commissioning, demonstration and instruction procedures.
- Provision of written notice before each (or series of) test, inspection, commissioning or demonstration procedures are to be carried out, not less than ten working days in advance.
- Demonstration to the EA/CA that test instruments and equipment are accurate.

The appointed contractor will be responsible for the quality control of the installed building services installations and commissioning/handover associated with these installations. The client team will monitor on behalf of the client the efficacy of the contractors programming and quality control systems.

It should be noted that the Client team will expect a dedicated technical services manager working for the main contractor to manage and oversee the design development, coordination, procurement, installation, commissioning and handover of building services installations in accordance with the employer's requirements and associated specifications and procedures.

1.29 BUILDING SERVICES SURVEY AND VALIDATION

Validation survey works shall be undertaken by the contractor for review and comment by the Client project team.

Ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the Works. Before commencing work, carry out a survey and examination of the engineering services. Examine all available drawings of the engineering services and report any discrepancies to the EA/CA.

Validation surveys shall determine the following:

- Space allocation
 - Location of existing services
 - Areas served
 - Services capacity, spare capacity and operational characteristics
 - Existing services connections, equipment locations, equipment condition and services routes
 - Existing services connections, equipment locations, equipment condition and services routes
- Review and verification of existing services drawings and schematic diagrams including, utility search information and buried services.

1.30 SUBMITTALS AND APPROVALS

1.30.1 General

This section outlines the requirements and procedures for submittals to the Employers Agent (EA) or Contract Administrator (CA).

1.30.2 Submittals

Prior to any orders being placed the CA shall review all drawings and manufacturer's details.

Submittals shall be in a clear, definable and easily read format with the specified technical details, notes, performance data and calculations where applicable all in the English language.

Where drawings are to be examined the manufacturer's details shown on the drawings must have been previously approved.

Include all costs for attending meetings associated with the submittal review procedure.

Agree with the CA where samples of materials offered for review are to be sent.

Issue progressively drawings, calculations and submittals as agreed in advance with the CA for review. All correspondence related to the examination and review procedure shall be directed through the office of the EA/CA. The time scale for review or comment or otherwise on all submittals shall be minimum ten working days.

1.30.3 Schedule of Drawings and Submittals

Provide a schedule of all proposed drawings and submittals required for comment. The schedule shall be provided two weeks from contract appointment.

Indicate as a minimum the following information on the schedule:

- Drawing number and revision number
- Drawing title and service
- Scale
- Latest date required on-site and/or for manufacturing purposes
- Date required for final comment
- Date for submission for comment
- Date of commencement of drawing production

The schedule shall be updated as necessary on a regular basis at intervals agreed with the EA/CA during the contract period.

The programme for production of drawings and other submittals should include the necessary time for:

- Submission
- Examination
- Alterations and re-submission in the event of the initial submission not being accepted
- Final issue

Allow adequate time in the programme in order not to cause delays. The full extent of all submittals shall be indicated in the schedule. Group submittals for a particular part of the building or building engineering service as agreed with the EA/CA.

1.30.4 Calculations

All calculations must be presented in a logical format and prepared to a recognised and agreed format and be suitably indexed.

All software programs used in the preparation of designs shall be agreed with the EA/CA prior to commencement of design activities. The use of unverified software must be declared and the initial outputs justified by full and complete hand calculations.

Software used in calculating the energy performance of buildings, as required under Part L of the Building Regulations, shall be as approved by the Building Control Body (BCB) and agreed with EA/CA prior to commencement of use.

Calculations that are preliminary in nature, i.e. do not form part of the final submittal, are to be referenced independently and clearly indicated 'Preliminary'.

State the methodology, formulae, design criteria, assumptions and all design margins used in the calculations.

Where necessary calculation sheets shall be accompanied by an annotated layout drawing identifying terminals, fittings and the particular sections of ductwork or pipework.

Each calculation sheet, drawing or schedule shall clearly identify the originator, date of production, checker (who signs or initials) and date of check.

The time scale for review or comment or otherwise on all submittals shall be minimum ten working days.

1.30.5 Equipment Performance Details

Details of the equipment selected for inclusion into the Works shall include the following information:

Plant item description, reference identification and serial number.

Electrical input rating – kVA, Volts, Phase.

Power, pressure rating, pressure drop, flow rates etc.

Operating mode – duty, standby, generator etc.

Starting characteristics – starter type, current, starts/hour and starting time.

Performance characteristics – (full load current and power factor).

Noise level.

Weight.

The format of the information shall be as agreed with the EA/CA.

1.30.6 Preparation of Drawings

Agree with the EA/CA a document numbering system prior to preparing any documents.

All drawings shall be prepared using a computer aided draughting system and the software used to produce drawings shall be approved prior to commencement of drawing production.

Each service shall be represented by a separate layer/overlay, for subsequent easy modification.

Prior to commencement of drawing production agree the sequence of layers, pen colours and sizes.

The medium for transfer of information shall be:

- Electronic

AutoCAD and Revit drawings files shall be:

- *.DWG
- *.DXF
- *.RVT

Drawing plots shall be "A" size to British Standard, with an agreed logo/title block.

The standard drawing size is to be:

- A1

Scales used on drawings shall be:

- Selected to convey clearly the proposals.
- GA's at a minimum 1:50.

1.30.7 Review of Submittals

Submittals shall be examined for:

- Compliance in principle with the design intent.

Such examination shall not relieve any responsibilities and obligations under the contract.

Examination of any submittal by the EA/CA shall not mean that the EA/CA is responsible for the correctness of the drawing or submittal or its suitability for purpose. These responsibilities shall remain as defined elsewhere and as the contract.

Allow adequate time in the programme for submittals with due allowance for incorporation of comments and resubmission in order not to cause delays.

Each package shall contain all drawings, design calculations, support information, manufacturer's literature, etc. necessary to facilitate examination by the EA/CA.

Revised items on drawings shall be clearly indicated and annotated with a revision number/letter.

Submittals shall be returned indication action:

"A" action

Examined no comments.

"B" action

Examined subject to minor amendments.

"C" action

Examined subject to major amendments.

In this case the drawings shall be re-submitted after correction or with further information added.

1.30.8 Mistakes in Submittals

Examination and/or issue on a EA/CA instruction of submittals shall not be deemed to remove any duties, obligations and responsibilities under the contract.

Be responsible for any error, discrepancy or omission in any submittal, presentation or drawing prepared or where others have prepared these for submittal.

The said indemnity shall be subject to the proviso that such error, discrepancy or omission is not due to any inaccurate data, drawing or information provided by the employer or by the EA/CA on his behalf.

1.30.9 Samples

Provide free of charge samples of material and workmanship proposed to be used in the Works.

Samples shall include all alternative finishes available if required.

In the case of articles of special construction:

Drawings may be temporarily substituted for the samples

Drawings when approved will be retained until the articles concerned are supplied, as a sample

The samples submitted and approved, shall remain the property of the Employer until the completion of the contract.

Approval of the EA/CA shall be obtained before equipment is placed on order.

The CA will undertake to approve samples within two weeks from receipt.

1.30.10 Revisions to Drawings

Where revisions take place either under the authority of a EA/CA instruction, or by written agreement with the EA/CA or when revised architectural, structural or services information is issued, all drawings shall be modified accordingly and shall be re-issued for construction purposes subject to examination by the EA/CA.

The issue of revised drawings shall be in accordance with, and with regard to the agreed programme for construction, and where time is available re-issues shall be grouped together as agreed with the EA/CA.

1.31 COMPUTER DESIGN CALCULATIONS

For CDP elements as stated within Section 1.1, the contractor will submit full design calculations for sample checking, review and comment. The design responsibility for these calculations remain with the contractor.

If the contractor proposes to utilise computer aided design calculation software in the production of design calculations or information for this project the following shall be adhered to:

- Only validated and correctly licenced software shall be used
- Ensure all design input data is relevant to the computer software being proposed for use
- Record all input data
- Record all design assumptions
- Output data shall be provided to the Client project team for review as part of the contractors proposed detailed design package

Whilst the use of computer design calculations is noted as a design tool, it remains the responsibility of the contractor to thoroughly check his proposal including all input and output data.

Building services calculations shall be undertaken by a competent design engineer and checked/signed off by a member of the Chartered Institution of Building Services Engineers (CIBSE) or equivalent.

1.32 APPEARANCE

All electrical panels, interfaces, switches etc. to be recessed, apart from within dedicated plantrooms and utility cupboards.

All services shall be set out in a neat, tidy and well organised manner.

Where services are exposed within plant rooms for example, they shall be left in a clean state, well finished without:

- Rough edges.
- Visible adhesives smears.
- Paint splashes.
- Mismatching alignment of labelling or protective wraps.
- Ill-fitting labels or protective wraps showing ripples or creases.
- Excessive, unsightly offsets and elbows.

The exposed services shall be installed:

- Using parallel runs where possible.
- Running services in consistent planes where possible (where pipes of different diameters are running together the underside of the insulation shall form one plane, this will mean centrelines are not in the same plane).
- Consistently spaced where services are running parallel.
- With consistent arrangement of supports for services set up to align with architectural elements wherever possible (i.e. 300mm grid).
- Very tidily with particular attention paid to junctions, joints etc.
- With runs parallel to structural lines and with due respect for the orientations, alignments and positions of architectural elements.

Any exposed wall-mounted mechanical and electrical services accessories, panels etc., are to be finished in brushed stainless steel.

Provide polypropylene cover trims and end caps to the services support system. Trim all drop rods and services supports to matching lengths where possible. Run all service supports in parallel lines.

At the first available opportunity complete an example area of the exposed services installation featuring all services anticipated. This installation is to be offered to the client design team for comment on appearance and form a benchmark for the appearance of other parts of the services.

1.33 OPERATING AND MAINTENANCE MANUALS (O&M'S)

On completion a full set of record information and a handover pack in the form of an operating and maintenance manual shall be provided.

Handover documentation and O&M's shall be provided in accordance with the guidance provided with BSRIA AG1/87.1 and BG79/2020.

A quality description of the building services shall be provided and this shall include easy to understand descriptions of how the users operate the systems including the impact on the heating/ventilation of manually opening doors and windows.

Our handover checklist is provided in Appendix G and O&M checklist is provided in Appendix H.

As part of the handover completion documentation RAMS shall be provided for each building services element to identify and clarify procedure required to both access and to maintain the completed installation(s).

Operating and maintenance documentation including record drawings shall be provided ten working days in advance of the proposed project completion date and made available electronically to the client team for review and comment.

Final O&M documentation (deliverables) shall comprise:

- Record drawings
 - PDF and Revit (.RVT)
- Hard copy, 2x A3 size (colour where appropriate) and full size schematics (placed in the frames within each switch room)
- Electrical Test Certification
 - PDF format to verify all cabling connections have been tested in accord with BS87671 and NICEIC guidance. All electrical test certification shall be NICEIC approved format.
 - Hard copy, 2x A4 size.
- Mechanical Test Certification
 - PDF format to verify all services have been tested in accord with the relevant standards. All test certification shall be in a suitable and agreed format.
- Hard copy, 2x A4 size.

The provision of O&M's as part of the handover and close out stage of the project is a pre-requisite to practical completion.

Failure to provide O&M's to the quality specified or within the required time periods will result in instructions being placed with a specialist firm to produce these documents as a separate work stream. All costs ensuing will be contra charged to the contractor's final account at no extra cost to the contract.

1.34 SOFTWARE

Obtain on behalf of the end user all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights.

Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Ensure that application software is written in compliance with BS 7649.

1.35 BUILDING INFORMATION MODELLING (BIM)

Not applicable.

2.0 DESIGN CRITERIA

2.1 MANHOLES, ACCESS CHAMBERS AND DRAW PITS

Where required these are to be brick built, minimum 600mm x 800mm, with a cover rated to match the loading of the landscaping it is situated within. Where they are within hard landscaping, the lid is to be recessed to allow inclusion of matching surface e.g. brick paving.

Provide all necessary ducts and draw pits.

For the HV/LV services, these are to be sized at least 400mm larger than the minimum bending radius of the cable.

Through pits to be provided at intermediate points, at a maximum spacing of 25m.

2.2 BELOW GROUND SERVICES

Where services are run below ground they are generally to be outside the building footprint.

Where they do pass beneath the building footprint (e.g. incoming HV/LV, water, data connections), the runs beneath the building footprint are to be as short as possible. All services shall avoid tree planting/roots and where this is not practicable, root barriers shall be installed.

All setting-out, excavation works and backfilling of trenches for the below ground services is to be in accordance with relevant National Joint Utilities Group (NJUG) guidelines and relevant British Standards, including the provision of temporary fencing, bridging, barriers and watching required.

The contractor is to determine and propose final routes for approved by the client team before work commences on site. Routes to follow the features of the site such as roadways and building lines. Road crossings are to be at right angles to the line of the road.

Commence sand backfill immediately following the successful inspection of both the trenches and newly installed services. Closures are to be left exposed until testing and inspection has been successfully completed. Ensure no damage is caused to the trench or services during the backfill process.

The separation distances between services are to follow the NJUG minimum separations shown opposite.

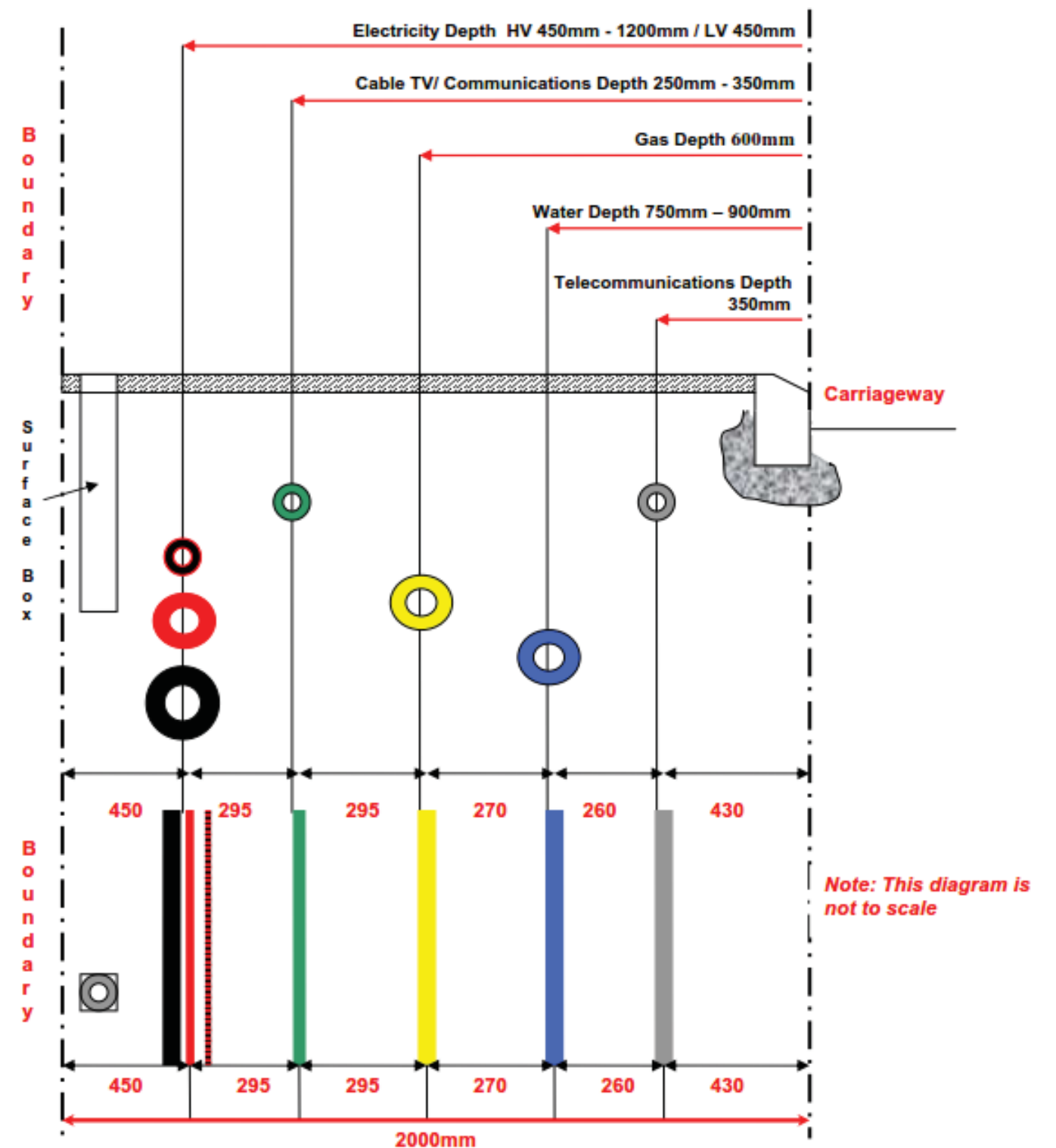


Figure 3 - Recommended Positioning of Utilities Apparatus in a Two Meter Footway³.

³ National Joint Utilities Group (NJUG) Guidelines on Positioning and Colour Coding of Underground Utilities Apparatus Volume 1.

2.3 FOUL DRAINAGE ABOVE GROUND

The foul drainage above ground systems shall be designed to Approved Document H and BS EN 12056.

All systems shall be vented to atmosphere at high level above the roof line utilising vertical stacks, except for stub stacks serving one WC pan and one wash hand basin waste.

All pipework serving more than one WC shall have a screwed capped end which will be turned up within the IPS to allow ease of access. All main pipework to ground connections shall have an inspection panel, which is coordinated with any covering.

2.4 DOMESTIC HOT & COLD WATER

The domestic hot and cold water services shall be designed in accordance with BS EN 806-2, BS EN 806-3 and supplementary guidance in BS 8558, CIBSE Public Health Engineering Guide G, CIBSE TM 13, HSE Approved Code of Practice & Guidance L8 (The Control of Legionella Bacteria in Water Systems), the requirements of the Water Supply (Water Fittings) Regulations 1999, comply with appropriate WRAS guidance., BS8558 and HSE ACOP L8.

2.5 PIPEWORK GENERAL

All pipework shall be selected for suitable for use and conditions.

Minimum pipe and system efficiencies shall be as follows:

PIPEWORK (MAXIMUM ALLOWED)	
HWS/LTHW Heat losses up to 25mm dia	6 Watts/metre
HWS/LTHW Heat losses 26mm to 50mm dia.	7 Watts/metre
HWS/LTHW Heat losses 51mm to 80mm dia.	10 Watts/metre
HWS/LTHW Heat losses 81mm to 150mm dia.	12 Watts/metre
HWS/LTHW Heat losses 151mm dia. & above	15 Watts/metre
LTHW Friction losses (index runs)	160 Pa/ m
LTHW Friction losses (non-index runs)	300 Pa/ m
CWS Friction losses (index runs)	220 Pa/ m
CWS Friction losses (non-index runs)	320 Pa/ m
HWS Friction losses (index runs)	190 Pa/ m
HWS Friction losses (non-index runs)	260 Pa/ m
HWS Return Friction losses (index runs)	160 Pa/ m

Table 1 – Minimum Pipe and System Efficiencies.

Minimum hot and cold water valve ratings shall be PN10 between 0 and 80°C and heating system valves shall be rated PN 16 between 0 and 95°C.

Copper pipework shall be to BS EN 1057, with long radius bends and fittings.

Steel pipework shall be to BS EN 10255 and BS EN 10216 minimum wall thickness of 6.0 mm, with long radius heavy grade steel fittings.

Test pressures for water-based systems shall be a minimum of 2 times maximum operating pressure for a minimum of 90 minutes.

2.6 INSULATION

The contractor shall provide the following information in relation to all insulation used on any part of the project.

This information must be obtained from all suppliers used to supply insulation to the project:

- Calculations for thickness for each service to meet energy requirements.
- Thicknesses shall exceed BS 5422 in accordance to achieve the performance requirements of section 2.5.
- The insulation must be foil faced mineral wool to Green Guide rated A or A+, with C rating for fire protection.
- Cold/cooling water pipework shall be vapour sealed with breaks at valves only.
- The insulation must be certified in accordance with an appropriate responsible sourcing scheme, such as BES 6001 or ISO 14001.
- Data sheets from all their suppliers for insulation materials, confirming that the products ordered for use on the development meet the above criteria.

Where the insulation is contractor designed it shall have a maximum thermal conductivity of 0.038 W/mK all other insulation should be selected and installed in accordance with the relevant BS and manufactures information.

Within all plant rooms, voids and risers proprietary insulation is to be provided to all major and minor plant, equipment, pumps and valves. In order of priority the following are to be used:

- Manufacturer supplied insulated casings.
- Valve bags.
- Materials shall be supplied by a member firm of the Thermal Insulation Manufacturers and Suppliers' Association.

Where possible, the number of mechanical and electrical sensors are to be minimised by using sensors that are common to several systems, or providing a communication interface between the systems to allow information to be transmitted.

Insulation shall be installed in accordance with the MANUFACTURER'S recommendations and shall be continuous. All valves shall be fitted with proprietary manufactured valve covers with Velcro fastenings for easy removal.

Isogenopac shall be applied to all pipework within the ground plantroom.

All insulation for pipes and ducts shall be fitted with direction service labels to BS1710 specification for identification of pipelines and services, with a maximum spacing of 3 metres for services.

Insulation to refrigerant pipelines shall be Armaflex or equivalent and be fastened not to compress the insulation, the completed installation shall be painted with UV resistant paint where exposed.

2.7 THERMAL EXPANSION

Design ductwork and pipework arrangements to negate the damaging effects of pipework expansion without the need for expansion bellows or flexible connections where practical.

2.8 AMBIENT TEMPERATURE

EXTERNAL DESIGN CRITERIA FOR DUTY:	
Winter	-1.7°C, 100% saturated
Summer	26°C dry bulb, 18°C wet bulb

Table 2 – External Design Criteria.

EXTERNAL DESIGN CONDITIONS FOR OPERATION OF PLANT:	
Winter	-4°C saturated
Summer	30°C dry bulb, 22°C wet bulb 50% RH

Table 3 – External Design Conditions for Operation of Plant.

Note: External temperatures taken from CIBSE Guide A 2015 inc. 2019 Corrections P2-7 Table 2.5 99% & P2-8 Table 2.6 1%. (London).

2.8.1 Internal Air Temperature

The building is expected to comply with the CIBSE guidelines with regard to the internal air temperature criteria and as detailed within the Room Data Sheets (RDS).

2.8.2 Outside Air Temperature Sensors

Not applicable.

2.9 WIRING AND CONTAINMENT FOR MECHANICAL SYSTEMS

Refer to the requirements for general wiring and containment specifications and installation practices described for electrical systems. These are also to be applied to the wiring and containment of all mechanical systems.

2.10 HEATING SYSTEMS & COOLING SYSTEMS

All heating systems shall be compliant with relevant CIBSE guidance and British Standards.

All insulation for ducts shall be fitted with direction service labels to BS 1710 specification for identification of pipelines and services, with a maximum spacing of 3 metres for services.

All DX systems and plant shall use R32 or R744 refrigerant (or lower GWP types if applicable).

2.11 NATURAL GAS SYSTEM

Not applicable.

2.12 GENERAL VENTILATION

Generally, for internal occupied spaces, allowance for fresh air shall be made in accordance with Building Regulations Part F including those which are heated, ventilated and air conditioned.

Mechanical ventilation shall only be provided to spaces as required for the removal of odour, and to control temperature or humidity levels where these criteria cannot be satisfied by natural means.

In the case of conflict or absence of data, the ventilation flow rates criteria given in the CIBSE Guides for equivalent area/room types shall be used.

All motors to be minimum efficiency of IE4 controlled by variable speed (inverter) drives.

All ductwork shall be insulated with mineral wool insulation to BS 5422:2009 to prevent heat losses and condensation formation on surfaces. General ventilation system shall comply fully with Building Engineering Services Association (BESA) DW 144 2016 Specification for Sheet Metal Ductwork, using galvanised mild steel ductwork.

All ductwork shall be constructed and installed to BESA Classification 'C' (High pressure up to 1,500Pa), to minimise air leakage.

Configure the thermal conditioning control system to allow for a temperature dead band of at least 4°C in order to reduce the risk of heating and cooling simultaneously and to reduce energy consumption.

Fusible link activated fire dampers shall be provided wherever ductwork passes through fire sub compartment walls, ceilings and floors in accordance with the fire officer's requirements.

Fire dampers shall have rectangular or circular spigots, be sized to match adjoining ductwork and be complete with installation frames for building into brick/block wall structures or wall plates for installation in stud partition walls.

All dampers shall be installed in accordance with the manufacturer's recommendations.

An access door shall be provided on one side of the damper of a size at least 400x600mm, placed on the bottom or side of the duct where the damper is built into a vertical wall. If the size of the duct is less than 425mm on width dimension, then access doors at least 150 x 300mm shall be fitted either side of the fire damper.

Similarly, for fire dampers built into floor slabs, the same positions for access doors shall apply, except the doors shall be positioned nearest the fusible link. The position of all access doors shall enable the fusible links to be replaced at a later date.

All fire dampers shall be fire rated in accordance with BS EN 10294-1:2005 and be fully compliant to BESA DW/145.

2.13 TOILET VENTILATION

All toilet ventilations systems shall be compliant with CIBSE guidance and DW 144.

Plant efficiencies shall be as for general ventilation section 2.10 of this report and maximum absorbed energy as follows;

Toilet extract fans with heat recovery	0.5 W/l/s
Toilet extract fans without heat recovery	0.3 W/l/s
Minimum ventilation heat exchange efficiency	75%

All insulation, ductwork, motors and speed controllers shall be to the standards identified for general ventilation above.

Toilet ventilation flow rates to comply with building regulations approved document F.

2.14 KITCHEN VENTILATION

The building is to operate a kitchen with domestic type appliances and therefore all kitchen ventilations systems shall be compliant with CIBSE and HSE guidance, DW 172 and as referred to DW 144.

2.15 HIGH VOLTAGE (HV) SUBSTATION

Contractor will have to apply for new connection to the local DNO as part of the project works to assess any need for a new substation.

2.16 LV DISTRIBUTION

Where systems are to be used as life safety and/or specified to be maintained/operational 'under fire conditions' ensure wiring selected is suitable for the temperatures to be encountered and fully compliant with BS 7671.

Cable containment shall be sized to allow a spare capacity of at least 10%.

LV panel boards and distribution boards shall be sized to allow 20% spare capacity. 10% of these spare ways shall be equipped with spare circuit protection devices; these shall be a representative selection. The remaining 10% of spare ways shall be unequipped and fitted with blanking plates.

2.16.1 Containment Groups

The following containment groups shall be used through the building. Services in different groups shall not share common containment.

LV1 – LV distribution

LV2 – General lighting & general LV power and final circuits

FA – Fire detection/public address voice alarm cabling

COMMS – Data

2.16.2 Containment Separation Distances

LV and mains cables, including lighting and general LV power circuits (Band II) shall not be grouped with sensitive cables (i.e. data or control cables – Band I).

Cables of different categories (e.g. Information Technology (IT) and power cables) shall not be in the same bundle or conduit.

Different bundles shall be separated electromagnetically from each other, either by using a suitable cable containment as a screen, or by placing the cables in different conduits.

Cables, when crossing (which should be avoided as much as possible), shall cross at right angles.

Screened coaxial signal (and control) cables carrying High Frequency (HF) signals can be bundled. An additional shield around the bundle reduces the coupling to the environment by providing a good path for any overall

Common Mode (CM) current.

Twisted pair (signal and control) leads can be bundled, provided that each pair is twisted separately.

Where parallel cable runs are both screened / contained within closed trunking or conduit, the minimum separation distances should be such as to provide a neat and maintainable installation.

Comply with the requirements of BS EN 50174-2 and BS 6701.

2.16.3 Electromagnetic Screening

Provide best practice separation and screening of cables.

Minimise the risk to IT equipment and interconnecting cables from electrical hazards.

Provide the IT installation with a reliable signal reference and adequate immunity from electromagnetic interference carried by the earthing network.

Implement recommendations of BS EN 50310, BS EN 50173 and BS EN 50174.

2.16.4 External Containment

Wiring passing through the external envelope is to be contained in stainless steel conduits and fully concealed.

2.16.5 Wiring, containment and electrical accessories

Provide LS0H cable types for all power, data, control and signal cables of all mechanical and electrical systems.

The wiring of all security systems is to be run in galvanised steel cable trunking, or within galvanised steel conduit.

No exposed surface mounted or unprotected security system wiring will be acceptable in any location.

2.17 GENERAL LIGHTING

All lighting shall be Light-Emitting Diode (LED). The total lighting power density for the building shall be no greater than 4.5 W/m².

2.17.1 Light Colour

The colour temperature of all the lights in a particular space is to be the same.

All light fittings across the project are to be 4000K colour temperature with colour rendering index of 80 or more unless specifically noted in the luminaire schedule.

All LEDs shall be provided with a maximum bin segregation of 3 steps (3 step binning).

The design criteria for internal lighting shall consider the variations between building occupants and their tasks, age awareness of external weather conditions/ambient lighting levels and their expectations. The building is expected to comply with the lighting design criteria as detailed below.

ACCOMMODATION TYPE	LIGHTING LEVEL – LUX (AVERAGE)	EFFICACY – LUMINAIRE LUMENS PER CIRCUIT WATT (MINIMUM)
Circulation Spaces	100	130
Kitchen	500	115
Main Hall	500	120
Plant Room	200	130
Store Cupboard	100	115
WC	100	115

This list is not exhaustive. In the case of conflict or absence of data, lighting level criteria given in the CIBSE Lighting Guides for equivalent area/room types shall be used.

2.18 GENERAL LV POWER

All general LV power accessories for general use including light switches, socket outlets and data points shall be selected from the MK Logic Plus Graphite Grey range with white toggle switches to provide adequate colour contrast in accordance with DDA.

Additional general LV power shall be provided to suit the mechanical building services installation and as required by AV and IT equipment provision.

Cleaner's sockets shall be provided and spaced for coverage with a 10m radii throughout the project scope areas. All general LV power accessories located within plant spaces and within ceiling voids shall be selected from the MK Metal Clad range with white toggle switches to provide adequate colour contrast in accordance with DDA.

All visible mechanical and electrical accessories are to be set out in a neat, tidy and well organised way.

Additional general LV power shall be provided as required by life safety systems, including fire detection and alarm and disabled refuge emergency voice communication.

All exposed electrical accessories within plant spaces to be provided with a Traffolyte label identifying the final circuit reference.

All exposed electrical accessories to be discreetly labelled identifying the final circuit reference. Adhesive label with background to match accessory. For stainless steel accessories, labels to be white text on black background.

2.19 EXTERNAL LIGHTING

All external lighting shall be Light-Emitting Diode (LED) and have a minimum efficacy of 110 lumens per circuit watt and colour rendering Ra greater than 60. External lighting shall be automatically controlled for presentation of operation during daylight hours and presence detection in areas of intermittent pedestrian traffic.

Obtrusive light shall be, as far as possible, eliminated and shall meet levels advised by the ILP guidance on obtrusive light and BS EN 12464-2.

2.20 DATA COMMUNICATIONS

All data communications accessories for general use shall be selected from the MK Logic Plus range.

Additional data outlets shall be provided to suit the mechanical and electrical building services installation and as detailed within Section 4.0 of this specification.

2.20.1 Comms Room Requirements

Dedicated circuits shall be provided for the following:

- Circuit to each cabinet;
- Circuit for small power;
- Circuit for lighting;
- Circuit for ventilation and/or cooling.

Each circuit to be individually protected via circuit protective devices at the local DB to avoid a problem of one circuit affecting another and the operational thereof.

Cable entry from high level into the comms room is preferred and cables shall drop to low level behind the cabinet and enter each cabinet at low level.

2.20.2 Responsibilities Schedule

ELEMENT	PRINCIPAL CONTRACTOR	ELECTRICAL CONTRACTOR	DATA INSTALLER	END USER
Enabling Works	X			
Containment (External)	X			
Containment (Internal)		X		
Back Boxes		X		
Faceplates for Back Boxes			X	
Backbone Cabling			X	
Cat 6A Cabling (Horizontal)			X	
Cat 6A Cabling (Vertical)			X	
Flexible Conduit			X	
Server Cabinet(s)			X	
Fly Leads			X	
Patch Cords (Copper) (Supply & Install)			X	
Installation of Fly Leads			X	
Installation of Patch Cords			X	
Patching Schedule			X	
Cable Management System			X	
Wiring/Interface of Sub Systems		X		
Telephones & Active Hardware			X	
Servers/Active Hardware				X
Commissioning/Set Up			X	
Integration of Sub System Software (Software & Programming)		X	X	
Documentation	X	X	X	

The contractor shall review and cross reference with the client's ICT Responsibility Matrix.

2.21 CENTRAL CONTROL/BUILDING MANAGEMENT

2.21.1 General

Panel wiring shall be in accordance with the approved drawings and current edition of BS 7671. Cables shall be sized to take account of the de-rating required for areas with limited or zero ventilation and for bunching of conductors.

2.21.2 Wiring Type

Tri-Rated		
400V Power Wiring	-	2.5 sq.mm (minimum)
230V Power Wiring	-	1.5 sq.mm
Control Wiring	-	1.0 sq.mm

2.21.3 Wiring Colour

The cables shall be colour coded as follows:

Three phase circuits	-	Brown, Black, Grey
Neutral	-	Blue
Earth	-	Green / Yellow
230V AC control circuits	-	Phase Brown, Neutral Blue
110V AC control circuits	-	Red
24V AC control circuits	-	White
24V DC control circuits	-	Purple
Incoming voltages	-	Orange

All extra-low voltage wiring to input and output points on controllers shall be coloured purple. Any external supplies to the panel shall have isolating links provided on the terminal rail.

2.21.4 Door Wiring

Wiring from the panel interior to the panel doors shall be subdivided into reasonable sized bunches and run through proprietary flexible plastic tubing, such as that manufactured by Insuloid. The tubing shall be supported at both ends and have sufficient loop to allow unrestricted opening of the panel door. The tubing shall be not more than 75% full.

Wiring to components on the door shall be neatly cleated and supported to relieve the strain on the terminals. Spare cables shall be wired in on door loom numbered S1-S6.

Voltages higher than 230V AC (nominal) shall never appear on the panel door, thus wiring from the Black and Grey phases is prohibited, apart from phase indicating lamps.

2.21.5 Control Panel Finish

The external finish of the control panel shall be RAL 7032.

2.21.6 Control Panel Controller

The control panel shall be controlled by the latest Trend IQ4, IQ4E and Trend Open Network Node (TONN) controllers located in the panel.

The controllers are fed from the live side of the control panel isolator. This means that the controller will remain live when the control panel isolator is switched off.

The controller is protected by a circuit protective device. This will need to be healthy for the controls to operate and a connection to be established to the onsite supervisor.

2.22 ENERGY

All new plant items shall be designed to comply with the Non-Domestic Building Services Compliance Guide.

2.22.1 Pumps

All pumps shall have an Energy Efficiency Index (EEI) \leq 0.23.

All circulation pumps are to be variable speed and have an Energy using Products (EuP efficiency class IE3 or higher).

2.22.2 Fans

To demonstrate compliance with Specific Fan Power (SFP) requirements the Contractor is to provide full pressure drop calculations of the index run for each fan. All fans with absorbed power motors over 100 Watts shall have speed control by modulation of frequency or voltage.

Take all necessary steps to ensure that the SFP requirements are satisfied. Including but not limited to; low duct velocities, large face area terminals, turning vanes in duct fittings, custom ductwork, large face area attenuators.

2.23 DYNAMIC SIMULATION MODEL (DSM)

The dynamic simulation and thermal modelling shall be undertaken by the contractor. Final Building Regulations UK Part L (BRUKL) output and certified Energy Performance certificate (EPC) shall be provided on completion of the works.

The contractor shall utilise the existing thermal model produced during Stage 3. The contractor shall allow to revise the model in its entirety to take into account their design and any architectural or structural changes that have taken place. The party which carried out the initial modelling exercise bears no responsibility for the model's accuracy.

2.24 COLOURS

Any light fittings to be finished in a standard non-metallic RAL colour unless stated otherwise on the drawings, within this report or within the technical schedules.

2.25 ROOM TERMINAL LOCATIONS

The positions of all connection points, accessories, apparatus, equipment and other room terminals shown on the tender drawings are approximate and for guidance in the preparation of the tender.

Agree, with EA/CA, which terminals are subject to final positioning on-site.

Confirm mounting heights with the EA/CA before commencing work on-site.

2.26 ELECTROMAGNETIC COMPATIBILITY

Ensure all equipment and systems are installed to provide electromagnetic compatibility within the system and with any other systems installed in the same area. Ensure all systems and buildings are assessed for protection to, and that such protection meets the requirements of BS EN 62305.

Ensure all equipment meets the requirements of the appropriate electromagnetic compatibility standard.

2.26.1 Test Certificates

Where testing specific to the project is required, ensure test certificates include:

- Project title.
- Details and date of test.
- Instruments used, serial numbers, calibration dates.
- Signature of those witnessing test.
- Contractor's name.
- Specific location of the item in the Works.

3.0 MECHANICAL BUILDING SERVICES

3.1 FOUL DRAINAGE ABOVE GROUND

Drainage shall be provided and connected to the new below ground drainage system. Drainage pipework shall be installed to areas as necessary to facilitate the sanitary ware layout and fitting out works.

Branch connections shall be provided at the main drainage stacks to allow connection of the drainage installations to WC's, tea points kitchenette(s), and other areas as required.

Plant and equipment zones shall be complete with local drainage connections to foul for condensate drainage. Consideration shall be made to the locations of internal ceiling mounted air conditioning and heat recovery units.

Externally, no condensate shall discharge on to areas liable to freezing to prevent slips and falls.

Below ground drainage systems shall be designed by the Civil Engineer.

Refer to and cross-reference with the Civil & Structural Engineers advice provided by Rolton Group Ltd under separate cover.

All pipework shall be solvent welded UPVC with vertical soil vent pipe stacks and horizontal WC pipes utilising grey coloured pipework and horizontal waste pipes being white coloured. The main vertical stacks and foul soil floats to WC pans shall be installed using grey plastic tube and the wastes from condensate, wash hand basins, sinks and showers shall be installed in white plastic pipework.

All vertical stacks shall be insulated for noise transfer prevention and fire resistance with foil faced mineral wool with density of 165 kg/m³ and minimum thickness of 50mm and 90mm thick

All pipework penetrations of floor slabs shall be fitted with mineral fire collars to provide 4 hours of fire protection to BS 476 part 20 and shall be installed to the manufacturer's instructions.

All wash hand basins shall be fitted with bottle type traps and sinks shall be fitted with P type traps.

All branches shall be connected to vertical soil vent pipes that shall be ventilated above room level fitted with approved ventilated covers.

All pipework shall be installed supported in accordance with the manufacturer's instructions.

All pipework routed through occupied spaces shall be noise attenuated where it is deemed a problem to the occupants.

Rodding points behind IPS shall be turned upwards to allow ease of access.

3.2 COLD WATER

Mains cold water shall be extended from the existing site Local Water Authority (LWA) distribution system to serve the new development.

The building shall be supplied by new mains cold water supply system with a Utility metered connection at the site boundary. Leak detection shall be required and connection for metering at buildingscontrol panel, complete with a 100 mm diameter duct and suitable access points for draw wires to be used.

All below ground pipes ducts shall be sized and installed by the subcontractor to provide suitable service to the plant room. All buried mains cold water pipes shall be sized to allow for a minimum pressure of 0.9 Bar gauge static pressure at peak demand and at incoming point to the building.

All buried pipes and ducts shall be manufactured from medium density polyethylene using fusion welded fittings, with all other service pipes being manufactured from BS EN 1057 copper tubes with soldered or brazed fittings.

The installation of barrier pipe such as Protectaline shall be undertaken if chemical contamination is found during ground investigations. If ground investigations have not been completed at the time of tender the sub-contractor shall allow for barrier pipework.

The cold water shall distribute to serve all cold water outlets in the building. Occupancy shut off valves, linked to passive infra-red detectors with overrun timers shall be installed to all cold-water feeds to WC areas. These will prevent water leakage from equipment/ fittings when rooms are not used.

A single external bib tap shall be provided external to plant room for the purposes of landscape irrigation. Any further requirement is to be provided by the Occupier.

All external taps and irrigation systems are to be supplied & installed with WRAS backflow and backpressure protection.

All cold-water services shall be suitably insulated and shall be ideally installed internally.

The design of the cold-water system shall ensure that excessive dead legs are avoided and to include for provision for fully draining down of the system.

Pipework shall be Copper Half Hard Table X, with lead free solder or brazed connections.

Pipework shall be chrome plated where surface mounted in exposed areas such as toilets and kitchenettes.

Pipework shall be thoroughly flushed and cleaned prior to being charged with water for pressure testing. Pipework shall be tested to a One Point Five multiplier [1.5x] times operating pressure or Eight [8.0] bar, whichever is the greater.

The cold-water system shall subsequently be put into operation and commissioned to achieve the required flowrates.

All outlets shall be fitted with flow restriction valves and sterilisation points and shall have a minimum pressure at each outlet boosted cold water outlet of 1.0 bar (gauge) and at each mains cold water outlet of 0.7 bar (gauge).

All pipework shall be fully insulated (to minimise heat gain) including between brackets and pipe with all joints taped. Valves shall be insulate bagged.

The contractor operatives working on wholesome water shall be registered with an approved scheme as WIAPS or TAPS.

3.3 HOT WATER

Hot water shall be generated by means of an unvented high efficiency hot water cylinder, which shall be sized and provided in accordance with CIBSE recommendations, and to meet the requirements of the 'Non-Domestic Heating Compliance Guide'.

Due to the size of the plant room hot water to all areas shall be supplied by a pre-plumbed hot water cylinder which also provides heating and shall be located in the plant room and fed from an air source heat pump.

The external heat pump unit shall be mounted upon a stable concrete pad (design by others) alongside the inverter Heat Pump used for comfort cooling. The interconnecting pipework shall be preinsulated and protected (corrugated) flow and return and be buried in a trench to where it rises into the plantroom; all ancillaries and pumps shall be provided to serve the HWS cylinder and plate heat exchanger where the HWS will then be distributed to the areas requiring hot water.

The Heat Pump shall service the requirement of the HWS cylinder manufactured by Mitsubishi Electric or equal & approved using DHW Main Controller.



Figure 4 - Pre-plumbed water cylinder by Mitsubishi that provides heating and hot water - www.mitsubishielectric.com/.

An electric immersion heater for the HWS cylinder shall also be provided to enable the cylinder unit to be heated should the heat pump require supplementary heating or be turned off.

The unvented HWS and heating cylinder and all associated components shall be installed strictly in accordance with the manufacturer's recommendations.

Contractor shall include for return pipework throughout the system. Return connections shall be located as close as possible to final outlet positions and no more than 1 metre away.

Hot water distribution pipework shall be located in voids where practical and shall be complete with insulation up to the outlet point.

Pipework shall be Copper Half Hard Table X, with lead free solder or brazed connections.

All sinks and all wash hand basin hot water outlets shall be fitted with Thermostatic Mixing Valves (TMV) with type 3 capabilities, with a nominal set point temperature of 41 degrees Celsius.

All outlets shall be hard plumbed, flexible connectors shall not be used.

All hot water outlets shall have the facility to have outlet temperatures blended.

Screw driver operated valves shall be installed to each outlet for ease of maintenance.

All tubes to be manufactured from BS EN 1057 copper tubes with soldered or brazed fittings. Small bore pipework may be considered by the contractor for energy saving but shall be installed in a neat and tidy manner.

All outlets shall be fitted with flow restriction valves and sterilisation points and shall have a minimum pressure at each outlet boosted cold water outlet of 1.0 bar (gauge) and at each mains cold water outlet of 0.7 bar (gauge).

All pipework shall be suitably insulated and all insulation shall be designed to meet requirements for minimum heat loss, which will reduce the size of hot water service pipework and pump energy. Valves shall be bagged insulated.

The contractor operatives working on wholesome water shall be registered with an approved scheme as WIAPS or TAPS

3.4 NATURAL GAS

Not applicable.

3.5 IRRIGATION

To allow the occupiers to irrigate the grounds, tamperproof, lockable bib taps are to be provided. The number & final locations are to be agreed by the Client/Architects before construction.

These shall be in the form of compact wall mounted stainless steel boxes with spherical type tap and hose connections. The tap shall be foam insulated and therefore offer reasonable frost protection. Concealed/telescopic pop-out taps are available as an alternative.

The irrigation point hose union shall have a hinged lid, which can be padlocked closed and come complete with a hose shield to improve the frost protection and prevent unauthorised removal of the hose.



Figure 5 - Hose Union c/w Lockable Cover - Typical - www.arrowvalves.co.uk.

The irrigation point hose union shall be rear entry, where the cold-water copper pipe supplied passes through the wall. This arrangement offers good frost protection since none of the pipe is exposed.

Irrigation point hose union shall come complete with all WRAS approved isolation and check valves to prevent back pressure & back flow.

3.6 LOW TEMPERATURE HOT WATER (LTHW) SYSTEM

Low temperature hot water heating shall be provided via underfloor heating throughout the building as indicated in RDS and performance design drawings.

Manifolds shall be located around the building. Final locations and number of manifolds shall be determined by an underfloor heating specialist and/or contractor.

The manifolds shall be located with agreement with the Architect and boxed in with an accessible cover, the zones shall be controlled by a room sensor and actuated valves.

All rooms shall be provided with wall mounted controller for heating which shall be away from corners/doors, away from heat sources and draughts and away from direct solar radiation.

Underfloor pipework shall be as per specialist specification. Manifolds shall be coordinated and boxed in with access panels.

All heating systems shall be provided with stainless steel dosing pots with magnetic side stream filtration capabilities. All shall be complete with stainless steel tundishes for chemical filling purposes.

Dosing equipment shall be installed where there is a high differential pressure between floor and return pipework.

All systems shall have external temperature sensors, internal sensors, modulation controls, boiler operation sequencing, to achieve all control requirements.

Frost protection shall be 3 stages based on criteria below:

1. If a return system water temperature falls below 20 degrees Celsius and the external temperature is below 5 degrees Celsius then all pumps shall operate.
2. If the external temperature of 3 degrees Celsius then the boilers shall operate in addition to raise internal temperature to 12 degrees Celsius.
3. If the external temperature is 3 degrees Celsius or lower then one of the boilers shall operate.

All of the above set points shall be fully adjustable.

All settings shall be fully adjustable in the range of -5 to 30 degrees Celsius (dry bulb).

Separate controlled heating zones shall be designed as follows using independent zone valves with central control.

The main plant room serving the building shall contain the pre-plumbed cylinder and ancillaries for the externally located air source heat pump system.

The external heat pump unit shall be mounted upon a stable reinforced concrete plinth (design by others). The interconnecting pipework shall be preinsulated and protected (corrugated) flow and return and be buried in a trench to where it rises into the plantroom; all ancillaries and pumps shall be provided to serve the buffer vessel where the heating/cooling will then be distributed around the building radiator system.

All isolated sections of pipe shall be fitted with drain points at low level, automatic air vents at high level.

All flow and return pipes shall have temperature sensors monitored at the BMS, which shall also be used for control purpose. The secondary pumps shall have remote sensors in the pipework to control the pump set.

Dosing of the systems shall be to manufacturer's recommendations.

All pipework shall be insulated with hangers installed around the insulation (not the pipe). All valves shall be insulated via bags or manufacturers system.

During construction, once underfloor pipework has been laid and tested, it shall be kept under pressure with a gauge at the manifold.

3.7 COMFORT COOLING

Not applicable.

3.8 GENERAL VENTILATION

General ventilation shall be provided to the main hall via opening windows and high level electrically operated Velux windows.

Refer to the architect for details of windows and rooflights.

All ventilation systems shall be designed, installed, tested and commissioned in accordance with all recommendations CIBSE guides, DW 144.

3.9 EXTRACT VENTILATION

A number of WCs shall be provided with extract only ventilation. These also include tea points/kitchenettes and shall be served by a mechanical extract ventilation system that shall extract the stale air from these areas and expel this to atmosphere. Extract fans shall be by Nuaire as indicated in Figure 8.



Figure 6 – Nuaire ES Opus In – line extract fan - www.nuaire.co.uk.

All necessary ductwork fittings and ancillaries shall be allowed for by the Contractor.

The extract fan shall automatically vary its speed as it receives signals from one of the interconnected sensors sited in the rooms being ventilated. When the signal is received the fan shall have the ability to increase speed gradually until the required level is achieved or it will work on a trickle and boost principle.

The mechanical extract fans shall be designed to extract at rates as determined by the Approved Document F and as noted on the room data sheets (RDS).

All extract fans are to also comply with the current Specific Fan Power (SFP) regulations as determined by Approved Document L for new Non-Domestic Buildings and the associated Non-Domestic Building Services Compliance Guide.

Fans shall be installed with adjustable run on timers and be operated by the rooms' light switch or associated Passive Infra-Red (PIR) motion detector.

Where fire doors are used, make up air shall be provided by door transfer grille (DTG) suitably sized to replace the extracted air with minimal noise and pressure. DTG's within fire doors are to be provided with intumescent blocks to match or improve on the rating for the door in which they are installed.

All DTG's are to come with matching metal grilles and be finished or coloured to a RAL or BS colour to the Client's/Architect's approval.

Alternatively, where no fire doors are used, the doors may be undercut to allow make-up air to be drawn in to the room.

Fan motors shall, where applicable, be fitted with inverter driven controls to match motor speed to required fan duty.

Careful consideration shall be given to the location of air supply intakes and exhaust air discharges to avoid recirculation. Acoustic treatment shall be provided as necessary to minimise noise ingress from surrounding roads and noisy areas identified in the Planning Requirements.

The extract ducts from the rooms shall be fitted with low pressure loss circular grilles or valves sized to have a maximum pressure drop of no more than 8 Pascals. The supply system to each room shall be as the extract with ceiling mounted diffusers in the adjacent corridor space, with ductwork fitted with fire damper in the wall.

Ductwork from grilles and diffusers shall be acoustic flexible ducting with galvanised mild steel ductwork forming runs longer than 1.0 metre.

Toilet ventilation system shall comply fully with DW144 HVCA Specification for Sheet Metal Ductwork.

3.10 KITCHEN VENTILATION

The building operates a domestic type kitchen, therefore the kitchen extract shall be taken via kitchen extract hood or kitchen canopy hood to the atmosphere. The kitchen extract hood shall be designed to suit the ventilation rate indicated in CIBSE Guides and RDS. Kitchen extract hood shall be provided and designed by the contractor and/or specialist and installed strictly to the manufacturer's standards.

The contractor shall provide all services and equipment attached to the kitchen extract system. Kitchen extract system shall be complete in 2 hour fire rated stainless steel ductwork.

The controller shall have infinitely variable speed control, whose motors shall be IE4 efficiency and complete with variable speed frequency inverters.

Noise in the kitchen space shall be maintained at no more than NR45 with all ventilation plant operating at the required volume to minimise CO₂ in the room space to a peak of no more than 1,000ppm, based on external air conditions of 470 ppm. The ventilation system shall have full speed control to increase extract flow rates to ensure upper carbon dioxide levels are not exceeded.

3.11 CENTRAL CONTROL / BUILDING MANAGEMENT SYSTEM

The contractor shall design, supply, install and commission a suite of manufacturers packaged controls and simple thermostat control where required.

It is proposed that the new mechanical building engineering services systems will be provided with dedicated/package control panels located in the plant room/plant area.

The new controls systems will be compliant with Building Regulations Part L2A or L2B feasibility option dependant and will provide energy efficient operation of the systems and enable full and easy control to ensure adequate internal temperatures at the time of occupation of the building. The controls system will where appropriate, also incorporate energy consumption monitoring via heat/flow meters and recording of energy consumption information including heat and water consumption.

The following plant (including but not limited to) shall be provided with suitable controls:

- Extract fans,
- Fire dampers,
- Heating system,
- Hot water system.

The following field devices shall be used for input / monitoring:

- Fire detection and alarm system interfaces
- Return air temperature sensors
- Room CO₂ sensors
- Room temperature sensors

4.0 ELECTRICAL BUILDING SERVICES

4.1 LV SUPPLY / PUBLIC UTILITY SUPPLY

The local Distribution Network Operator (DNO) is UK Power Networks (UKPN).

A new incoming electrical supply will be provided to the new community centre, terminating within the plant room. Preliminary assessment and calculation have determined the need for a supply with a maximum demand in the order of 45kVA. This estimated electrical load allows for spare capacity, as well as the electrical supply for a fully electric kitchen and electric heating and cooling.

Incoming supply cabling shall run underground from the site boundary via a 125/150mm DIA black HDPE rigid duct and enter the electrical intake room via a slow radius bend.

It is likely that a new half hourly (HH) metering arrangement will be required subject to confirmation from UK Power Networks.

4.2 PHOTOVOLTAIC (PV) SYSTEMS

Not applicable.

4.3 LV DISTRIBUTION

The main LV distribution board will be located within the Store room 09 and comprise a Miniature Circuit Breaker (MCB) split load distribution board assembly with outgoing ways to feed the local LV distribution boards, building services plant and equipment.

Local LV Distribution Board's (DB's) shall comprise generally of separate lighting and general LV power distribution boards fed via a dual metered extension enclosure.

Dedicated DB shall be provided to the kitchen.

The contractor shall, as a costed option, allow for the installation of automatic power factor correction to achieve a power factor of at least 0.95.

Labelling shall be screw fixed; self-adhesive type labels shall not be accepted.

All supplies associated with the operation of systems under fire conditions shall be wired using appropriately selected fire rated cabling and supported on cable tray or ladder having a fire rating of 2hrs, steel supports shall have a maximum stress of 10N/mm² in accordance with BS 8519 Annex E.

All cables shall be BASEC approved and provided by the same manufacturer.

Delivery and storage of all cables shall be to manufacturer's recommendations with the ends sealed to prevent ingress of moisture and escape of insulation or impregnation.

Cable ends cut on site which are not to be terminated immediately shall also be sealed. All cable ends shall be sealed upon completion of tests.

Cables shall not be handled or installed when the temperature is below 0°C. Allowance for a minimum period of 24 hours before cables are used when the cables have been exposed to such temperatures.

Cables shall be run from the tops of their drums, with supporting ramps if necessary, the drums being braked to avoid over running.

Cables shall not be exposed to impact or stress by twisting or stretching forces. Allowance shall be made for expansion joints in long runs. Cables shall be laid in multiple runs so that minimal crossing of cables occurs. Minimum bending radii shall not be exceeded for each cable type, size, installation arrangement and detail. If a cable is damaged in any way during installation, it shall be made good or replaced, free of charge, as dictated by and to the satisfaction of the engineer.

All cable types and specifications shall be installed to be suitable for the environmental conditions which the cables will encounter in service. Multiple cables shall be fixed to cable tray or cable hanger/support systems. No multiple runs of cable, of any type or specification, shall be installed with more than two layers, laid flat, on cable tray or cable hanger/support systems. Multiple runs of cable shall mean two or more cables.

All fixing cleats, cable tray and associated nuts, screws, bolts and frameworks shall be protected against corrosion.

All terminations shall be fully shrouded. Access to busbars and cabling terminals shall only be by removal of fixed screwed cover plates.

Updated fixed circuit charts shall be provided within each distribution board.

Final circuit cabling shall be LSF twin and earth cabling contained within dedicated basket tray and PVC conduit systems installed for drops within walls throughout.

Provide Low Smoke Zero Halogen (LSOH) cable types for all power, data, control and signal cables of all mechanical and electrical systems.

The wiring of all security systems is to be run in galvanised steel cable trunking, or within galvanised steel conduit.

Containment systems shall be mounted via strut and drop rods. Unistruts and drop rods shall be cut back to size, filed smooth and complete with end caps throughout.

Containment systems shall be installed in accord with BS 7671. Containment systems shall offer a min. of 10% spare capacity. Wiring in escape routes shall be supported such that they will not be liable to premature collapse in the event of fire. All containment shall be supported using metal fixings and cable ties or held in metal containment systems and mounted in the horizontal plane.

The following containment groups shall be used through the building. Services in different groups shall not share common containment:

- LV1 – General LV submains
- LV2 – General LV power and general lighting final circuits
- FA – Fire detection & alarm cabling, safety circuits
- COMMS – Data, security, Building Management System (BMS)

LV distribution shall comply in every respect with BS 7671.

DB REFERENCE	DB LOCATION	MANUFACTURER	TYPE & MODEL
DB – MB – 1 New	Store 09	Eaton	TBC min 12way TPN split load MCB distribution board
DB – MB – 2 New	Kitchen	Eaton	Final Kitchen layout dependant

Table 4 - Distribution Board Schedule.

4.4 GENERAL LIGHTING

General lighting shall be provided by high efficiency LED fittings located throughout the building. Automatic occupancy detecting lighting controls shall be provided to all rooms, excluding hall and the kitchen. Lighting in some spaces with natural daylight will be provided with daylight dimming or switching functions.

White (4000K) LED lamp sources shall be used throughout.

Throughout the majority of staff spaces 600mmx600mm recessed modular luminaires shall be installed. Recessed downlights shall be installed to circulation spaces and WCs. Linear corrosion resistant LED luminaires shall be installed in plant room. Suspended linear luminaires shall be installed to the halls.

Luminaires shall be controlled via either presence detection, absence detection with local lighting control switches or local lighting control switches.

Presence detection control shall be applied to the following typical area(s):

- Circulation & corridors
- Toilets
- Entrance lobby
- Plant room
- Store rooms

Local switch control shall be applied to the following area(s):

- Kitchen
- Main hall

Where lighting is proposed to be controlled via absence/daylight control the lighting control system shall be based on either integral manufacturer's control systems or a simplified plug and play lighting control system using Digital Addressable Lighting Interface (DALI) protocol and ceiling/wall mounted presence or absence detectors.

Light switches shall generally be retractive, push-to-make type within absence detection areas. Additional gangs shall be provided within teaching spaces to allow separate switching/dimming of each row of luminaires.

In areas where presence detection control is proposed the contractor shall also include manual controls to override the automatic controls.

4.5 GENERAL LV POWER

General LV power accessories, including switched socket outlets and data points, shall be selected from the MK Metal Clad or MK Logic Plus ranges. Accessories shall be Approved Document M compliant, offering colour contrast with their background and separation between switched (e.g. through graphite grey face plates on white walls, with outboard rocker switches).

General LV power and data shall be combined within perimeter wall mounted 3-compartment dado trunking systems to serve various items of end user equipment and computers.

New small power supplies shall also be provided to mechanical building services plant and equipment plus any associated control(s) or building management system outstations / connections.

Cleaner's sockets shall be provided where applicable.

All accessory mounting heights are to be in accordance with the requirements of Building Regulations Part M, BS 8300 and the Equality Act.

The contractor shall provide supplies to all rooflight actuators and controls interfaces and coordinate fully with other services and the architect to install cabling and transformers (where required) from the power to the actuators.

All works shall comply fully with the requirements of BS7671.

4.6 EMERGENCY LIGHTING

Emergency lighting shall be provided within escape routes, large open areas and in high risk locations, in keeping with the relevant standards.

The emergency lighting installation shall provide 3 hours of non-maintained emergency illumination.

Emergency lighting shall be selected on the basis of integral 3hr battery packs within standard luminaires or standalone LED emergency luminaires. Standalone LED emergencies shall be either recessed or surface fixed area dependant and to coordinate with the ceiling finish.

Luminaires shall incorporate a testing facility.

Emergency lighting shall be selected on the basis of 'area' or 'corridor' versions room application dependant.

Emergency exit illuminated signage shall be provided to coordinate with the Architects proposed fire strategy plan(s).

Final exit doors to the outside will be complete with LED emergency bulkhead either over the door frame or to the keep side of the door. Where practical and possible the emergency luminaires shall be incorporated within the perimeter external lighting luminaire to avoid duplication.

All wiring to the respective internal emergency fittings shall derive from the source of the local lighting final circuits, so as to facilitate operation in the event of a local circuit failure.

The emergency lighting installation shall comply with BS 5266.

4.7 STREET / AREA / FLOOD LIGHTING

External lighting shall be installed to provide adequate lighting levels to the building perimeter and the car park to allow safe movement at night. This lighting will be controlled via a timer and integrated "smart" controls.

External lighting shall be provided as per design and planning drawings.

All external lighting shall be photocell (integrated smart controls) and time clock controlled via a multi-channel digital and programmable 24 hour 7 day 365 day/year programmer with override.

Ensure all luminaires and controls are finely adjusted and aligned to provide a uniform illumination of the area covered.

Ensure luminaires mounted on buildings, have the wiring routed within the building. The external lighting design shall be in accordance with BS EN 12464-2.

4.7.1 External Luminaire Installation

Provide all external luminaires as required for the particular project complete with control gear, mounting brackets, fixing clamps, interconnection, spigot, lamps, tools etc. as appropriate.

Exercise care in the positioning of external luminaires to avoid the possibility of glare to CCTV cameras serving adjacent areas or the particular project.

4.7.2 Wiring Installation

Ensure that generally, below ground cables originate from external lighting distribution boards and are run via underground pipe ducts to draw pit locations close to the luminaires' positions.

Ensure all cables not enclosed in pipe ducts are protected by cable tiles with marker tape and route markers.

Ensure wiring to column mounted luminaires is buried XLPE/LSF/SWA/LSF cables.

Ensure the cable is looped to terminal/fuse units mounted in the bases of the columns. Provide suitable brackets for fixing the cable glands in the column bases. Ensure connections from the terminal/fuse units to the luminaire are LSF/LSF cable with earth protective conductor.

4.7.3 External Lighting Control

Provide solar dial quartz type time switch with battery reserve incorporated with a main external lighting control panel. Provide photocell control where required and where agreed.

Provide override switches. Ensure operation in conjunction with solar dial time clocks to control external lighting distribution board contactors (on and off).

Provide separate lighting circuits for external lighting controlled by contactors (if required), for all external lighting final circuits.

All cables leaving the building shall have suitable TVSS devices fitted where they leave the building, or there is sufficient segregation from other cables such that the TVSS device on the main distribution board provides sufficient protection in accordance with BS EN 62305.

4.8 TELECOMMUNICATIONS

A new incoming broadband connection and telephone lines shall be provided into the new server room.

The contractor shall undertake the design, supply, install, test, commission and set to work a new telecommunications system in accordance with the drawings, specification, room data sheets and manufacturer's recommendations.

Refer to Openreach (A BT Group Business) for a copy of their relevant Standards, Guides and Codes of Practice.

The contractor shall perform all onsite excavation, back filling and install 90mm diameter Openreach approved ducting into the plantroom. Incoming telephone lines shall be installed, entering the building within the electrical intake room and shall run to the communications cabinet, location TBC. The end user shall be utilising a Voice Over Internet Protocol (VOIP) system. Telephones to be supplied and installed by the client's data installer.

4.9 PUBLIC ADDRESS / SOUND AMPLIFICATION

Not applicable.

4.10 FACILITIES FOR THE DISABLED

Induction loops (fixed) shall be provided within the main hall.

The fixed hearing loops shall have thin foil aerial laid forwards and backwards under floor finishes or as agreed. Systems shall allow use by users changing devices to T setting.

Alarm systems shall be provided within each accessible toilet and shall provide alarm locally in the lobby adjacent.

4.11 ACCESS CONTROL

Not applicable.

4.12 SECURITY DETECTION AND ALARM

Intruder detection devices will be installed throughout the new building.

Install cabling in accordance with the security system specialist supplier/manufacturer's specification and recommendations.

Provide the project with security systems protecting internal spaces from intruders, and controlling access into the building via certain doors, in accordance with the drawings.

Install systems in accordance with all relevant standards.

Provide testing/commissioning, training and maintenance.

The security system will generally consist of the following, where indicated:

- Intruder alarm system.
- Closed circuit television systems.

Ensure external security cables are run in dedicated pipe ducts and draw pits to pick up the existing site infrastructure.

The intruder alarm system shall be provided with a DualCom GSM module for offsite notifications and monitoring.

Provide all power supplies, including local 230V un-switched fuse connection units, where applicable, for all security systems.

4.13 CLOSED CIRCUIT TELEVISION (CCTV)

CCTV shall be provided to cover areas as per design drawings.

The Contractor shall employ an approved specialist, to design, supply, install, test and commission the new installation for the CCTV System

The CCTV system shall be tailored to deal with the following, but not limited to:

- Break-ins
- Danger to individuals from attack
- Health and safety of individuals on the premises or site.
- To monitor entry/exit point to the building(s)
- To monitor persons entering and leaving the premises
- Vandalism

The CCTV system will capture images from day/night cameras around the site. Images will be recorded on a network video recorder and stored for a pre-set period.

The system shall be capable of being monitored by an external CCTV monitoring station.

The Contractor shall allow for the supply and installation of all underground ducting, cable draw pits and cabling for the CCTV system.

CCTV locations are shown for guidance only. The design contractor shall develop the design in accordance with BS 7958, to ensure all areas are adequately covered.

CCTV system headend to be suitably sized to allow future expansion of the system; provide 10% spare capacity.

The quality of evidences collected by the CCTV system shall be sufficient for the prosecution of persons committing unlawful acts.

4.13.1 Network Recording Equipment (NVR)

NVR's shall provide a secure, reliable and scalable platform for high performance end-to-end IP based security solutions. NVR's shall be complete with appropriate software preloaded and configured for plug-and-play network video recording and management of multi-megapixel IP cameras.

NVR's shall allow remote access support for system administrators.

The recording/storage necessary for the camera additions shall be calculated to ensure the following specification is maintained:

- Recording at 1920x1080, 25fps for Twenty-Eight [28] days.

Recordings shall be motion based such that periods in which no motions are detected shall be recorded at a reduced frame rate.

NVR's shall provide effective recording for long-term video retention. NVR's shall take up no more than 2U and be rack mounted chassis type with sliding rails and cable management arm, for ease of serviceability.

Appropriate software licences shall be provided for the associated server equipment.

The system shall be designed in accordance with BS 7958⁴, to ensure all areas are adequately covered.

4.13.2 Workstation(s)

A CCTV workstation shall be provided in a location TBC. Workstations shall be pre-loaded with appropriate software.

4.13.3 Software

CCTV system software shall be an easy to use video management platform, optimised to allow security professionals to manage and interact with high definition video. A distributed network platform shall efficiently capture, manage and store high definition surveillance video whilst managing bandwidth and storage.

Software shall be pre-installed and configured.

Software shall record and manage video from the associated IP cameras.

All software platforms shall provide an easy-to-use interface and allow personnel to evaluate and respond to events with minimal training.

4.13.4 Cameras

IP CCTV cameras shall be installed cover the entrances gates and the entrance lobby.

Cameras shall be mounted externally to the building fabric or mounted internally semi-recessed into the ceiling. All penetrations shall be adequately sealed.

External Fixed Dome Camera – Located on building perimeter to cover entrance & gate.

- Minimum 5.0 Megapixel, day/night high definition.
- Camera shall offer monitoring both daytime and night-time activities, vandal resistant construction. Embedded with self-learning video analytics
- Integrated lens for remote focus and zoom control

Internal Fixed Dome Camera – Located within entrance lobby

- Minimum 3.0 Megapixel, high definition.
- Camera shall offer embedded self-learning video analytics.
- Integrated lens.

4.13.5 Monitor(s)

Monitors shall be provided in a location TBC. Workstation shall be complete with 19" LED HD flat screen desk top mounted screen.

4.13.6 UPS

The Contractor shall install all outgoing circuits which feed equipment associated with the operation of the system under power outage via a dedicated rack mounted UPS.

UPS systems shall be provided to support the NVR's and the Power over Ethernet (PoE) switches to ensure that the recording equipment is backed up by an essential supply and that the operation of the IP network associated is maintained during a power failure.

The contractor shall provide a suitably rated UPS with autonomy suitable to allow the operation of the system at full load for a min. autonomy of Sixty [60] minutes.

4.14 FIRE DETECTION & ALARM

A fire detection and alarm system will be installed in compliance with the relevant standards. Visual alarm devices will be provided in all WCs. Mechanical plant, kitchen shutter and door hold opens will be interfaced with the fire alarm system.

The fire alarm system shall be provided with a BT RedCARE line for offsite monitoring.

General:

Supply, install, connect, test and commission the complete fire alarm installation as specified and in accordance with all relevant Standards.

Provide fire alarm systems to be fully analogue addressable and comprising the following:

- Master control / annunciator panel comprising VFD display, event printer, LED zonal indicators
- Manual break glass call points
- Automatic detection devices
- Electronic sounders and Xenon flashing beacons
- Interfaces with mechanical plant control systems to facilitate total plant shutdown/restricted operation
- All mechanical ventilation plant off
- All mechanical ventilation plant on extract only
- Ensure the fire alarm system interfaces with mechanical air services fire dampers, installed where ductwork passes through fire compartment walls and floors etc. Ensure dampers (mechanically operated) indicate on the system as a separate address

Provide system activated by manual contacts and automatic detectors.

⁴ British Standards Institution (BSI) - Closed Circuit Television (CCTV). Management and Operation. Code of Practice.

Ensure upon actuation of a manual call point the following occurs:-

All sounders throughout the building operate in evacuation mode, i.e. a continuous signal.

The zone and individual initiating device, indicates at the master indicator and repeat indicator panels.
Any magnetic door release units de-energise and doors close.

4.14.1 Installation Details

Provide for all initiating devices wired in the form of a ring/loop. Ensure maximum number of addresses do not exceed manufacturers specification and also allows a minimum of 20% spare capacity.

Design/install additional loops required to meet these criteria. Ensure loop circuit lengths do not exceed manufacturer's specification.

Four core loop cables shall not be permitted.

Ensure each initiator device is clearly labelled with a unique address code.
Appropriate indication on main control and repeat panel when sensor removed from based.

Ensure removal of sensor head does not render any part of system inoperative. To assist detector identification where installed in voids, provide remote indication LED's as close as practicable to device but in clear view.

Engraving to comprise detector reference and description of location.

Ensure all cable terminations and conductors are labelled with their respective loop or circuit reference by means of proprietary labelling system.

Ensure cables are installed direct to the building fabric fixings using proprietary screw and rawl plugged 'P' clips. Use of nailed clips and PVC tie wraps is not acceptable. 'Firetuf' or equivalent may be used where appropriate.

Install cable tray where multiple cable runs (i.e. more than 2 cables routed together) occur, making allowance for a minimum of 10% space capacity.

Ensure all equipment is suitable for flush surface installations and complete with respective mounting boxes.

Provide a Xenon flashing beacon complete with red lens installed externally above each main panel.

Provide flashing Xenon beacons in areas of high ambient noise or acoustic enclosures, in addition to audible sounders.

Allow for sounders to be wired and connected in two radial circuits throughout each zone. Define sounder zones/circuits by a suffix to each symbol indicated on the record drawings (e.g. 'A' and 'B').

Install 'End of Line' devices complete within purpose made boxes. Ensure units are accessible and suitably labelled and of the type recommended by the manufacturer.

Allow, when routing circuits, for volt drop in accordance with the manufacturer's equipment recommendations.

Minimum size of conductors for 'actuation' circuits is 1.5mm² and 2.5mm² minimum for 'sounder' circuits.

Include all auxiliary control wiring to field items/systems such as door release units, shutdown/actuation of mechanical plant systems, sprinkler system pressure sensors, extinguishing systems, fusible link systems etc. where applicable. Ensure the necessary relay and termination facilities are included within respective annunciator/control panel(s) to receive/control the above.

Provide for each fire alarm system a dedicated mains supply from the 'LV' source terminating in the control and repeat panels respective power supply via a wall mounted isolating switch. Ensure the 'LV' source supply is controlled by a suitably rated lockable switch fuse/MCB, together with respective terminating isolation, painted red and labelled "FIRE ALARM - DO NOT SWITCH OFF".

Incorporate power supply units in main control panel(s).

Ensure capacities of batteries are sufficient to comply with minimum requirement of 24 hours monitoring operation duration's, under mains failure conditions. Main control panel and repeater panel - 24 hours. All batteries to be marked with installation date.

Fire panels and associated equipment are not to be located on outside walls, where ever possible. With proper access being provided for maintenance.

4.14.2 Short circuit isolating devices

Allow for installing one-line isolator per fire control zone and no more than twenty detectors wired without an isolator installed. A fire control zone need not equate to the number of 'zones' the alarm system is divided into for the convenience of display messages.

It is likely that the 1:20 figure will determine the number of isolators in most cases.

4.14.3 Testing and Commissioning

Carry out on completion of the installation works, together with the selected manufacturer, the complete testing, commissioning and demonstration of the system operation. Detailed method statements to be produced for system testing prior to witnessing by the Engineer. Tests as a minimum must include:-

Insulation and continuity tests to cover all circuits, prior to installation of devices.
A visual inspection of the whole of the installation.

The functional operation of all panels, devices, accessories and items of equipment including such items as may have been supplied by others but wired under the electrical installation. These tests to be made under normal operating conditions.

24 hour simulated mains failure followed by 1 hour sounder duration check

Twenty simulated faults, at randomly chosen locations on each loop circuit and sounder interface secondary circuit for each of following type:-

- Open circuit.
- Short circuit.
- Sensor removal/alarm device removal.
- Earth fault.

Prove function of override facilities installed to inhibit operation of any shut down systems during routine fire alarm system testing.

4.14.4 Audibility Tests

Fully test the fire alarm system audible alarm facility to ensure that the correct audibility levels are achieved as required by the relevant Standards.

Carry out the tests on completion of the installation when all mechanical plant is fully functioning to ensure that realistic results are obtained, including all normal background noise levels.

Measure and record the sound pressure level in each room, area or plant space. Carry out a number of tests and record in each area to obtain average values.

4.14.5 Documentation

Issue the required fire alarm system test certificate(s) as detailed in the relevant Standards.

Record all audibility test results and present in tabulated form.

Issue copies of all documentation including the above to the Engineer for comment prior to inclusion in final handover documentation.

Provide maintenance/instruction manuals in form of hard cover binder detailing whole operation of fire alarm system, recommended regular testing and maintenance in accordance of requirements of the specification.

4.14.6 Installation Wiring

The system shall be installed using pliable CWZ (enhanced) zero halogen, low smoke (OHLS) sheathed cables to detectors from the main control panel and sub panels.

Be BASEC approved.

Cable sheaths are to be red.

Of only one manufacturer.

4.14.7 Segregation of Safety Services

Independent cable tray and conduit systems shall be provided.

In addition to other conduit systems, an independent galvanised installation shall be provided for fire alarms only.

The system shall comply fully with the requirements of BS 5839-1 and 8.

4.15 LV EARTHING AND BONDING

Earthing and bonding shall be provided throughout and shall comply with Requirements for Electrical Installations IET Wiring Regulations Eighteenth Edition BS 7671 and BS7430 Code of Practice for Earthing.

The earthing and bonding of the electrical installation shall include but not be restricted to the following:

- The frames of equipment forming part of the electrical installation, conduit, trunking and cable sheaths shall have sufficient supplementary bonding, so as to form a continuous path to earth.
- All extraneous metalwork within the plant areas shall be properly bonded to earth by means of earth cabling. Earth connections shall be crimp type lugs bolted to metalwork.
- All extraneous metal work throughout the building. Including pipework and ductwork.

4.16 LIGHTNING AND SURGE PROTECTION SYSTEMS (LSPS)

The Contractor shall with the aid of a specialist (where applicable) undertake a complete pre-design Risk Assessment in accordance with BS EN 62305 specifically BS EN 62305-1 Figure 1 and implement the findings of this assessment and undertake the detailed design, supply, install, test, commission and set to work a full lightning protection installation as necessary.

System shall be provided in accordance with:

BS EN 62305-1	Protection Against Lightning General Principles,
BS EN 62305-2	Protection Against Lightning Risk Management,
BS EN 62305-3	Protection Against Lightning Physical Damage to Structures and Life Hazard,
BS EN 62305-4	Protection Against Lightning Electrical & Electronic System within Structures.

The contractor shall ensure that the following sources of potential damage are eliminated by the proposed lightning protection system:

- S1 - Flashes to the Structure
- S2 - Flashes near the Structure
- S3 - Flashes to the Services connected to the Structure
- S4 - Flashes near the Services connected to the Structure

In addition to the above the Contractor shall ensure that for each of the above sources of damage, the following three types of potential damage / risk are eliminated by the proposed lightning protection system:

- D1 - Injury to living beings due to step and touch voltages
- D2 - Physical damage, i.e. fire, explosion, mechanical destruction, chemical release due to lightning current effects including sparking.
- D3 - Failure of internal systems due to lightning electromagnetic impulse (LEMP)

In addition to the two sections above the Contractor shall ensure that for each of the above potential damages / risks, the following three types of losses are eliminated by the proposed lightning protection system:

- L1 - Loss of human life,
- L2 - Loss of service to the public,
- L4 - Loss of economical value.

The Contractor shall apply the following considerations for a Lightning Protection system for this new development:-

- a) The lightning protection system shall as far as practicable utilise the inherent protection afforded by structural steel frames, metal cladding and other metalwork where available.
- b) The specialist shall be responsible for ensuring continuity between conducting building elements and shall provide bonding connections as necessary.
- c) The Contractor shall note that the initial design intent for the building structure does not include steel work, the Contractor should consider the PVC covered aluminium tape, suitably coloured so as not to produce a strong visual impact on the building, to form the down conductors, and shall be provided with earth rods and connecting tape conductors as required by the British Standard. All builders work requirements for such work shall be detailed by the specialist and issued to the Employers Agents. Where possible tapes shall be concealed with testing facilitated at each concrete earth rod inspection pit, which in turn shall be provided with tamper-proof fixings so as to stop unauthorised access.
- d) Testing shall be carried out during construction to ensure that any requirements for additional conductors are included prior to finishes being applied.
- e) Final testing shall be carried out in the presence of the Engineer and recorded in accordance with BS EN 62305.
- f) Records of the installation shall be provided in accordance with BS EN 62305 and incorporated in the Operating and Maintenance manuals.
- g) Suitable corrosion inhibitors shall be applied to all bolted bonding connections.
- h) Special attention must be paid to the bonding of incoming services, services risers and roof mounted plant all in accordance with BS EN 62305.

All metallic projections on or above the main surface of the roof structure shall be bonded to the protective system and shall form part of the air termination network. The Contractor shall pay special attention to the building link walkways and atria finished roof details to ensure that these areas are adequately bonded in accordance with BS EN 62305.

Testing joints shall be provided within the earth rod pit, as described earlier.

The Contractor shall ensure that the lightning protection system incorporates bonding to all extraneous metalwork as required to be covered in accordance with BS EN 62305 including but not limited to, roof plant installations, aerials, masts, flues, ductwork, lighting columns, street furniture, metallic covered walkways, metallic structures / sculptures, external plant not covered by an angle of protection in accordance with BS EN 62305 and any other metallic structures / installations that require to be bonded to the system in accordance with the British Standard and the associated Risk Assessment. Close attention and review is required to ensure that the atria roofs are covered by lightning protection, but the fixing detail shall be considered and coordinated with the glazed detail and finish.

Provide surge protection devices for protection of electronic equipment against induced surges and transient over voltages on computer networks, instrument systems, telephones and power lines etc.

Ensure surge protection devices protect electrical and electronic equipment and devices against indirect effects of lightning strikes and electrical faults.

Provide surge protection devices in locations in circuits to protect vulnerable equipment and components without affecting normal operation. Ensure surge protection devices divert surge currents and safely 'clamp' transient over voltages. Provide devices which automatically reset, without damage, following any surge or transient etc. occurring.

Ensure application of surge protection devices provides full system protection to all sections of circuits.
Provide surge protection devices at both ends of each protected circuit(s) when systems are interconnected or field equipment is considered to be at risk.

Ensure low resistance and low impedance earth connectors are provided to all surge protection devices, in accordance with manufacturer's recommendations and requirements. Provide all earth cables and connections as short and direct as possible. Ensure all earthing arrangements are fixed and protected in accordance with the specification.

Ensure all devices have BASEEFA certification. Provide for special considerations in hazardous area equipment and applications where surge protection is required.

4.17 DATACOMMUNICATIONS

The contractor shall with the aid of a specialist undertake the design, supply, install, test, commission and set to work a new data transmission installation in accordance with the drawings, specification, room data sheets and manufacturer's recommendations.

Data cabling and containment shall be provided and based upon a cabling system of the Category 6a specification with ceiling void mounted cable basket and dado trunking.

Small power and data shall be combined within perimeter wall mounted 3-compartment dado trunking systems to serve various items of end user equipment and computers.

Data connections shall also be provided to mechanical building services plant and equipment plus any associated control(s) or building management system outstations / connections. CCTV, access control and intruder alarm connections shall also be provided where necessary.

Within the hall, small power / data / AV arrangement will be agreed with the relevant stakeholders during the detailed design stage to service proposed interactive whiteboards or digital screens.

4.18 VERTICAL TRANSPORTATION

Not applicable.

4.19 ELECTRIC VEHICLE (EV) CHARGING (EVC)

Not applicable.

5.0 REFERENCE SPECIFICATION & PARTICULAR CLAUSES (APPENDIX A)

NBS - INTRODUCTION

This document section has been compiled using NBS, which the copyright belongs to NBS Chorus.

The content incorporates that of the NBS, generally arranged in line with the Common Arrangement of Work Sections for building works (CAWS) as published by Construction Project Information Committee (CPIC).

NON-SPECIFICATION CLAUSES

User created, non NBS, clauses may appear within the specification.

APPENDIX A
MECHANICAL AND ELECTRICAL BUILDING SERVICES - NBS OUTPUT SPECIFICATION

APPENDIX B DEFINITIONS

GENERAL:

Where used in the documentation the following definitions shall apply and shall be interpreted as such:

- Works: all services shown on the drawings and described in the specification shall be deemed to be included in the contract.
- Drawings: the tender drawings.
- Elsewhere: detailed or specified elsewhere in other clauses, sections, shown on the drawings or contained in the specification or conditions of contract.
- Services: services means the inclusion of one or more system.
- System: all equipment, accessories, controls, supports and ancillary items, including supply, installation, connection, testing, commissioning and setting to work necessary for that section of the Works to function.
- Design process: all the activities necessary to convert design input into design output
- Review: give notice and submit details to the CA for his comment and review, which shall be granted in writing only. In the event of the CA not accepting that submitted, resubmit alternative details for review or modify that submitted in accordance with the CA comments. Review of any submittal by the CA shall not mean that the CA is responsible for the correctness of the submittal or its suitability for purpose and does not relieve any contract responsibilities.
- Competent person: a person, by reason of theoretical and practical training or actual experience or both, is competent to perform the task or function or assume the responsibility in question and is authorised to perform such a task or function.
- Duct: an enclosed space specifically intended for the distribution of services, with direct access for personnel.
- Trench: a covered horizontal service space in the floor or ground with access from above.
- Cavity: a space enclosed within the elements of a building within which services are installed, e.g. the space between ceiling and floor above. See Building Regulations.
- Service Areas: includes areas within a building with limited finishes such as loading bays, car parks etc.
- Concealed Services: includes installations within ducts, trenches or cavities.
- Exposed Services: includes installations outdoors or unprotected within service or occupied areas.
- Terminal Units: terminal units such as radiators, convectors, fan coil units, induction units, variable or constant volume air boxes and other like equipment.
- Ancillaries: all specified fittings, accessories, inserts, test points, bracketing, terminal equipment connected to and installed in the engineering services system.
- CIBSE: the Chartered Institution of Building Services Engineers
- BSRIA: the Building Services Research and Information Association
- IET: the Institution of Engineering and Technology
- IOP: Institute of Plumbing
- FRS: Fire Research Station
- HSE: Health and Safety Executive

DEFINITIONS OF TECHNICAL TERMS

The definitions of technical terms associated with the engineering services installations are those included the latest edition of:

- CIBSE - Guides; Commissioning Codes; Technical Memoranda; Building Energy Codes; Lighting Guides; Application Manuals
- IOP - Plumbing Engineering Services Design Guide
- BSRIA - Technical Publications
- Loss Prevention Council - Rules for Automatic Sprinkler Installations
- BS 7671 Requirements for Electrical Installations (IET Wiring Regulations)
- British Standards, including Codes of Practice.
- Statutory Acts.

APPENDIX C
MECHANICAL & ELECTRICAL BUILDING SERVICES DRAWINGS

APPENDIX D
ELECTRICAL BUILDING SERVICES LUMINAIRE SCHEDULE

APPENDIX E
PREFERRED SUPPLIERS LIST

MECHANICAL BUILDING SERVICES⁵

Underfloor heating/cooling	Warmafloor
Dosing	Sentinel, Fernox
Pipework	Yorkshire tube
Supply and Extract Fans	Nuaire Limited Vent-Axia Limited Vectaire
Grilles and Diffusers	Waterloo Air Products plc Gilberts (Blackpool) Ltd Schalko
Packaged/pre-plumbed Water Cylinders	Mitsubishi Electrics Gledhill
Attenuators	Noico
Heat Pump Systems	Mitsubishi Electric Corporation Daikin Industries Ltd
Point of Use Water Heaters / Boilers	Zip Industries Heatrae Sadia (Baxi Heating UK Limited)
Mixing Valves (TMV3)	Horne Reliant
Pumps	Grundfos Pumps Ltd Wilo
Water Booster Sets	Grundfos Pumps Ltd Flowmech Wilo KGN Pilliger
Water Storage Tanks	Dewey Waters Balmoral Tanks
Valves	Oventrop Tour Anderson Hattersley Newman Hender Limited Pegler
CO2 Detectors	Duomo CO2MC

ELECTRICAL BUILDING SERVICES

Cabling	Draka (UK) Ltd Prysmian Group
CCTV System	Avigilon
Containment Systems	Marshall Tufflex MK Electric
Disabled Call Alarm System	C-TEC (Computationics Limited)
Distribution Switchgear Distribution Boards	Eaton MEM
Emergency Lighting	Thorlux
External Lighting	Thorlux
Fire Detection Systems (Final Connections & Commissioning) Fire Detection Systems (Open Protocol)	Honeywell Advanced Electronics Ltd Apollo Fire Detectors Ltd
General Lighting	Thorlux
Induction Loops (Hearing Loops)	C-TEC (Computationics Limited)
Intruder Alarm System	Honeywell Security UK SECOM Plc
Inverter Controls	Danfoss Ltd
Lighting Control System(s)	Ex-Or Ltd Thorlux Lighting a Division of F.W. Thorpe
Lightning Protection System	Furse Thomas & Betts Ltd
LV Small Power Accessories Surge Protection Devices	MK Electric Furse Thomas & Betts Ltd

⁵ NOTE:- Where equipment has been named it is deemed that the contractor has allowed for this equipment with their tender.

APPENDIX F
TENDER SUMMARY

F1.0 SUMMARY OF TENDER

F1.2 MECHANICAL AND ELECTRICAL SUMMARY OF TENDER

F1.1.1 SUBMISSION

The tender shall be submitted in the form of the Tender Return Summary given in Section 1.2.

Following submission of the tender the contractor shall afford the contract administrator/project manager the facility to examine the detailed summated quantified schedule of rates used to build up his tender and shall supply any further information necessary to substantiate his offer to the satisfaction of the employer.

F1.1.2 CONTRACTOR'S PROPOSALS

The following minimum information is to be included by the contractor in his tender submission:

- a). Specification of any specialist installations fully describing the proposed installation included for in the tender submission.
- b). Design Consultants – The name and addresses of any outside consultants employed or to be employed by the contractor shall be submitted with the tender.
- c). Insurance Policies - Copies of all insurance policies (including Professional Indemnity) held by the contractor.
- d). Schedule of manufacturers used in preparation of tender showing equipment to be supplied by each manufacturer.

F1.1.3 TENDER SUMMARY

The contractor must complete each and every section of the tender return summary when submitting this tender offer in line with the requirements of the electrical services specification.

The use of lumped prices covering several sections will not be accepted.

Failure to adhere to these instructions may result in the tender being disqualified.

A schedule of rates will be required for all aspects of the works one week from the award of the contract.

F1.2 MECHANICAL AND ELECTRICAL SERVICES SUMMARY - COSTING

The contractor is required as part of completing this summary document to advise and complete accurately the costing information requested below.

MECHANICAL SERVICES

		ITEM PRICE (£)
1.0	Preliminaries	
2.0	INCOMING SUPPLIES	
2.1	Incoming water supply and liaison with authority	
3.0	Disposal systems	
3.1	Foul Drainage Above Ground	
4.0	Domestics	
4.1	Domestic services pipework/valves/pumps/hangers etc, and connection to sanitaryware	
4.2	Heat pump to HWS	
4.3	PIR shut off and leak valves/system	

		ITEM PRICE (£)
4.4	Insulation	
4.5	External irrigation	
5.0	Heating/Cooling	
5.1	Heat pumps	
5.2	LPHW pipework, hangers, pumps and ancillaries	
5.3	Underfloor pipework and manifold system	
5.4	Overdoor heater	
5.5	Insulation	
5.6	Manifold boxing/access units	
6.0	Ventilation	
6.1	Kitchen ventilation units, antivibration mounts, ductwork including external discharge and louvres. Liason and coordination with kitchen specialist.	
6.2	Toilet ventilation units, antivibration mounts, ductwork including external discharge and louvres.	
6.3	Hall Velux rooflight unit integration	
7.0	BMS/Controls systems	
7.1	Packaged controllers	
8.0	BWIC	
8.1	Concrete pad for heat pump	
8.2	Concrete bases for vessels	
9.0	Other	
9.1	Testing/Commissioning/Flushing/chlorination of all systems	
9.2	Seasonal commissioning and soak testing	
9.3	Mechanical to electrical connections	
10.0	Management	
10.1	Operating and maintenance manuals	
10.2	Stakeholder/staff training	
10.3	Other items not included above:-	
	a	
	b	
SUB TOTAL		
CONTINGENCY @5%		

	ITEM PRICE (£)
TOTAL	

ELECTRICAL SERVICES

	ITEM PRICE (£)
1.0 PRELIMINARIES	
2.0 INCOMING SUPPLIES	
2.1 Incoming Electricity supply and liaison with authority	
2.2 Communications connections	
3.0 GENERATION/SUPPLY/HV DISTRIBUTION	
3.1 LV Supply / Public Utility Supply	
4.0 GENERAL LV DISTRIBUTION/LIGHTING/POWER	
4.1 LV Distribution	
4.2 General Lighting	
4.3 General LV Power	
4.4 Window actuators/transformers	
5.0 LIGHTING	
5.1 General Lighting	
5.2 Emergency Lighting	
6.0 COMMUNICATIONS – DATA	
6.1 Data Transmission	
7.0 SECURITY	
7.1 Security Detection and Alarm	
8.0 PROTECTION	
8.1 Fire Detection and Alarm	
8.2 Earthing and Bonding	
8.3 Lightning and Surge Protection Systems	
9.0 TESTING	
9.1 Testing/Commissioning	
9.2 Seasonal commissioning and soak testing	
9.3 Mechanical to electrical connections	
10.0 MANAGEMENT	
10.1 Operating and maintenance manuals	
10.2 Stakeholder/staff training	
10.3 Other items not above:-	
a	

	ITEM PRICE (£)
b	
SUB TOTAL	
CONTINGENCY @5%	
TOTAL	

CONTRACT TOTAL	ITEM PRICE (£)
TOTAL	

SCHEDULE OF RATES

Should the contractor be successful he must submit his fully priced schedule of rates for all aspects of the work quantifying and totalling the tender sum. These rates shall be used as a basis for any possible variation(s).

The contractor shall include any percentage mark ups used on sub-contracted works.

CONTRACT TOTAL IN WORDS [EXCLUDING VAT]	ITEM PRICE (£)

For and on behalf of:

COMPANY:	
POSITION:	
ADDRESS:	

SIGNATURE	
DATE:	

F1.3 SUB CONTRACTORS

Name and addresses of all sub-contractors and specialists.

Enter here the names and addresses of any other sub-contractors, supply chain or specialists to be employed on this project and the nature of the work to be undertaken:

WORK:	
COMPANY:	
ADDRESS:	

WORK:	
COMPANY:	
ADDRESS:	

WORK:	
COMPANY:	
ADDRESS:	

WORK:	
COMPANY:	
ADDRESS:	

NOTE:

The client and/or contract administrator/project manager reserves the right to refuse to allow any portion of the work to be sub contracted by any company whose name does not appear in the specification as a sub-contractor.

F2.0 SCHEDULE OF ALTERNATIVES

ITEM	ALTERNATIVE	COST IMPLICATION (£)	DELIVERY (WKS)

It shall be fully understood that the contractor's offer to carry out the works is based on the materials and manufacturers specified.

The project team (client side) are under no obligation to accept any of the above alternatives.

Should the Engineer wish to accept one or more of the alternatives offered then the Contractor will be informed in writing.

APPENDIX G
CHECKLIST FOR HANDOVER AND CLOSEOUT

The following building services certification/documentation must be in place where applicable prior to handover and close out and therefore practical completion of the project.

MECHANICAL BUILDING SERVICES CERTIFICATION			
MECHANICAL SYSTEM	FORMAT REQUIRED	SUBMITTED (☑) INCOMPLETE (☒) NOT APPLICABLE (N/A)	COMMENTS
Air conditioning (comfort cooling) system test certification			
Air conditioning (comfort cooling) system performance testing results			
Ventilation system test certificate / performance testing results			
Heating system test certificate			
Pressure systems test certificate	HSC L122		
Pressure vessels and systems written schemes of examination	HSC L122		
Pipework systems test certificates	HVCA TR/6 & TR/20		
Drainage system test certificate	Approved Document H		
Water distribution systems, flushing, cleaning and chemical dosing certificate	BS 6700		
Chlorination certificate for drinking water systems	BS 6700		

ELECTRICAL BUILDING SERVICES CERTIFICATION			
ELECTRICAL SYSTEM	FORMAT REQUIRED	SUBMITTED (☑) INCOMPLETE (☒) NOT APPLICABLE (N/A)	COMMENTS
Electrical Installation Certificate (IET)	BS 7671		NICEIC Format
Emergency Lighting Completion Certificate	BS 5266		NICEIC Format
Public Address Voice Alarm Completion Certificate	BS 5839-8 BS 6259		
Fire Detection And Alarm System Completion Certificate	BS 5839-1		NICEIC Format
Closed Circuit Television (CCTV) System Completion Certificate	BS EN 50132-7		
Central Control/Building Management Description of Operation and Completion Pack			

BUILDING SERVICES DOCUMENTATION		
DOCUMENT	SUBMITTED (☑) INCOMPLETE (☒), NOT APPLICABLE (N/A)	COMMENTS
Record/As Installed Drawings and Plans Used and Produced throughout the Construction Process along with Design criterion		In accordance with BSRIA BG79/2020
General Details of Construction Methods and Materials Used in Construction		
Manuals Produced by Specialist Contractors and Suppliers which Outline Operating and Maintenance Procedures and Schedules for Plant and Equipment		In accordance with BSRIA BG79/2020
Details On The Location and Nature of the Public Utilities and Services including Emergency and Fire Fighting Systems		In accordance with BSRIA BG79/2020
Details of any Wayleaves or Easements in Place		
Simplified Building User Guide		CIBSE TM31 Building Log Book Toolkit
CIBSE TM31 Log Book		CIBSE TM31 Building Log Book Toolkit
Schedule of Emergency Contacts		In accord with BSRIA BG79/2020
BRUKL Compliance Document		
EPC		

PRACTICAL COMPLETION		
ACTION	RESPONSIBILITY	COMPLETE (☑) INCOMPLETE (☒) NOT APPLICABLE (N/A)
Have the appropriate Health and Safety Executive (HSE) inspections taken place?	CDM Principal Designer	
Have the appropriate licences been obtained for any stored hazardous substances?	Client	
Has all the commissioning work been completed successfully and signed off (witnessed) by the appropriate member of the design team?	Design Team/Contractor/Commissioning Engineer	
Have all commissioning reports been issued?	Contractor/Commissioning Engineer	
Have all the required test certificates been issued?	Contractor	
Has the end user training/operator training taken place and attendance recorded?	Contractor/Client	
Has a schedule of outstanding works been agreed?	Project Manager/Contract Administrator	
Have any additional works that are required been agreed?	Contract Administrator	
Are all statutory examinations complete?	Project Manager	
Have all the fire systems and means of escape been inspected and approved? A risk assessment must have been completed.	Contractor/Local Fire Authority/Fire Officer	
Have all listed defects/snags been identified and rectified to acceptable standards?	Design Team/Contractor	
Has all the system(s) and product warranties been issued?	Contractor	
Have all the meter readings and fuel stocks been recorded?	Contractor/Client	
Have all the required tools, spares and consumables been issued with an accompanying inventory.	Contractor	
Have all the record drawings been completed, checked and signed off?	Contractor/Design Team/CDM Principal Designer	
Have all details of the construction methods and materials been issued to the CDM Principal Designer?	Contractor	

APPENDIX H
OPERATION AND MAINTENANCE (O&M) MANUAL CHECKLIST TEMPLATE

INFORMATION/PROCESSES REQUIRED

1. The user guide.
2. Operation and maintenance (O&M) manual.
3. Record drawings.
4. Familiarisation and training sessions.
5. Commissioning information.
6. Plant and system warranties.

THE USER GUIDE

7. Emergency procedures to be included.
8. Helpdesk contact, details of out of hours contacts and emergency contacts to be included.
9. General floor plans required, highlighting the site demise, location(s) on a coloured up set of floor plate drawings.

O&M MANUAL

10. The content should be as follows:-
 - a. Installation records.
 - i. The name and address of the installation.
 - ii. Details of local and public authority consents.
 - iii. Details of the design teams, consultants, contractors, designers, installation contractors and subcontractors.
 - iv. Dates for the start of the installation, for handover (practical completion) and for the expiry of the defects liability period.
 - v. Information on all guarantees affecting components, systems and plant items, together with expiry dates and names, addresses and telephone numbers or relevant contacts.
 - vi. For each item of plant and equipment installed within the building and contained in the list of services covered by the O&M manual, copies of the following documents should also be provided, where applicable:
 - Test certificates.
 - Manufactures' guarantees and warranties.
 - Insurance inspection reports.
 - Safety and fire certificates.
 - vii. A clear statement should be made in this section concerning hazards and safety precautions of which operators and maintainers need to be aware. This should include:
 - Any known feature or operational characteristic of the equipment or system installed which may produce a hazard.
 - Any known hazard against which protection can be provided.
 - Any mandatory requirements relating to safety.
 - Any other safety precautions which should be observed.
 - Any other relevant warning.
 - b. The purpose of the installation.
This section should provide a general overview of the original design intent (available in outline from the design brief and in detail from the specification. It should include a summary of each engineering system installed, giving:
 - i. The parameters and conditions within which it has been designed to operate a system.
 - ii. The type of each service (gas, electricity and water) required to operate a system.
 - iii. The intended method of control.
 This section should be kept as brief as possible.
 - c. Description of the installation.
 - i. The system type (such as cold water supply).
 - ii. System location and what it serves.
 - iii. What the system depends upon in order to function.
 - iv. Design data, basic design parameters, basic assumptions made during design.
 - v. Reasons for selecting particular plant.
 - vi. Expected service life (where available).

- vii. Planned operational efficiency.
- d. Equipment and materials schedules.
 - i. The type, model number, duty and serial number of all component items within the system should be listed, together with the names of their respective manufacturers or suppliers. This should include major materials used (such as fibre glass etc.)
 - ii. Type of materials used such as LSF cable, glass fibre insulation, MDPE barrier pipe etc. and identify where these are used.
- e. Parts identification and recommended spares.
 - i. This should comprise a parts identification list detailing and identifying replaceable assemblies, sub-assemblies and components. It should include suppliers' recommendations for both spares and running spares (parts required for replacement due to wear or deterioration).
 - ii. Items normally held in stock by a supplier, or for which a refurbishment service is available, should be identified separately.
- f. Spares Policy.
 - i. This section should offer a guide to the setting up of a spares facility including recommended stock levels. It should be prepared after consultation with the occupier regarding the consequences of failure, risk to core business, and the period of acceptable downtime. It should also take into account suppliers' recommendations as given above. Again, those items normally held in stock by a supplier (or for which a refurbishment services is available) should be clearly identified.
- g. System commissioning and test data.
The results of all commissioning work and associated tests should be given. This should include:
 - i. Measured data.
 - ii. Measurement points.
 - iii. Test equipment used.
 - iv. Details of calibration certificates.
 - v. A statement of whether design requirements were achieved.
 - vi. It is always useful for the commissioning certificates to include plant data, such as model, type and serial number. This information can be used as a cross-check against as-installed data sheets. This information can be easily transferred into an asset database.
- h. How the installation is to be used.
Instructions must be given for the safe and efficient operation of each engineering system, under normal and emergency conditions. These will be in addition to manufactures' literature for plant items and should include:
 - i. A recommended strategy for operation and control.
 - ii. An outline of the general operating mode.
 - iii. Control data (location, effect, object, sequence, limits of capability, modes, and set-points).
 - iv. Standard operating and emergency operating procedures, and sequences for start-up, running and shut-down, under normal and emergency conditions. These should be accompanied where possible with photographs or video recordings of the standard operating and emergency operating procedures.
 - v. Interlocks between plant items.
 - vi. Operating procedures for stand-by plant.
 - vii. Precautions necessary to overcome known hazards.
 - viii. The means by which any potentially hazardous plant can be made safe.
 - ix. Target figures for both energy consumption and energy costs.
 - x. Forms for recording plant running hours, energy consumption and energy costs. Monitoring against target figures mentioned above.

- i. How to keep the installation operational.
The manufactures' recommendations and instructions for maintenance must be detailed for each item of plant and equipment installed. Clear distinction should be made between planned tasks (preventative maintenance) and work done on a corrective basis. Instructions should be given on each of the following:
- i. The isolation and return to service of plant and equipment.
 - ii. Adjustments, calibration and testing.
 - iii. Dismantling and re-assembly.
 - iv. The exchange of components and assemblies.
 - v. Dealing with hazards that may arise during maintenance.
 - vi. The nature of deterioration and checks for defects.
 - vii. Special tools, test equipment and ancillary services.
- j. Maintenance schedules. (Cross referenced with equipment schedules)
Maintenance schedules should be provided for all preventative maintenance tasks. These should be based on both manufactures' recommendations and other authoritative sources (such as statutory mandatory requirements). The schedules should include:
- i. Inspections.
 - ii. Examinations.
 - iii. Tests.
 - iv. Adjustments.
 - v. Calibration.
 - vi. Lubrication.
 - vii. Periodic overhaul.
- The frequency of each task may be expressed as specific time intervals, running hours or completed operations, as appropriate. Collectively, the schedules will form a complete maintenance cycle, repeated throughout the working life of the installation.
The source of the schedules should be stated, and necessary periodic purposes should also be noted.
- viii. Procedures for the logical diagnosis and correction of faults should be provided.
 - ix. A schedule of all plant requiring lubrication should be provided, together with manufacturers recommendations on the type of lubricants and the method and frequency of application. Where a type of lubricant is identified by product name, a generic reference (such as a British Standard) should also be given. Information must also be provided on special requirements for the handling and storage of lubricants.
- k. Disposal of the installation.
Where relevant, information should be provided on the following details:
- i. Any known dangers likely to arise during the disposal of specific items of plant or equipment and material used, together with the necessary precautions and safety measures.
 - ii. Methods for safely disposing of or destroying the equipment or parts thereof, including packaging, insulation, fluids and other materials.
 - iii. Sources from which further advice can be obtained.
 - iv. Recycling information for the specific item of plant and materials.
- l. How the installation may be changed.
- i. Modifications are authorised changes which affect safety, reliability, operation or maintenance of a system or any of its components.
 - ii. Information on permitted plant or system modifications allowed for by manufacturers or system designers, should be included for each system. Space must be provided in the manual for the recording of all modifications and changes as they occur (this would initially comprise a series of appropriately header blank pages). Furthermore, it is essential that a procedure is devised and incorporated to ensure that all modifications are noted in every copy of the manual, wherever they are located.
- m. Manufactures' literature.
- i. Details of all manufacturers and suppliers of equipment listed in the manual should be provided, including name, address, telephone and fax number, e-mail contact and website. Any additional information likely to help the building operator make contact with, or obtain advice from, a manufacturer or supplier should also be included.
 - ii. Where appropriate, details of local stockists of spare parts, replaceable assemblies or complete units should also be provided. Details should be arranged in alphabetical order of manufacturer or supplier name to provide a logical information-retrieval procedure.
 - iii. A complete set of all manufactures' literature should be provided for the plant and equipment installed, and assembled for each building services system. This literature should provide the following information:
 - Description of the specific product as purchased. Including actual models used.
 - The cost and date of purchase.
 - Performance-behavioural characteristics of the equipment in use.
 - Applications (suitability for use).
 - Operation and maintenance details.
 - Labour, plant, materials and spatial resources required.
 - Methods of operation and control.
 - Cleaning and maintenance requirements.
 - Protective measures.
 - Labour safety and welfare associated with the equipment.
 - Public safety consideration.
 - iv. Where the data is not adequately provided in the manufacturers literature, the author of the O&M manual should attempt to gather the information. If the information proves unavailable, or if a supplier is unwilling or unhelpful, this should be treated as a breach of contract.
- n. Index of drawings.
An index should be provided of all as-fitted drawings supplied during the installation process, identified by number and title. The index should also include a schedule of all drawings issued by manufacturers and suppliers during the course of the installation work, such as control panel wiring diagram.
- o. Emergency information.
An important feature of any manual is the emergency information. This information should be located at the end of the document for ease of reference, and should include name, address, telephone and fax number, and e-mail addresses of the appropriate contracts in the event of fire, theft or burglary, and gas, electricity or water failures, and leaks. It should also list firm or staff to contact in the event of the failure or breakdown of plant, such as lifts, boilers or pumps. Where applicable, the location of the fire-fighting equipment, hydrants and rising mains should be described. Special attention should also be given to hazards particular to the building. Depending on client policy, a note of security installations may also be included.
11. Minimum information should be provided to meet with the requirement of The Health & Safety at Work Act 1974.
 12. Refer to BSRIA Limited Guide BG 2007/1.
 13. Provide a brief description of the work carried out.
 14. Identify residual hazards and how they have been addressed as part of the contract works.
 15. Any hazards associated with the materials used.
 16. Provide information regarding the removal of or dismantling of installed plant and equipment including access and lifting arrangements.
 17. Health and safety information to be provided for cleaning and maintaining the systems.
 18. Describe the nature, location and markings of significant services including firefighting services.
 19. Describe essential services and their integration to the site systems.
 20. Provide information and as built drawings, plant and equipment including means of safe access and egress, service voids, fire doors and compartmentation.
 21. A Control of Substances Hazardous to Health Regulations (COSHH) section to be provided where applicable.

RECORD DRAWINGS

22. Schematics to be provided.
23. Overview system layouts and control strategy to be provided.
24. Use the client room referencing / room numbering system.
25. Factory / manufacturers / suppliers drawings.
26. Electrical drawings
 - a. Layout drawings should indicate:-
 - i. Cable origin, route, loading, conductor metal, size, insulation type and colour, number of cores and number of cables on tray / in trunking / containment.
 - ii. Whether cables are run in the building fabric, on containment or surface affixed.
 - iii. The location, route and depth of underground cables.
 - b. Layout drawings should show:-
 - i. HV/LV switchgear.
 - ii. Primary cable / trunking distribution routes.
 - iii. Distribution switchgear.
 - iv. Distribution boards.
 - v. Trunking, tray and ladders in switch rooms and plant rooms.
 - vi. Single and three phase wiring and cable routes including sub-circuits.
 - vii. Electrical equipment including isolators, starters, socket outlet, control and other associated equipment.
 - viii. Final circuit references.
 - ix. Sections through risers and ceiling voids.
 - x. Lighting configuration, including control locations, switches and circuit identification.
 - xi. Emergency lighting fittings and supply circuits.
 - xii. Fire detection and alarm control and indicating equipment locations, cable routes, interfaces and device layouts including those in ceiling voids.
 - xiii. Lightning conductors and air terminals.
 - xiv. Earth electrodes and test clamps.
 - xv. Earth tapes.
 - xvi. Main earthing terminals, sub earth bars and clean earth bars.
 - xvii. Cabling providing specialist earth circuits.
 - xviii. Telephone (voice) and IT (data) cabling.
 - c. Schematic drawings should detail:-
 - i. Electrical systems, including cable size, type and number of cores.
 - ii. Fire alarm systems.
 - iii. Emergency lighting.
 - iv. Security system.
 - v. Public address systems.
27. Mechanical drawings
 - a. Layout drawings should indicate:-
 - i. The installation of mechanical services, including the size and route of ductwork and pipework.
 - ii. Plant room layouts including the identity of plant, size and rating.
 - iii. The identification and location of services concealed within the building fabric, structure or buried underground. Depth and points of entry to the building of water and gas services. Meter locations.
 - iv. Locations of pipework regulating, isolating, commissioning, control valves and backflow prevention valves.
 - v. Locations of regulating dampers and fire / smoke dampers including points of access.
 - vi. Location of acoustic silencers.
 - vii. Location of air distribution grilles, diffusers and terminal units.
 - viii. Details of vibration dampers.
 - b. Schematic drawings should detail:-
 - i. Heating, ventilating, air conditioning piping and plumbing systems including flow rates, temperatures and pressures.

- ii. Control system(s) arrangement, including building management system (control) sensor locations, field controllers, outstations and control panels.
28. Control and wiring diagrams
 - a. The origin, route and destination of the cabling.
 - b. The conductor sizes, number of cores (including spare cores), insulation type, rating, name and number of relevant British Standard or industry code for which the cable complies.
 - c. Cable identification, method and colour.
 - d. Joints and draw boxes.
 - e. Power supply cabling and their circuit protective device reference.
 - f. Location and type of sensors.

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The Development: **Heelands Community Centre, Milton Keynes – Upto RIBA Stage 3 (Performance Design).**

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