



HARNISS

HALEBOURNE CARE GROUP

**MECHANICAL, ELECTRICAL AND PUBLIC HEALTH SERVICES
PERFORMANCE SPECIFICATION**

Harniss Consulting

1 Weekley Wood Avenue
Kettering
Northants
NN14 1UQ

Tel: 01933 656850

Email: info@harniss.co.uk

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1 Introduction

- 1.1.1 This specification details the performance requirements for the mechanical, electrical and public health services installations for a standard base-build care home for Halebourne Care Group. When reviewing this specification, the reader will need to consider that the specification is produced as a base-build generic development document and as such project specific requirements may dictate enhancement or variation from the detail herein. When review this document against a specific project the contractor shall detail any such derogations that may be required as part of their tender submission.
- 1.1.2 This performance specification shall be read in conjunction with the main contract conditions and preliminaries and all other documentation produced or issued by the Employer, Employers Agent, Architect, Structural and MEP Engineers.
- 1.1.3 This performance specification sets out the principal requirements for the mechanical, electrical and public health services installation but does not obviate the Design and Build Contractor of their responsibility for any part of the installation to achieve the necessary performance requirements and in a manner that accords with all appropriate standards, statutory requirements and established custom and industry best engineering practice.
- 1.1.4 The installation shall be complete in every respect, including all ancillaries whether specifically mentioned or not, necessary for the systems to be installed, tested, cleaned, commissioned and perform correctly to meet the design intent, performance requirements and function in a safe and efficient manner.
- 1.1.5 During the tender period, any anomalies or discrepancies shall be brought to the attention of the Employers Agent, who shall direct the Contractor as to which criterion / requirement is to be met. The Contractor is deemed to have allowed within their tender return for the most onerous criteria or requirement where anomalies occur, but are not specifically identified within their tender submission.
- 1.1.6 The Contractor shall provide as part of their submission fully detailed system-by-system Contractors Proposals for all the Mechanical, Electrical and Public Health work elements. The contractor shall use all reasonable endeavours to design and construct to the requirements of this specification, which shall be deemed to represent the Employers Requirements. Any requirements that cannot be complied with shall be scheduled as a list of derogations in the Contractor's Proposals, including a clear description and reasoning for non-compliance. Where appropriate and agreed, the Client will confirm a relaxation to compliance of any particular requirement, as part of the contract, specific to any such submitted derogations. Note, the suit of documents that complete the Employers Requirements, take precedence over Contractors Proposals, therefore, should any works proceed which deviate from this specification without such agreement, the Employer reserves the right to request that services are removed and rectified with no additional cost to the client, nor detriment to quality or the contract programme.

- 1.1.7 Where specific fittings and or equipment is identified on the tender drawings, such as luminaires, these are indicative only to illustrate the design intent. The Contractor shall allow for suitable quantities of plant, equipment and components as required to meet the specified performance criteria detailed herein. Room data sheets have been included to provide the contractor with the quantities of power and data presentations to inform their tender submission, the final location of these shall be subject to final design coordination with the Project Architect and Interior Detailer.
- 1.1.8 Technical submissions shall be submitted, to the Employer and their professional team, for approval. These submissions shall be for all mechanical, electrical and public health services plant, materials, accessories and equipment during the detailed design phase with all submissions provided in good time to enable the client team to fully review and comment, which shall not be less than 14-working days. Any comments passed by the Employer or their professional team, shall not obviate the Designer/Contractor of any responsibility for the performance and suitability of the plant, product, material and or equipment for the application intended. Technical submissions for each system and all items of plant and equipment shall be issued prior to procurement and installation works commencing on site.
- 1.1.9 All ceiling mounted equipment (luminaires, grilles, fire devices, WiFi points, etc) shall be fully coordinated. Where the mechanical and electrical packages are sub-let individually, the contract shall assume that the coordination of all services, including the production and issue of the reflected ceiling plans shall fall under the responsibility of the Mechanical Contractor who shall ensure all services are fully coordinated with architecture, building structure and the Interior Designers requirements and visual aspirations. The Contractor shall ensure that the design of their systems, distribution and location of equipment and components shall be done so to ensure that access hatches in ceilings are kept back-of-house, where practicable. Access hatches to all plant, equipment and system components shall be fully detailed on the reflected ceiling plans and agreed with the client team prior to the commencement of services installations. Access hatches in resident accessible spaces shall only be accepted where specific written agreement has been provided by the client.
- 1.1.10 The Contractor shall complete the Contract Sum Analysis provided in section 8 of this specification, which shall be returned with the tender submission along with Contractor's proposals and a schedule of derogations, as a minimum.
- 1.1.11 The Contractor shall issue a detailed design programme that includes time allowance and issue dates for all information, including but not limited to:
- Detailed plan layout and schematic drawings for all systems
 - Builders work drawings
 - Equipment schedules
 - Technical submissions for all plant and equipment
 - Preparation and production of base design calculations
 - Production of lux level plots for all areas
 - Fully populated reflected ceiling drawings indicating fire detection, fire mist heads, etc.) for Client and Design Team approval
 - Part L compliance/energy strategy information

- 1.1.12 The mechanical, electrical and public health services design, including approval of the reflected ceiling plans and all technical submittals, should be complete prior to procurement and first fix activities commencing. Should the Contractor undertake first fix activities prior to the completion of all the design aspects and having satisfied the client team that the coordination of all services and in particular the completion of the setting out of all ceiling devices and ceiling access hatches as part of the reflected ceilings plans has been completed, they shall do so at their risk. The client shall not incur any cost or programme extension as a result of such works being undertaken where approval has not been received.
- 1.1.13 The Contractor shall undertake thermal modelling using software in accordance with CIBSE AM11. Modelling to demonstrate that the building's design and services strategy can deliver comfort levels in occupied spaces in accordance with the criteria set out in CIBSE guide A Environmental Design, CIBSE TM52, CIBSE TM59, room data sheets and the performance criteria set out herein.
- 1.1.14 The timely provision of design information, including the reflected ceiling plans, shall be linked to Contractor payment. Failure to provide the necessary information to the agreed and/or critical dates shall allow valuations or applications for payment to be adjusted accordingly.

2 General Requirements

2.1 General

This section defines the general requirements for the proposed works.

The Specification sets out the principal requirements of the installations but does not relieve the Contractor of their responsibilities for any part of the installation to achieve the necessary performance. The works shall be complete, tested and commissioned in their entirety.

The Contractor is deemed to have allowed within their tender offer for all items to ensure that the installation is complete in every respect and in accordance with the design intent.

This part of the Specification shall be read in conjunction with the subsequent sections and applied as appropriate.

For the avoidance of doubt, where there is a variance between this specification and the room data sheets, the most onerous requirement shall take precedence. All discrepancies shall be brought to the attention of the Contract Administrator.

The Contractor shall complete the Contract Sum Analysis provided in section 8 of this specification, which shall be returned with the tender submission along with contractor's proposals and a schedule of derogations as a minimum.

2.2 Definitions

The following definitions, where applicable, shall apply in construing the conditions and descriptions referred to in this document.

The EMPLOYER/CLIENT shall mean the company/body for which the works is being undertaken.

The EMPLOYERS AGENT shall mean the practice/company representing the Employer on project management matters.

The CLIENTS BUILDING SERVICES ENGINEER shall mean the practice/company specifying the building services performance requirements representing the Employer on all building services matters.

The QUANTITY SURVEYOR shall mean the practice/company representing the Employer on all costs, clauses and payment matters.

The ARCHITECT shall mean the practice/company appointed to advise/detail the architectural works.

The STRUCTURAL ENGINEER shall mean the practice/company appointed to detail structural works.

The CONTRACTOR shall mean the Contractor employed to undertake the works.

PROVIDE means design, supply, install, connect, complete, test and commission.

ALLOW/ALLOWANCE means the cost of the items referred to will be at the sole risk and expense of the Contractor.

NECESSARY means the cost of items referred to shall be carried out to the extent and by a method consistent with good practice.

BS means British Standard Specification current at the date of the detailed design.

CP means the British Standard Code of Practice current at the date of detailed design.

CO-ORDINATED means with all related services, structure and architectural requirements etc.

COMMENT or APPROVAL means that items shall be submitted to the Client and their team for comment and until returned endorsed 'No Comment' shall not be incorporated in the works.

2.3 Regulations & Installations Standards

The Contractor shall ensure that the design, installation, commissioning and handover of the mechanical, electrical and public health services installations shall fully comply with the latest editions or revisions of all applicable industry standards, including but not limited to the following:

- a) All British Standard Specifications
- b) All British Standard Codes of Practice
- c) Building Regulations
- d) The Health and Safety at Work Act
- e) Recommendations of the Health and Safety at Work Executive
- f) Electricity Acts
- g) Electricity at Work Regulations
- h) Building Research Establishment Digest Recommendations
- i) Local Bye-Laws and Regulations
- j) Requirements of the Building Control Officer, Fire Officer and Environmental Health Officer
- k) The Employers Building Insurer Requirements
- l) Requirements of the local Water Supply Company, Electricity Supply Company and local Authority
- m) The Institution of Engineering and Technology requirements for Electrical Installations (BS 7671), including all amendments and Appendices.
- n) COSHH Regulations
- o) Requirements of British Telecom and other telecommunications companies whose services will be taken into the building.
- p) Local Authority Regulations and Approvals (including Environmental Health Officer, Local Fire Officer and Building Control Officer)
- q) Local Water Supply Company Bye-Laws
- r) Water Regulations
- s) Health & safety Executive ACOP L8 and HSG 274
- t) All relevant publications such as Guides, Technical Memorandum, etc produced by the Chartered Institution of Building Services Engineers (CIBSE)
- u) BSRIA Publications and Technical / Building Guides and Principles
- v) Gas Safety Regulations
- w) Construction (Design and Management) Regulations
- x) Clean Air Act
- y) Control of Pollution Act

The design and installation shall be in accordance with all relevant elderly care home accommodation standards including the Care Standards Act and the Care Quality Commission National Minimum Standards.

Where published documents are referred to in the above list, the Contractor shall ensure that the complete works comply with the current edition.

Any intention to design to criteria other than those listed above shall be clearly identified.

The design concept shall investigate and evaluate the latest development in energy efficient equipment. Components, elements and control systems shall be chosen for cost effective optimum performance.

All services shall be designed and installed to facilitate inspection, adjustment and maintenance in the future.

All systems used to satisfy the environmental conditions shall be harmonious in operation; resilient in the case of failure; efficient and cost effective in capital operation and maintenance expenditure.

Wherever possible, equipment used shall qualify for Enhanced Capital Allowance and be listed in the Energy Technology List (ECA Scheme).

2.4 Design Criteria

Any intention to design to criteria other than those listed herein, including the referenced industry standards, regulations and best practice, shall be clearly identified.

The design concept shall investigate and evaluate the latest development in energy efficient equipment. Components, elements and control systems shall be chosen for cost effective optimum performance.

All services shall be designed and installed to facilitate inspection, adjustment and maintenance in the future.

All systems used to satisfy the environmental conditions shall be harmonious in operation; resilient in the case of failure; efficient and cost effective in capital operation and maintenance expenditure.

2.4.1 Mechanical Services

The following design criteria shall be used as the basis of the design for the mechanical services installation:

Thermal Transmittance Values

Refer to the building specification produced by the project architect for the building envelope thermal performance figures.

It is the Main Contractor's responsibility to ensure compliance with all parts of the Building Regulations which will require an holistic approach to both building thermal performance and the efficiencies of the fixed-building services to achieve the optimum route to compliance with AD Part L of the Building Regulations and any energy / carbon targets imposed by the Local Authority.

Outdoor Temperatures

Summer	30°C db, 20°C wb
Winter	-5°C db, 100% saturation

An external temperature of 35°C shall be used for cooling equipment selection.

<u>Internal Temperatures</u>	Winter (°C)	Summer (°C)
Bedroom	- 23°C	
Ensuite	- 23°C	
Entrance Lobby	- 22°C	
Reception	- 22°C	- 24°C
Welcoming Area	- 22°C	- 24°C
Lounge / Bar	- 22°C	- 24°C
Dining	- 22°C	- 24°C
Lounge / Dining	- 22°C	- 24°C
Private Dining	- 22°C	- 24°C
Cinema	- 23°C	- 24°C
Bathroom	- 25°C	
Hairdresser	- 23°C	- 24°C
Visitor WC	- 21°C	
Resident WC	- 23°C	
Office	- 21°C	- 24°C
Commercial Kitchen	- 18°C	- 24°C
Commercial Laundry	- 20°C	- 24°C
Staff Rest	- 21°C	
Staff Change	- 23°C	
Drugs Room	- 19°C	- 19°C
Sluice	- 18°C	
Store Rooms	- 18°C	
Linen Store	- 23°C	
Cleaner	- 18°C	
Nurse Station	- 21°C	
Plantroom	- 5°C	- 35°C
Server/Comms Room	- 19°C	- 19°C
Resident Corridor	- 23°C	
Staff Corridor / Stair	- 19°C	

Infiltration Rate

As per figures in CIBSE guide A.

Control Tolerance

+/- 2°C on room temperature (Note, this is for control purposes only and the Contractor shall design the systems based on the required design temperatures as detailed above)

External Noise Level

As required by the Environmental Health Officer and Local Authority, but should not exceed 38dB(A) on any residential elevation, where a natural ventilation philosophy is adopted.

Internal Noise Levels

Refer to acoustic section below.

Ductwork

Ductwork shall be sized to the following criteria:

Plantroom and Risers	6m/s maximum (8m/s for kitchen extract)
Distribution above False Ceilings	4m/s maximum
Final Distribution to Grille/Diffuser Plenums	2.5m/s maximum
Aspect Ratio	Not to exceed 4:1

Due consideration shall be given to the acoustic specification/requirements of any area served or through which ductwork passes and the above maximum figures reduced accordingly where appropriate.

Notwithstanding the above, the ductwork distribution system shall provide noise levels in accordance with the noise design criteria. Ventilation openings and duct penetrations through the structure/partitions shall not undermine the sound reduction indices of the structure/partitions. Should cross-talk attenuators be required, then they shall be selected and installed to ensure that the structure/partition sound reduction indices are maintained when speech conditions occur.

Water Temperatures

Primary Heating Flow & Return	- 45°C/40°C
Domestic Hot Water Distribution	- 60°C (return not below 55°C)
Domestic Hot Water (Staff only Sinks)	- 55°C
Domestic Hot Water (all WHB/Showers)	- 41°C
Domestic Hot Water (Showers)	- 38°C
Domestic Hot Water (Baths)	- 43°C

'Hot Water' Warning notices are to be provide above any tap or outlet where temperature exceeds 44°C.

Pipework

The pipework shall be sized for maximum velocities and pressure losses as follows:

LTHW:

- 250 Pa maximum per metre run
- 1.5 m/s maximum velocity for pipework 32 mm diameter or above
- 1.0 m/s maximum velocity for pipework of 25 mm and under

Domestic Water:

- 400 Pa maximum per metre run
- 1.5 m/s maximum velocity for pipework 28 mm diameter or above
- 1.0 m/s maximum velocity for pipework of 25 mm and under

Care shall be taken to ensure that vulnerable users are not able to come into contact with surface temperatures exceeding 43°C. Vertical pipe drops shall be boxed in or run within partitions or wall chasings, surface mounted pipework shall not be permitted in any areas.

All concealed pipework within ceiling voids and risers etc. shall be insulated.

Ventilation Systems

The ventilation system shall be designed to achieve the minimum requirements to meet occupancy loadings for each given space. Generally, the ventilation strategy for the building will adopt a natural philosophy which will require room configuration, trickle ventilation and opening windows to conform with the minimum standards as set out in AD Part F and CIBSE AM10. To achieve a sound natural ventilation philosophy the architect and mechanical engineer will need to work closely, ensuring where any ironmongery limits the ventilation provision of any such management procedure to overcome this is agreed with both the client team and approved by the Building Control Officer.

Heating

No allowance shall be made for the heat gain from lighting, occupants and equipment within the heat loss calculations.

The Contactor shall make due consideration to the effect of ductwork air leakage within the design for air systems and fan selection.

The ASHP plant size shall be based on the specified external design conditions with overload capacity as detailed in the CIBSE Guide.

The areas to be heated by the LPHW heating system shall comprise of all habitable rooms which have a calculated heat loss exceeding 150 Watts. Where room heat losses fall below 150 Watts and heating is not provided, the heat loss shall be added to the calculated loss of an adjacent space, where internal design temperatures accord. Where VRF comfort cooling is proposed, the VRF system shall also provide the heating.

Where the room heat loss dictates, all ensembles and bathrooms shall be provided with an electric, polished chrome, ladder style, low surface temperature electric towel radiator complete with digital thermostatic control. Towel radiators shall be provided by the Mechanical Contractor and power supplies provided by the Electrical Contractor.

The system shall be based on a 24-hour heating system operation during steady state conditions at the external winter design condition, with all ventilation plant operating at peak design air volume flow rates.

All Underfloor heating shall be sized 10% greater than the design heat loss for underfloor heating spaces.

Comfort Cooling

Comfort cooling shall be avoided where sufficient ventilation rates cannot be provided to limit heat gains to rooms. Comfort cooling shall be provided to rooms as identified within the Room data sheets and on the design intent drawings.

The building shall be designed to conform to the overheating requirements of the building regulations applicable to this development.

The internal dry bulb summer design air temperature associated with the comfort cooling systems shall be as detailed in this specification, but to the following areas:

- All Drugs Rooms
- Communications Rooms

- Reception
- Welcoming Area
- All lounges and Dining Rooms
- Private Dining
- Gyms
- Hair Salon
- Cinema
- Kitchen
- Laundry

The comfort cooling for the selected lounges/day spaces shall be designed based upon the installed lighting load and design occupancy level, and shall include for all fabric, equipment and solar gains. The selection of these units shall be undertaken with a sympathetic approach to the interior design of each space. The preferred option will be to provide recessed ceiling mounted cassette type units to mitigate the need for concealed services and large access panels for maintenance.

Concealed, ducted Fan Coil Units shall be provided to the reception and welcoming area. Wall mounted units in front of house spaces will not be permitted.

The drugs room comfort cooling shall be designed based upon the installed lighting load, 2 no. occupants in the room and equipment heat gains to suit installed appliances or minimum 2000W, whichever the greater.

The cooling load for the communications room shall be based on the installed active equipment loads as defined by the IT specialist. In the event of this information not being available the unit shall be sized to meet a cooling load of no less than 2500W.

Cooling to the Laundry shall be calculated to include heat gains of the specialist equipment but shall be a minimum of 10kW.

The comfort cooling systems shall be designed to achieve the internal noise criteria as stated later in this section. The external condensers will need to be designed, selected and positioned to ensure that the relevant external noise criteria as described below is achieved, this may dictate the need for acoustic screening which will be deemed as being including within the tender contract sum analysis.

Operation Parameters

The care home shall operate 24 hours a day, 365 days per year.

Where occupancy is not specifically qualified for a given space, the furniture detailed on the architectural drawings shall be deemed to be representative of the maximum occupancy and as such environmental designs shall meet these levels.

Metering

A detailed metering strategy in compliance with CIBSE TM39 shall be developed in conjunction with the Client to achieve their desired objectives with respect to metering. The provision for metering shall be no less than the minimum provision as detailed in Building Regulations Part L2A and referenced guidance.

Metering is also specifically required to the Kitchen and Laundry water, gas and electrical supplies.

All metering is to be linked to the BMS panel and readable from both the panel and the meter itself.

Plant Selection Margins:

ASHPs	+10%
Pumps	+10% flow rate & +20% pressure
UFH	+10%
Heating System Pipework	+5%
Fans	+10% flow rate & +20% pressure

2.4.2 Electrical Services

The following design criteria shall be used as a basis for the design of the electrical installations. The design criteria shall satisfy the local Electricity Supply Company's requirements and also meet the following:

- The electricity supply from the transformer will be 230/400v; 3-phase; 4-wire; 50Hz; earthed as advised by the local Electricity Supply Company.
- The contractor, as part of their design, shall assess the risk in respect to the use of arc fault detection devices (AFDDs) and provide a clear statement where these devices are not being installed. Any such risk assessment shall be fully detailed to include all building operation / management mitigation measures, where imposed, which are to be approved in writing by the client and fully documented within the Operation and Maintenance manuals, Electrical Tester certification and the Building Logbook.
- Where AFDDs are specified these shall be at the origin of the final circuits requiring protection and shall be in AC single-phase circuits not exceeding 230V, in accordance with BS 7671.
- AFDDs shall comply with BS EN 62606 and coordination with overcurrent protective devices, where necessary, shall be fully in accordance with the manufacturer's recommendations.
- The earth fault loop impedance at the low voltage supply terminals shall be as advised by the local Electricity Supply Company.
- The prospective short circuit current at the low voltage supply terminals shall be as advised by the local Electricity Supply Company.
- Method of protection against electric shock shall be earthed equipotential bonding and automatic disconnection of supply.
- Basis of calculation and impedance criteria to be used is Tables 41.1, 41.2, 41.3 and 41.4 of BS 7671.
- Ambient temperature to be used for calculations shall be 30°C minimum, or as calculated.
- Specific criteria as detailed on the room data sheets.
- The lighting design shall be undertaken in accordance with the performance specification, room data sheets and all applicable guides and standards where appropriate including BS EN 12464-1 Lighting of Work Places and BS 5266 / CIBSE LG12 for Emergency Lighting. Lighting levels shall be in accordance with the CIBSE Lighting Guides LG9 and LG2 and relevant health authority/NHS documentation, and shall at least achieve the average maintained illuminance levels as detailed in the Room Data Sheets.

Design lighting levels shall be as follows:

Area	Illumination Level (Lux)
Bedroom	150 lux
En-suite	150 lux
Dementia Bedroom	200 lux
Dementia En-suite	200 lux
Entrance Lobby	200 lux
Reception	200 lux
Reception Desk Area	500 lux
Welcoming Area	300 lux
Café / Bar Kitchenette Counters	500 lux
Lounge / Bar	300 lux
Dining Rooms	300 lux
Cinema	300 lux
Bathroom / Shower Rooms	300 lux
Hairdresser	300 lux
Hairdresser Work Stations	500 lux
WC's	200 lux
Offices	500 lux
Commercial Kitchen	500 lux
Commercial Laundry	300 lux
Staff Rest	200 lux
Staff Change	200 lux
Drugs Room	500 lux
Sluice	500 lux
Store Rooms	100 lux
Cleaners	150 lux
Linen Store	100 lux
Maintenance Store	300 lux
Plantroom	200 lux
Server/Comms Room	300 lux
Corridors	200 lux
Dementia Corridor	300 lux

Where rooms of different lighting specification are combined to form a single space, the entire space shall be illuminated to the highest Lux level specified (i.e. no change in lighting levels shall be permitted, other than dimmable). The lighting within offices shall fully comply with the recommendations of CIBSE Lighting Guide LG7.

Luminaire lamp colour temperatures shall be as follows:

Area	Lamp Colour Temperature (Kelvin)
Bedrooms	2700K

En-suite	2700K
Entrance Lobby	3000K
Reception	3000K
Reception Desk Area	3000K
Welcoming Area	3000K
Café / Bistro Counters	3000K
Lounge/Bar	3000K
Dining	3000K
Cinema	3000K
Bathroom/Shower rooms	3000K
Hairdresser	3000K
Hairdresser Work Stations	4000K
WC's	4000K
Offices	4000K
Commercial Kitchen	4000K
Commercial Laundry	4000K
Staff Rest	3000K
Staff Change	4000K
Drugs Room	4000K
Sluice	4000K
Store Rooms	4000K
Cleaners	4000K
Linen Store	4000K
Plantroom	4000K
Server/Comms Room	4000K
Corridor	3000K

Lighting levels shall be achieved utilising fixed lighting in all cases. Decorative light fittings (such as chandeliers and wall lights) in bedrooms and day spaces shall not be included within the lighting design calculations, nor shall portable or task lighting (such as desk lamps).

The cinema shall be provided with fully dimmable lighting controls to vary the lighting level between off and 100%.

A luminaire schedule has been provided as part of the contract documentation. The Contractor shall utilise these luminaires in the production of the tender submission. Should the Contractor wish, alternative luminaires may be offered as a cost option within the Contract Sum Analysis. A detailed luminaire schedule shall be provided to support this option. Should this option be of interest, samples of all luminaires shall be submitted for approval by the Client, Employers Agent and Clients Building Services Engineer prior to procurement (note, this approval applies to intent and aesthetics only, and does not obviate the Designer / Contractor of any responsibility for the performance and suitability of the luminaires for the area and application intended and should also not impact on any other fixed building services installation and building fabric performance).

External lighting designs shall comply fully with the requirements of CIBSE Lighting Guide LG6, BS 5489 Part 9, BS EN 13201, and BS EN 12464-1 Lighting of Outdoor Spaces, ILE Reduction of

Obtrusive Light guidelines and all other applicable standards. Reference shall be made to the specific landscape design for the project and any specialist consultant design information, including any external lighting (decorative or functional) requirements identified therein. The following minimum lux levels are to be achieved.

2.4.3 Acoustic Requirements

The Contractor shall provide all necessary items of acoustic equipment to achieve the design noise and vibration criteria in accordance with the Environmental Noise Impact Report. Where no guidance is offered, the Contractor shall ensure that noise levels at the site boundary are no greater than 5dB under the background noise level as measured before the development commenced.

The internal noise levels to be achieved by the mechanical and electrical services installation when operational shall be NR35 or as detailed as follows:

Bedroom	NR25
Ensuite	NR 30
Entrance Lobby	NR 35
Reception	NR 35
Welcoming Area	NR 35
Lounge	NR 35
Dining	NR 35
Private Dining	NR 30
Cinema	NR 30
Bathroom	NR 35
Hairdresser	NR 35
WC	NR 35
Office	NR 35
Commercial Kitchen	NR 45
Commercial Laundry	NR 40
Staff Rest	NR 35
Staff Change	NR 35
Drugs Room	NR 35
Sluice	NR 40
Store Rooms	NR 40
Linen Store	NR 35
Plantroom	NR 55
Server/Comms Room	NR 40
Corridors	NR 35

The acoustic performance requirements shall be met by the following means as necessary:

- Correct selection and sizing of system plant
- Specifying low-noise plant and selection of fan units at low or medium speed at design duty
- System side attenuators in ductwork
- Atmospheric side attenuators in ductwork
- Cross talk attenuators in ductwork as necessary
- Anti-vibration mountings

- Flexible couplings
- Ductwork acoustic insulation

2.4.4 Sanitary Ware

Sanitary ware shall be provided in accordance with the Architect's/Interior Designer's Sanitaryware Schedule and any detailed requirements by the Architect/Interior Designer. All sanitary ware shall be subject to approval of samples prior to acceptance/procurement.

2.5 Design Calculations and Design Drawings

A detailed design programme and deliverables schedule shall be provided prior to the commencement of the detailed design process.

The design drawings shall be fully co-ordinated with the Architect's and Structural Engineers drawings and shall fully detail the design intent of the installation. The design drawings shall substantiate in all respects the design calculations.

Copies of design calculations and drawings shall be submitted to the Clients Building Services Engineer by the Contractor for comment prior to ordering of materials and commencement of installation or related structure, etc. Notwithstanding this, the Contractor shall be responsible for any error, discrepancy or omission in any calculation or design drawing prepared by them or on their behalf, whether or not such calculation or design drawing has been passed 'No Comment' by the design team.

The Contractor shall be responsible for carrying out all calculations required to size and select all materials, plant and equipment to satisfy the requirements of this specification.

Heat gains, losses, and ventilation rates, etc., to all areas within the building shall be evaluated in accordance with the latest edition of the CIBSE Guides, Building Regulations, etc., to comply with the Employer's Requirements.

Heat gain calculations shall be carried out for all spaces to ensure that no space suffers from overheating. The calculations should include, but not be limited to, the total of solar infiltration, lighting, small power, equipment and occupancy gains, including both sensible and latent gains.

The Contractor shall be responsible for carrying out the 'Design' and 'As Built' SBEM and overheating calculations (L2A requirement) as required by Building Control and ensuring that the completed building meets the requirements.

The Mechanical Contractor shall also be responsible for undertaking building modelling and assessment for overheating as defined under criterion 3 of the Building Regulations. The Mechanical Contractor shall be responsible for advising the construction team of the limiting U & g-values for glazing specification to ensure compliance with Building Regulations which shall be achieved without placing unrealistic restrictions on other building elements, form of construction and the fixed building services installations.

Calculations shall be forwarded to the Contractor (or the Architect) and the Employer before any plant, equipment and materials are placed on order to allow the assumptions made and calculations provided to be inspected.

The full design calculation package should be updated throughout the contract period to incorporate any changes made, actual cable and circuit lengths used on site, etc. Two copies of

the completed calculation package should be handed over as part of the as-built information to comply with the requirements of TM31.

2.5.1 Public Health Services

Calculations shall comprise, but not be limited to the following:

- Incoming water mains sizing
- Sizing of cold-water storage tank
- Cold-water service pipework sizing
- Hot, cold and drinking water services pipework sizing
- Hot water calorifier's capacity sizing
- Soil and waste pipework sizing

Design drawings shall comprise, but not be limited to the following:

- | | |
|--|------|
| - Full set of co-ordinated floor plans | 1:50 |
| - Details of sanitary plumbing and water services layout in all relevant areas, i.e. toilets etc. | 1:20 |
| - Co-ordinated service duct layouts | 1:20 |
| - Details of access panels required for maintenance purposes | 1:50 |
| - Water Services and sanitary plumbing schematic layouts | NTS |
| - Co-ordinated incoming services layout | 1:50 |
| - Fully populated reflected ceiling drawings indicating all | 1:50 |
| - Ceiling mounted equipment (luminaires, grilles, fire detection etc) for Client approval prior to procurement and first fix installation. | |

2.5.2 Mechanical Services

Calculations shall comprise, but not be limited to the following:

- Air volume flow rate requirements
- Pump sizing and selection curves
- Fan sizing and selection curves
- Ductwork sizing
- Pipework sizing
- Heat losses
- Heating plant load
- Acoustic calculations
- Grille and diffuser sizing and selections

Design drawings shall comprise, but not be limited to the following:

- | | |
|--|------|
| - Co-ordinated floor layouts and sections | 1:50 |
| - Co-ordinated plant area layouts and sections | 1:20 |
| - Co-ordinated Plantroom layouts and sections (including Public Health services) | 1:20 |
| - Schematic diagrams of mechanical services and controls (Showing all design flow rates) | NTS |
| - Details of co-ordinated services | 1:20 |
| - Riser shafts co-ordinated layouts | 1:20 |
| - Co-ordinated field power and control wiring layouts for | 1:20 |

Mechanical plant

- Schematic diagram of motor control centre and field power and control cabling NTS

Pipework schematics shall show velocity, flow rate, pipe size and pressure drop per metre to each main and branch.

Ventilation schematics shall show velocity, flow rate, duct size and pressure drop per metre to each main and branch.

2.5.3 Electrical Services

The electrical services installation shall be provided as a complete and fully functioning installation at the agreed completion date.

Calculations shall comprise, but shall not be limited to the following:

- Detailed calculations on all disconnection times, earth fault loop impedance, short circuit protection and discrimination, including volt drop, current carrying capacities of cables, space factors, grouping etc. to establish sizes for all cables and equipment on approved software such as Amtech, etc.
- Lighting design calculations, including provision of Isolux diagrams, photometric data and glare calculations on Dialux / Relux software
- Emergency lighting calculations on Dialux / Relux software
- Schedule of loads including diversity values
- Protective and equipotential bonding conductor sizing calculations or as Chapter 54 in BS 7671
- Protective device discrimination graphs / Study on approved software such as Amtech.
- Incoming electricity supply capacity
- Acoustic calculations to verify fire alarm sounder type and locations.

Design drawings shall comprise, but not be limited to the following:

- | | |
|--|-------|
| - External lighting | 1:50 |
| - All mains LV distribution routes | 1:50 |
| - Co-ordinated reflected ceiling plans showing lighting layout | 1:50 |
| - Co-ordinated small power layouts | 1:50 |
| - Co-ordinated fire alarm layouts | 1:50 |
| - Co-ordinated plant area and plant room layouts | 1:20 |
| - Co-ordinated lightning protection layout | 1:50 |
| - Schematic wiring schedule and wiring diagrams | NTS |
| - Earthing schematic | NTS |
| - Main distribution schematic | NTS |
| - Fire Alarm Schematic | NTS |
| - Lighting Control (Internal – if required; External) | NTS |
| - Nurse Call / Staff Attack System | NTS |
| - Access Control / Security / CCTV Systems | NTS |
| - Details of all co-ordinated services | 1:20 |
| - Riser shafts details | 1:20 |
| - Co-ordinated data and voice cable tray layouts | 1:50 |
| - Co-ordinated external services layout including | 1:100 |

Incoming supply, supplies and ducts for External
Lighting installations, etc.

NOTE. Earthing & Mains Schematic can be provided on the one drawing

2.6 Room Data Sheets

The room data sheets along with the Employers Requirements shall be read in conjunction with this specification and part of separate documentation being issued by the client. No additional cost will be accepted where full documentation has not been issued/reviewed and or included within the M&E submission, and it is the responsibility of the Main Contractor to co-ordinate all the information contained within the tender documentation.

During the tender period, any anomalies or discrepancies shall be brought to the attention of the Employers Agent, who shall direct the Contractor as to which criterion / requirement is to be met. The Contractor is deemed to have allowed within their tender return for the most onerous criteria or requirement where anomalies occur but are not specifically identified within the tender submission.

2.7 Building Regulations Part L2A / Energy Performance Certificate

The Contractor shall ensure that the mechanical, electrical and public health services installation fully comply with Part L2A of the Building Regulations in force at the time of installation. This shall include all necessary designs and installation requirements covering all aspects of the services installations.

The Contractor shall be responsible for developing the energy strategy during the detailed design period in conjunction with the remainder of the design team and any design development. The Contractor shall have made all due allowances to meet any local planning policy or funder requirements in relation to energy / carbon targets; as well as compliance with the Building Regulations.

An Energy Performance Certificate shall be provided at project completion.

The Contractor shall provide all necessary calculations and technical information in order to ensure that Building Regulations approval is obtained.

The 'As Built' analysis, associated BRUKL document and Energy Performance Certificate shall be completed and submitted prior to Practical Completion – Practical Completion may not be granted without this information in place.

2.8 Contractor's Working Drawings

2.8.1 General

The Contractor shall be responsible for the correct settings out of the works and shall provide fully detailed and co-ordinated working drawings.

The working drawings shall be based on the design drawings and shall take into account all drawings applicable to other disciplines, trades and service; site constraints and all modifications which may have or will take place to the buildings or installations. These drawings shall be correctly related to the selected plant and equipment.

The Contractor shall be responsible for providing all working drawings in adequate time to ensure that there is no delay in the programme for construction of the building and external works. The Contractor shall be responsible for any error, discrepancy or omission in any drawing prepared by them or on their behalf whether or not such drawing has been passed 'No Comment'

The Contractor shall be responsible for co-ordinating their working drawings with all other information, structure, interior details etc. along with the Architect's and Structural Engineers drawings. The drawings shall be fully dimensioned ready for installation.

The Contractor shall update their working drawings in accordance with any revisions to the Architect's and Structural Engineer's drawings.

Working drawings shall be fully dimensioned ready for installation, indicating the positions on plan relative to walls, grid lines, etc., of the locations of all conduit, trunking, cable trays, conduit outlet boxed, cable routes, pipework, ductwork, control equipment, isolators, plant equipment, supports, detectors, luminaries, etc. All drawings shall be prepared using AutoCAD software with each drawing being produced in "DWG" format on a CAD draughting system. Double line ductwork drawings shall be provided. Invert levels shall be shown along with setting out dimensions from building grid lines.

Double line drawings for all primary main containment, such as cable tray, ladder, basket tray, trunking as appropriate shall be shown in ceiling voids and riser locations.

All working drawings shall be provided at either A1 or AO size together with an A3 copy along with an e-mailed PDF copy to all parties at every issue.

All working drawings shall be submitted to the Employers Agent and Clients Building Services Engineer for comment prior to commencement of the installation. The Contractor shall allow a minimum period of 14-working days for any comments to be issued. Sufficient time shall also be allowed to accommodate the comments made. Work shall not be commenced on site until the appropriate drawing has been endorsed 'No Comment' by the Clients Building Services Engineer. Any work commenced, or materials ordered prior to receipt by the Contractor or Contractor's drawings marked 'No comment' will be at the Contractor's own risk. Should any work installed, or materials orders, require alteration, amendment or re-ordering to suit any comments made shall render the Contractor solely responsible for accepting any costs incurred.

An approved and fully up to date copy of all working drawings and specification shall be kept on site by the Contractor and made available for inspection at all reasonable times.

2.8.2 Public Health Services

Working drawings shall comprise, but no be limited to the following:-

-	Co-ordinated incoming services layout	1:50
-	Full set of co-ordinated plans	1:50
-	Details of sanitary plumbing and water services layout in all relevant areas, i.e. toilets etc.	1:20
-	Co-ordinated service duct and Plantroom layouts	1:20
-	Details of access panels required for maintenance purposes	1:50
-	Water services and sanitary plumbing schematic layouts	NTS

2.8.3 Mechanical Services

Working drawings shall comprise, but not be limited to the following:

-	Co-ordinated floor layouts and sections	1:50
-	Co-ordinated plant area layouts and sections	1:20
-	Co-ordinated plantroom layouts and sections (Including public health services)	1:20
-	Wiring layouts (power and controls)	1:20
-	Schematic diagrams of mechanical services and controls	NTS
-	Control panel wiring diagrams (including field wiring and package plant)	NTS
-	Details of co-ordinated services	1:20
-	Riser shafts and co-ordinated layouts	1:20
-	Ductwork fabrication drawings	1:50
-	Control panel fabrication drawings	NTS
-	Manufacturers drawings of all plant equipment	1:50
-	Details of all purpose made brackets, hangers, guides, anchors etc.	1:20
-	Details of access panels required for maintenance purposes	1:50
-	Co-ordinated incoming services layouts	1:50

2.8.4 Electrical Services

Working drawings shall comprise, but not be limited to the following:

-	Co-ordinated external services layout including incoming Supply, supplies and ducts for external lighting installations Etc.	1:50
-	External lighting	1:50
-	All main LV distribution routes	1:50
-	Co-ordinated reflected ceiling plans showing Lighting Layout	1:50
-	Co-ordinated lighting plans	1:50
-	Co-ordinated small power layouts	1:50
-	Co-ordinated fire alarm layouts	1:50
-	Co-ordinated plant area and plant room layouts	1:50
-	Co-ordinated lightning protection layouts	1:50
-	Co-ordinated data and voice Cable Tray and Conduit Layouts	1:50
-	Schematic wiring schedule and wiring diagrams	NTS
-	Earthing schematic	NTS
-	Main distribution schematic	NTS
-	Details of all co-ordinated services	1:20
-	Riser shaft details	1:20
-	Details of access panels required for maintenance purposes	1:50
-	Manufacturer's drawings of all plant and equipment	1:50

2.9 Builderswork Drawings

The Contractor shall be responsible for preparing detailed builderswork drawings.

The builderswork drawings shall be based on the working drawings and shall take into account all drawings applicable to other disciplines, trades and services and all modifications which may have or will take place to the buildings or installations. These drawings shall be correctly related to the selected plant and equipment.

Any hatches required for access to isolation valves, etc. shall be detailed and signed off by the Architect before installation. Hatches in resident accessible areas shall be avoided and shall only be acceptable with the prior written agreement by the client or their agent.

The Contractor shall be responsible for providing all builderswork drawings in adequate time to ensure that there is no delay in the programme for construction of the building and external works. The Contractor shall be liable for any costs associated with delays, incorrect works, etc., caused by their failure to issue approved builderswork drawings in sufficient time.

The Contractor shall be responsible for any error, discrepancy or omission in any drawing prepared by them or on their behalf, whether or not such drawing has been passed 'No Comment'.

The Contractor shall allow 10 working days for the processing and commenting on the builderswork drawings by the Clients Building Services Engineer within his programme, along with sufficient time to modify the builderswork drawings.

The Contractor shall be responsible for co-ordinating his builderswork drawings with all other information, along with the Architect's and Structural Engineer's drawings. The drawings shall be fully dimensioned ready for installation, including setting out dimensions from building grid lines.

All builderswork drawings shall be prepared on a CAD draughting system using AutoCAD software with all drawings being produced in "DWG" format.

The builderswork drawings shall include, but not be limited to the following:

- Details of all bases for plant formed in concrete, brickwork or wood, to a scale of not less than 1:20
- Details of all attendant builderswork holes, chases etc. for ductwork, louvers, pipework, conduits, etc. and any item where access for services is required to a scale of not less than 1:50
- Details of support, fixings etc. for the lift installations, to a scale not less than 1:20
- Details of holes required in structural beams, to a scale not less than 1:20

2.10 On Site 1-20 Drawings

During the construction phase the Main Contractor shall provide a wall fixed A3 size colour printed and laminated copy of the latest agreed 1:20 room layout drawing within each corresponding room to assist all trades and checking consultants.

2.11 Record Drawings

The Contractor shall supply a comprehensive set of record drawings of the works. The record drawings shall be based upon the marked-up copies of the working drawings.

The record drawings shall include the following:

- General arrangement drawings of all services to a scale of not less than 1:50
- Detailed layouts and sections of all plant rooms, plant enclosures, tank rooms, etc. and similar spaces to a scale of not less than 1:20.
- The circuit diagrams of all electrically operated equipment not detailed in the Operating and Maintenance instructions.
- Complete wiring diagrams, and/or piping diagrams, of external connections between panels, thermostatic controls, starters and the like where supplied under the Contract.
- All valve charts indicating the complete system in diagrammatic form, and indicating all valves installed on the systems, together with a corresponding numbered scheduled listing the size, duty and type.

Four weeks before the anticipated contract completion date, the Contractor shall supply draft copies of all record drawings to the Employers Agent and Clients Building Services Engineer for comments. The completed and approved drawings shall be signed by the Contractor as record drawings and shall be submitted to the Client and/or his representative at the practical completion date of the contract.

The drawings shall show the complete installation including sizes and runs of all services, the precise locations of all services which may be buried within the structure and those sections of any external distribution services which are laid in the ground. The positions of all underground electric, communication, cold-water and gas service points at the entry to buildings shall be clearly indicated, together with their depth and the locations of all service isolators.

Any special thermal or other protective envelopes around services which are buried shall be clearly stated. The drawings shall include the geographical locations and identification number of each circuit control valve or isolator in accordance with the labelling and circuit control diagrams. The drawings shall show the names of manufacturer's model and type numbers and all details of duty and ratings of all items of plant including thermostatic control equipment.

A wall mounted mains water schematic (framed) shall be provided within the plant room adjacent to the incoming mains, showing system configuration and main points of isolation.

A wall mounted mains schematic (framed) shall be provided next to the main switchboard, incoming supply and sub-mains switchboards as appropriate.

The print of each of the composite "as fitted" distribution board chart / circuit layout diagrams shall be fixed securely to the inside of the hinged front of the main control panel. The chart shall be protected by a non-flammable transparent material and where inadequate space exists the prints may be suitably reduced in size.

The Contractor shall also include for providing a numbered disc suitably attached to all valves and including isolating, regulating, control and other automatic valves which shall be numbered in conjunction with the "as fitted" drawings.

In addition, the Contractor shall obtain and provide four sets of manufacturer's details drawings of all plant and equipment as may be appropriate. These drawings need not be prepared

specifically as record drawings but may be copies of the manufacturer's working drawings with suitable titles and reference number added.

The completed drawings will be signed by the Contractor, confirming them to be "as fitted" drawings and will be submitted to the Employer's Agent at the same time as the Operating and Maintenance manuals.

Full details shall be shown of the installation including positions of equipment ancillary items, valves, drain cocks, air vents, control equipment, conduits, trunking etc. as actually installed.

Valve charts and mechanical and public health schematic layouts for all plant areas, distributions board schedules and LV schematic drawings shall be submitted for approval in time for these to be corrected, framed and displayed at practical completion of the contract.

All drawings shall conform to the following standards.

- All drawings shall be prepared on a CAD draughting system with all drawings being produced in "DWG" format.
- All drawings shall be of the international A series, no other size will be accepted.
- All lettering in titles, headings etc., shall be in height not less than 5 mm.
- All other lettering on the drawings shall be capitals, in a height of not less than 2.5mm
- All ductwork shall be shown double-lined.

Each drawing prepared by the Contractor shall have the following information on the drawing.

- Name of Contract and where appropriate the phase number, zone or floor number.
- Description of drawing.
- Drawing number
- Scale
- Name and address of the Contractor

Upon completion, three complete electronic sets (CD) and a single hard copy shall be provided by the Contractor.

The various drawings to be framed and displayed in plant/equipment areas shall be prepared in Melamine laminate with black lettering on a white background. The drawing shall be framed and securely fixed on the wall in the particular plant/equipment area.

If the Contractor fails to comply with these requirements the Client will have the right to arrange for the records to be prepared elsewhere and the whole of the costs involved in this, including all costs of surveying, printing etc. shall be borne by the Contractor.

Where portions of the work shall be rendered inaccessible by false ceilings etc., during construction, "as fitted" drawings shall be completed before work is concealed.

The Contractor shall maintain on site a set of drawings for the purpose of marking up alternations and variations from which the record drawings will be produced.

If during the defects liability period further discrepancies are found, these shall be amended on all appropriate copies at the Contractor's expense.

2.12 Technical Submissions

The Contractor shall issue all drawings, schedules, calculations, equipment selections and supporting design information as detailed herein for comment by the clients engineering team.

The Contractor shall allow for a comment period of not less than 14-working days for comments to be returned where information is passed in work / system packages and a minimum of 20-working days where issued as a complete project.

Where there are outstanding comments to which have not been closed out by the Contractor to a suitable resolution, then any procurement of plant or equipment and any installations shall be done at the Contractor's risk. The client shall not incur any cost or programme slippage as a result of the contractor not planning for suitable comment and review period or for the removal of any plant, equipment or installed item due to not following the approval process.

2.13 Operation & Maintenance Files and User's Manuals

The Contractor shall provide three paper and one electronic interactive copies of the Operation & Maintenance Manuals.

Discussions shall be held with the Principal Designer to ensure Safe Systems of Work in the files are referenced within the Health & Safety File.

Original copies (not photocopies) of all test certificates, Building Regulations Approval Certificate and valid certificates from Local Authorities, Statutory Undertakers and Public Utility Companies confirming that the various installations have been tested and meet their requirements, shall be issued to the Employer (or his representative) by the Contractor upon completion.

Certified evidence that inspections have been carried out by the Building Control Officer and the Fire Officer is required and written confirmation from the Fire Brigade that the completed works meet with their requirements.

The Contractor shall provide Energy Performance Certificates and any necessary information and certificates, etc., in respect of energy ratings and energy targets required at the time of handover by Building Control.

At Practical Completion, provide 1no hard copy of the Operational & Maintenance Files along with 3 electronic copies on USB sticks of the User's Manuals describing the emergency shut-off procedures, correct operating and maintenance requirements for all elements of the works with recommended methods of cleaning and maintenance where appropriate. The User's Manual is to be in a simple easy to read format for use by Staff, Maintenance Engineers, and Cleaner's, etc. during everyday use.

In addition, the Contractor shall upload all O&M Manuals to the Clients document management system as detailed in the Employers Requirements.

Note that the timely issue of the Operation & Maintenance Files and the aforementioned certificates prior to Practical Completion are conditions of the award of Practical Completion.

As a general principle the manuals shall comply with BSRIA BG1/2007 document along with the particular details contained in this specification. The arrangement of the manual shall be as follows:

Section One – Contents

Section Two – Description of Mechanical and Public Health Services

- Description of each system, basis of design and principal components.

- Date of installation
- Names of relevant parties.
- Design specifications.
- Performance specifications.
- System schedules, tables etc.

Section Three – Operating Instructions

- Start/stopping procedures via step by step instructions for each plant/system
- Step by step instruction procedure for shutting down each plant/system in an emergency situation.
- Adjustment and regulation.
- Description of operational routines including points of isolation for all incoming services.
- Seasonal changeover.
- Fault finding and troubleshooting procedures.
- Safety precautions and emergency procedures (including telephone numbers for emergency services (including utility supply companies)).

Section Four – Inspection and Maintenance

- Inspection schedule and planned maintenance instructions (to include step by step instructions on the maintenance of all items of plant, clearly indicating daily, weekly, monthly, quarterly, six monthly and annual procedures).
- Maintenance and lubrication schedules and procedures.
- Periodic maintenance requirements for all plants.
- Date for ordering plant replacements, components and spares.
- All information to satisfy all health and Safety and Statutory Regulations in clear defined text.
- Legend for colour coded services
- Risk assessment and method statements for all maintenance activities.
- Schedule of normal consumable items
- List of spares.

Section Five – Test Sheets

- All air and water pressure Test Certifications, air and water system balancing test certificates, plant and equipment manufacturers commissioning test certificates, chemical water treatment analysis test certifications, chlorination certificates, acoustic consultant's reports, controls commissioning test certificates, all control settings etc.

Section Six – Service

- Manufacturer's names, addresses and telephone numbers.
- Local Authority names, addresses and telephone numbers.
- Sub-Contractors names, addresses and telephone numbers.

Section Seven – Manufacturers Literature

- Full list of manufacturer's recommended spares.
- Full details of spares provided under the contract together with their storage location.
- Manufacturer's literature of all plant and equipment including maintenance instructions
- Wiring diagrams and typical fault finding routines.
- Manufacturer's literature shall be actual copies; photocopies will only be acceptable in the second and third copies of the manual.

- Copy of all manufacturers guarantees, warranties and maintenance agreement offered by Sub-Contractors and manufacturers.

Section Eight

- Reduced set of the records drawings
- The reduced drawings shall be A3 size folded to suit the manual

Section Nine – Equipment Schedule

- Full detailed schedule of all plant and equipment identifying their locations, duties commissioning performance figures, reference numbers, serial numbers, unique identification number (cross referenced to the record drawings) plus the manufacturers name, address and telephone number.
- Schedule of keys.

Section Ten – Maintenance/Replacement Strategy

- Details of maintenance and replacement strategy for all items of plant and equipment.

2.14 Building Log Book

A building log book shall be provided, following the guidance given in CIBSE TM31 'Building Log Book Toolkit' and to meet the requirements Approved Document Part L of the Building Regulations.

2.15 Asset Register of All M&E Equipment on site

At completion the Contractor shall provide full details including details of manufacturer, product ID number, installation cost, date purchased, number installed etc. in the form of an asset register. The register shall also confirm the products that are eligible under the Governments Enhanced Capital Allowance (ECA) scheme.

2.16 Deleterious Material

The Contractor shall not specify for use nor use in the Works any substance and/or material which is not in conformity with any relevant British or European Standards or Codes of Practice or which are generally known to the UK construction industry to be deleterious to health and safety or the durability of the Works in the particular circumstances in which it is used or which is not used in accordance with the guidance contained in the publication "Good Practice in the Selection of Construction Materials 2011" published by the British Council for Offices.

Upon Practical completion of the Works or any part thereof the Contractor shall provide written confirmation to this effect addressed to the Employer or to its successors in title and to those who derive title under it. This confirmation shall be included in the Operation and Maintenance Manuals.

2.17 COSHH – Control of Substances Hazardous to Health

The Contractor shall comply with the requirements of the current Control of Substances Hazardous to Health (COSHH) Regulations. Upon Practical completion of the Works or any part thereof the Contractor shall provide written confirmation to this effect addressed to the Employer or to its successors in title and to those who derive title under it. This confirmation shall be included in the Operation and Maintenance Manuals.

2.18 Discrepancies

If any discrepancies or anomalies between the Drawings, Details, Specification or Schedules are detected by the Contractor, they shall inform the Employers Agent immediately and request formal instructions on the course of action to be taken.

After acceptance of the tender the Employers Agent's interpretation of the specification and drawings shall be binding.

2.19 Setting Out

The Contractor shall set out the work and be responsible for the accuracy of the same and the positioning of all the fittings.

The Contractor shall be deemed to have taken full account of the latest architectural, structural, and services drawings, so as to ensure that the requirements of these other services do not conflict or vary the requirements of the particular setting out drawings.

The Contractor, at his own cost, shall amend any errors arising from his own inaccurate setting out.

The Contractor shall be responsible for providing builderswork information in sufficient time for the progression of any element of works. Any inaccuracies arising from the inaccurate setting out or late information shall be rectified at the Contractor's cost.

2.20 Co-ordination of Services

The Contractor shall be required to co-ordinate closely with all trades and ensure a planned approach to the installation of the contract works.

All works shall be installed so as to cause no hindrance or delay to other trades.

Any delays experienced should be reported to the Employers Agent.

2.21 Verification of Local Authority and Utility Services Mains

The Contractor, prior to commencement of any works, shall:-

- By consultation with the relevant Authorities, verify/determine the precise size, location, depth and extent of all existing services and any apparatus within or adjacent to the site boundaries, including existing services, which will affect the installation of new works.
- Determine the precise size, locations and level of all services to which they are required to take due consideration of in the completion of their works.
- Commence early negotiations with the Local Authority, Police and Statutory Authorities, in order to determine the constraints with regard to road closures, road opening notices, hours of working, lighting, traffic control, noise and safety requirements.

The Contractor shall be expected to accommodate the requirements of these Authorities without disruption to the progress of the Contract Works.

2.22 Interference with Existing Services

In the pursuance of this Contract, it may be necessary to modify or re-route existing services.

When it becomes apparent that an existing service is affected by the proposed works, the attention of the Employers Agent should be drawn to this fact and his authorisation sought prior to the implementation of any action at site level to interfere with or divert such services.

The Employers Agent shall direct the Contractor with regard to the appropriate action to be taken, having due regard to the prevailing conditions at this time.

The Contractor shall have included for all diversions of services within their Tender.

2.23 Workmanship

The materials and workmanship are to be of the best quality and executed in accordance with the Specification and Drawings for the specific project.

The work is to be carried out by fully trained and qualified personnel. Only competent and/or Registered Tradesmen may be employed on the installation of the works, described in this Specification.

The Contractor is required to ensure that the whole of the installation complies with the working drawings and details, with full account being taken of any co-ordination drawings that may be issued.

The respective services shall be installed to true alignment and to the levels indicated on the drawings.

All services shall be supported in the manner described in the Specification, unless particular manufacturer's requirements for support are more stringent than this Specification; in which case the manufacturer's instructions shall be complied with.

2.24 Supervision of Installations

The works shall be supervised by the Contractor with the specialist M&E Sub-Contractors supervised by competent persons qualified in each of the services disciplines.

The supervisory staff shall produce weekly progress reports detailing percentage completion of each section of the works and any items requiring the attention of the Contractor.

2.25 Samples of Workmanship and Materials

The Contractor may be required to provide, free of charge, a sample of any of the specified materials. Elements of workmanship having been approved shall form the basis of the standard by which all other materials or workmanship are judged.

Should all or any part of the installation fail to comply with the standard or quality previously approved, then such work will be rejected.

In the absence of specific samples being required, then the accepted standards of material and workmanship laid down in the relevant British Standards or Codes of Practice shall apply. Working samples of luminaires will be issued for client review to ensure the temperature colours match between differing luminaires.

2.26 Redundant Materials

The Contractor will be required to take down all obstructions and redundant materials to facilitate the installation of the works that shall be removed from the site.

All redundant sections of the services installation shall be made safe and removed from site.

2.27 Notice Prior to Cover

The Contractor shall give reasonable notice to the Employers Agent and Clients Building Services Engineer whenever any works materials are intended to be covered with earth, insulation or otherwise concealed and in default of so doing shall if required uncover and reinstate such work and materials at his own expense, irrespective of whether such work is correctly installed or not.

2.28 Statutory Undertakings/Additional Requirements Under Bye-Laws

Notice of any requisition or complaint or any communications whatsoever affecting the works shown or specified which is made to the Contractor or his Specialist Supplier by a Statutory or other competent Authority, shall be referred immediately to the Employers Agent and Clients Building Services Engineer and confirmed in writing. The Employers Agents instructions shall be awaited before proceeding further with any portion of such works referred to.

The Contractor shall be liable for any loss or cost of any subsequent other work found to be necessary by reason of his neglect to notify the Employers Agent and Clients Building Services Engineer at the time and in the manner herein prescribed.

2.29 Guarantees

The Contractor shall ensure that the guarantees of equipment are given in joint names of the Contractor and the Employer and that the benefits of any guarantees which run beyond the end of the Defects Liability Period are passed to the Employer.

2.30 Sub-letting

Where it is normal practice that certain sections of the Contract Works shall be sub-let, the Contractor shall submit details at the time of tendering of any proposed sub-letting for approval.

2.31 Defects Inspection

The Contractor shall complete his own defects and snagging inspections and carry out remedial works prior to offering the installation for inspection. The Contractors defects schedules shall be submitted to the Employers Agent and Clients Building Services Engineer prior to his inspection being carried out.

2.32 Commissioning and Handover Procedure

The commissioning and handover procedure, including the events and programme leading up to practical completion and audit by the Care Quality Commission, shall be as defined in the Employers Requirements. The Contractor shall make due allowance for these activities within the programme.

The contractor is to allow for 2no client training days to run through all services systems and demonstrate how to control and maintain all systems. Both client training days shall take place after practical completion has been granted and agreed at a date that suits the client's representative. The Contractor shall provide a professionally filmed video of the training and shall provide an electronic copy as part of the O&M Manuals.

The Contractor is to organise Client Witnessing of all mechanical and electrical systems a minimum of 2-weeks before Practical Completion is programmed, to allow sufficient time for the Client's representative to produce their report of any non-compliances found and those non-compliances to be rectified before Practical Completion. If witnessing attendance is arranged and systems found to be incomplete, then additional witnessing shall be required at a further cost to the Contractor.

2.33 Site Visit

The Contractor shall visit site before submitting his tender and allow for all matters affecting the Works, including restrictions imposed by the Employer, local conditions of the existing building work and accessibility of the Works and site.

Before visiting the site, the Contractor shall obtain permission of the Employer. If the Contractor fails to attend site during the tender period and any costs incurred as a result of this will not be considered.

2.34 Building Expansion / Settlement

If the route of any services entails crossing building expansion or settlement joints, the Contractor shall make due allowance to cater for the building movement.

The Contractor shall liaise with the Structural Engineer to establish the maximum anticipated movement and location of any expansion/settlement joints.

2.35 Plant / Equipment Technical Submissions

The Contractor shall provide full details of the proposed plant and equipment associated with the mechanical, electrical and public health services in the form of technical submissions that shall be issued to the Employers Agent and Clients Building Services Engineer for comment. These technical submissions shall be submitted in sufficient time for any comments to be incorporated prior to the respective item of plant/equipment being ordered by the Contractor.

2.36 Component / System Compatibility

All elements of the building engineering services shall be selected by the Contractor to suit the application they are intended for. For example, components installed in an external environment shall be suitable for external temperatures and the climatic weather conditions they are to be installed in. Weather-proof devices/services shall be installed where susceptible to the influences of rain.

All building engineering services components/systems shall be installed using products in accordance with manufacturer's recommendations paying particular attention to the environment they are to be installed in. Also all components shall have a minimum ingress

protection not less than as listed below or in accordance with the manufacturer’s recommendations if greater:

External	IP55
Under Cover (no rain but still external climate)	IP54
Internal	IP31

All ingress protection ratings to be in accordance with BS 4752; areas such as covered car parks are to be classified as “under cover”.

All building engineering services components shall be installed to suit the specified internal/operating temperatures and pressures.

2.37 Platforms, Walkways and Bases

Where necessary galvanised mild steel or suitable timber/plywood platforms and walkways shall be supplied and installed by the Contractor. These shall be provided to ensure all plant can be easily maintained, and to provide protection to pipework and ductwork, particularly along notional access routes/paths. The platforms and walkways shall be finished to match their location and shall be securely fixed in position.

At roof level the Contractor shall provide sufficient bases for the various items of plant/equipment, packaged Plantrooms, etc. together with the pipework, ductwork, cable tray, and ladder rack etc., distribution routes.

2.38 Electromagnetic Compatibility

All items of electrical plant and equipment including those associated with mechanical plant and lift installations, shall fully comply with EMC Directive 89/336/EEC and all subsequent amendments associated with electro-magnetic compatibility.

In general, all electrical plant and equipment shall be designed such that:

- Electromagnetic disturbances generated do not cause any interference to other systems/equipment.
- The performance of any items of plant and equipment is not affected by electro-magnetic disturbances within the environment in which the plant and equipment has to operate.

The Contractor shall ensure that all items of electrical plant and equipment have the required EMC Directive Declaration of Conformity, and copies shall be provided to the Employers Agent and Clients Building Services Engineer upon request.

2.39 BREEAM

Only where BREEAM is a scheme requirement, the Contractor shall make all due allowances within the tender and subsequent design solutions to achieve any BREEAM rating targeted. The requirements and scope will be different from one scheme to the next, therefore the Contractor is to ensure that all suitable allowances and inclusions are incorporated within their submission to meet the credits targeted within the BREEAM Pre-Assessment.

2.40 Cleaning

The Contractor shall ensure that all aspects of the building services installations are thoroughly cleaned prior to handover. Where services are concealed, they shall be thoroughly cleaned before concealment is completed. The Contractor shall pay particular attention to the requirement for temporary covers over all pipework and ductwork open ends in order to minimise the ingress of dirt and debris. The Contractor shall also ensure that all ventilation ductwork systems are internally cleaned as part of the commissioning works to ensure the highest possible standards are achieved.

As part of the cleaning exercise the Contractor shall ensure that all plant and equipment internally and externally located is thoroughly cleaned.

2.41 Design Life

The building services installations shall be designed and installed to achieve a design life in accordance with CIBSE Guide M.

2.42 Plant Maintenance and Replacement Strategy

The plant removal principles for component or complete unit replacement shall be developed by the Contractor during the design stage. The design and installation shall permit every item of plant or equipment to be maintained in line with recognised industry standards and replaced if necessary. The Contractor shall provide a detailed plant maintenance and replacement report highlighting the strategy for maintaining and replacing all items of plant and equipment. The report shall also form part of the Operating and Maintenance manuals and Health and Safety File as appropriate.

2.43 Record of Fire Stopping

The Main Contractor is to provide a record of all fire stopping through fire lines within the building. This record is to include the service penetrating the fire line, person completing the works and the method and product used for fire stopping. The record is to be provided in PDF drawing and schedule format.

The Mechanical and Electrical Contractors shall provide a record of all fire stopping of building services penetrations including but not limited to Fire/Smoke Dampers, Fire Dampers, Fire Wraps, Fire Collars, Fire Sleeves, intumescent blocks etc. The record is to be provided in PDF drawing and schedule format.

All fires-stopping materials and mastics shall be fully compliant and approved by the relevant manufacturer of the products, services and materials to which they are stopping around. This approval shall be provided in written form and provided as part of the Operation and Maintenance manuals.

2.44 Spares

The Contractor shall allow within his tender for the provision of the following spares:

- 2No. of each LED-type luminaire used within the scheme
- 5No. UFH manifold actuator heads

- 4No. TMV3 mixer valves (or TMV taps as appropriate)
- 2No. TMV3 shower valve
- 2No. shower roses and flexible hoses
- 1No. HWS return pump to be mounted on the wall in the plantroom
- 2No. minimum weight of 5kg bags of water softener salt.

3 Mains Service Utilities Supplies

3.1 General

Provide suitable gas, electricity and water supplies plus provision of telecom supplies to the building. The Contractor shall be responsible for all load assessment, applications and management of the utility supplies to ensure timely connection.

Applications for the utility supplies shall be made at the earliest opportunity and carefully monitored to ensure the necessary supplies are available to meet the programme.

Utility supply capacities shall be determined and confirmed by the detailing Designer prior to order.

An update report on the status of the utility supplies shall be provided at each site meeting.

Entry positions for gas(where applicable), electricity and water shall be agreed with the Employer, but shall be typically as shown on the design intent drawings.

The main intake and meter will be located in the plant room together with a main building panel board, earthing connection point, etc.

The gas (where applicable), electric and water supplies shall be sufficient for a building of this size and sized by Services Designer and issued to the Clients Building Services Engineer for comment prior to utilities orders being placed.

Metering shall be provided to satisfy the Building Regulations as a minimum.

A soil survey shall be undertaken by the main contractor, where deemed necessary the contractor is to provide an uplift in costs to install 'Protecta-Line' Pipework as an additional line item.

The contractor shall be responsible for all liaisons and all co-ordination with the telephone supply authority for the supply and installation of the main FTTP service in respect of any new incoming communications cabling, ducting, chambers, etc.

1No 90mm Openreach service duct and 1No 90mm spare duct shall be provided from the site boundary to the corner of the Comms room to facilitate the FTTP connection and any future ethernet connections.

The client team has, as part of the initial design intent process, undertaken preliminary utility load assessments to inform developer's enquiries to the relevant statutory authority to establish network capacity, budget cost and indicative connection positions. This information is provided in the format of a utilities tracker document to steer the Services Contractor during the tender process.

3.2 Annual energy usage

Provide calculations to demonstrate the energy usage of each supply provided to the site. This shall be split down into each operating unit and should be based on an approved calculation package. This information is required to accurately determine the capacity of supplies required and shall form the basis of the target energy usage on site. The information shall be in sufficient detail to allow the weekly, monthly and annual targets to be compared to the actual usage.

3.3 Supply Contracts

The Main Contractor is to make all applications and pay any deposits associated with applications for all new connections. The Main Contractor shall pay all energy use charges for temporary supplies until Practical Completion when they will arrange for the transfer of services to the Employer.

The Main Contractor is to arrange and procure all meter supply agreements on behalf of the Client. Meter agreements shall be provided for client review and approval prior to procurement.

4 Mechanical Services

4.1 General Requirements

The Contractor shall carry out the design and installation of the entire work which shall generally consist of, but is not limited to, the following main elements:

- Low temperature hot water heating installation
- Pipework distribution
- Ventilation systems
- Kitchen/laundry ventilation
- Comfort cooling installations
- Hot and cold-water systems
- Above ground drainage installations
- Automatic control systems
- Sprinkler Systems
- All necessary pipework, valves, supports, fixings, etc. for the above systems.
- All necessary power and controls wiring for the above systems.
- All necessary testing, balancing, commissioning and setting to work for the above systems.

4.2 Low Temperature Hot Water Heating Installation

4.2.1 Requirements of Service

Provide, install, test and commission and set to work a low temperature hot water (LTHW) heating system sufficient to meet the maximum instantaneous heating demand for the building. The system shall provide heating to all areas in accordance with the design parameters.

4.2.2 Design Parameters

Provide a Low Temperature Hot Water (LTHW) heating system to provide heating to all areas in accordance with the room data sheets. The system shall comprise as a minimum the following:

- Primary Heating Circuit (Subject primary plant selection).
- Constant temperature secondary circuit serving ventilation fans (where provided/required).
- Variable temperature secondary circuit serving radiators (where required) and underfloor heating throughout the building

The LTHW system shall be designed to operate at a Part L2 2021 maximum heating flow temperatures of 55°C. Heating Circuits to space heating shall operate at 55°C flow and 50°C return in line with Part L requirements.

Provide the systems with all regulation and monitoring devices, insulation, couplings, expansion devices, commissioning components and safety equipment and ancillaries to ensure proper, safe and efficient commissioning, operation and maintenance of the complete system including:-

- Isolation valves.
- Strainers.
- Flexible mounts, couplings and anti-vibration devices.

- Flow regulation valves.
- Double regulation valves.
- Temperature and pressure gauges.
- Test points.
- Vent and drain points.
- Control sensors and transducers.
- Control valves.
- Chemical dosing set.
- Flushing valves.
- Air and dirt separator.
- Expansion loops and bellows.
- Anchor points.
- Ancillaries.

Detail and locate all of the above on the installation drawings.

Provide adequate means for initial filling of the system.

Pressurise the entire heating system from a packaged pressurisation set serving the system from the boilers, to include jockey, duty and standby pumps, expansion vessels, a break tank and integral control panel. The control panel shall monitor the duty pumps operation, trip/failure indication and auto changeover plus provide a suitable common alarm to the BMS.

The primary LTHW systems shall incorporate a duty and standby pump. The primary LTHW system shall incorporate a common flow and return header from which the secondary circuit connections shall be taken.

The secondary constant temperature LTHW circuit shall incorporate a duty and standby pump set and shall provide LTHW to air handling units, duct mounted heating coils etc. throughout the building (If required). The circuit shall incorporate 2-port pressure independent modulating control valves to provide control to all equipment. The secondary constant temperature circuit pumps shall be of the variable speed type such that they automatically regulate the quantity of LTHW flow rate to suit the circuit characteristics as valves open and close. Differential pressure control and a pump minimum flow bypass arrangement shall be provided within the system as necessary.

The secondary variable temperature LTHW circuit shall incorporate a duty and standby pump set and shall provide LTHW to the underfloor heating and any general radiators/ heat emitters throughout the building. The circuit shall incorporate a 3-port modulating mixing valve to provide variable temperature via weather compensated control. The secondary variable temperature circuit pumps shall be of the variable speed type such that they automatically regulate the quantity of LTHW flow rate to suit the circuit characteristics as heating zone control valves open and close. Differential pressure control and a pump minimum flow bypass arrangement shall be provided within the system as necessary.

The Contractor shall take particular care with the LTHW pumping and flow rate design to ensure that adequate LTHW is provided in the primary circuit to serve the secondary circuit, whilst not exceeding the ASHP manufacturers recommendations or requirements.

The secondary variable temperature pipework shall be distributed horizontally within ceiling and/or roof voids as required. The main distribution arrangement shall incorporate isolating valves and commissioning sets in the flow and return pipework respectively for each main branch connection. The main distribution shall then feed individual vertical risers distributed throughout the building which shall then connect to the various UFH manifolds and heat emitters. Within each vertical sub-branch, isolating valves and commissioning sets shall be provided in the flow and return pipework respectively.

Where an ensuite has an external walls and subject to heat loss calculations shall be provided with an underfloor heating solution to match the sanitaryware layout. Ensuited heating to be provided via adjacent bedroom heating where possible.

Within the primary LTHW system a proprietary air/dirt separator shall be provided. The unit shall be provided with a normally closed bypass facility which shall permit the unit to be removed if necessary while ensuring no disruption to the system operation.

Within the primary LTHW system a stainless steel dosing pot of suitable size to suit the system volume shall be provided.

Throughout the LTHW pipework installation, the Contractor shall take particular care to ensure that adequate provision is provided for thermal movement (expansion and contraction). To achieve this proprietary bellows shall be used where it is not possible to accommodate the expansion and contraction by the means of pipework sets. The Contractor shall ensure that adequate anchors points and pipe guides are provided throughout the installation to ensure the provisions for expansion and contraction can function correctly.

All heating pipework shall be insulated. Any LTHW pipework located externally shall be electrically trace heated.

Sample and analyse the incoming water supplies prior to the initial filling and pressure testing and again before chemical cleaning. This shall include a microbiological analysis of the water, which as a minimum will include readings for TVC (Total Viable Count) at 37°C at 1 day, TVC at 22-24°C at 3 days, iron bacteria, denitrifying bacteria, pseudomonas and sulphate reducing bacteria, plus any criteria that do not comply with the EEC Drinking Water standards. Such tests shall be undertaken at an independent certified test lab and the results issued to the Client's Representative, indicating non-compliance and contaminants likely to have a detrimental effect on the water system (if any). If any system is filled more than a week before chemical cleaning, the system shall be filled with water containing appropriate levels of inhibitor and biocide.

Provide water treatment to counteract scale, corrosion and micro- biological growths in the heating system. Ensure that the chemicals proposed are entirely compatible with all material and components present in the system. Provide written evidence from all suppliers confirming acceptance. Prior to the application of the water treatment chemicals, the pipework system shall be given a thorough pre-commissioning clean by the water treatment specialist. This shall take place at initial fill of the system and shall be undertaken prior to the system being set to work and commissioned.

Allow for the provision of adequate drain cocks and air vents to enable the system to be completely drained and purged of air.

Provide sufficient flow regulation devices and test points, temperature and pressure gauges and tappings to properly commission the system and facilitate full post completion operation and maintenance in accordance with BSRIA and CIBSE guidelines.

Ensure that flushing valves are installed in the required locations and of adequate diameters as detailed in the CIBSE Commissioning Code W and BSRIA guidelines. Normally sized drain cocks are not adequate.

Ensure that the complete installation includes all necessary flow regulation, adequate temperature and pressure gauges plus tapping's for commissioning and maintenance.

All Overdoor heaters or air curtains to be electric.

Ensure frost protection is provided by the Electrical Sub-Contractor to the following areas by means of suitable sized electric heaters:

- Electrical switch rooms
- Internal plant rooms
- Water tank rooms

Supply and install a quick fill connection to the LTHW system to facilitate filling of the system by means other than by the pressurisation set, incorporating the appropriate level of backflow prevention in accordance with local water authority requirements and current Water Regulations.

4.2.3 Underfloor Heating

Underfloor heating to be provided throughout the project, to serve the Carehome bedrooms, corridors and other ancillary areas.

The underfloor heating Specialist Contractor shall review the latest architects plans and details and Structural Engineers details when designing the underfloor heating system to ensure that the selection of pipework and thermal insulation matches the floor depths and floor finishes. Commentary shall also be provided on the proposed constructions to ensure they meet the necessary requirements of the underfloor heating installation.

The Contractor shall also provide appropriate information to ensure that all floor finishes and adhesives used are compatible with the underfloor heating system operating temperatures.

The underfloor heating specialist to design the full underfloor heating design including heat losses, suitable underfloor heating installation detail (to suit floor construction build ups) and controls.

Underfloor heating specialist to ensure underfloor heating circuits are design to fixed furniture layouts & floor constructions to achieve required heat losses.

Underfloor heating specialist to confirm all underfloor heating manifold locations with the client/architect and ensure suitable secondary underfloor heating systems pressures from the manifold.

The underfloor heating specialist to ensure LTHW underfloor heating is to be sized to achieve bedroom ensuite via bedroom underfloor heating circuit.

Where UFH is being utilised, the installation shall be fully co-ordinated, undertaken by a specialist contractor and comprise of the following:

- UFH tubes, tube clipping system (and associated insulation), fittings, valves, manifold assemblies, drains and vents.
- Where pipework distributes from the manifolds through heated spaces to serve adjacent rooms etc., this shall be run within insulation to prevent uncontrolled heating and overheating.
- All control units, temperature sensor and controllers necessary for the system to operate correctly and each circuit be controlled independently including interface with the BMS system.
- Where controllers provided these shall be lockable to limit resident control only within a defined band to prevent the overheating of spaces.
- Manifolds shall be located within store cupboards, or other back of house areas and boxed in.
- LTHW connection to manifolds from the main heating system shall be complete with:
 - Dedicated local pumps
 - 3 port valve arrangement
 - High temperature shut off valve
 - Side stream filtration

No underfloor heating to be provided in locations where comfort cooling is to be provided.

4.2.4 Air Source Heat Pump

The provision of ASHP plant for the projects space heating requirements to provide in accordance with the projects energy strategy and part L compliance requirements as required.

Minimum of 3No. ASHP's for space heating each sized at 50% complete with multi directional thermal store(s). Thermal stores shall be sized and arranged to provide optimal return temperatures to the ASHP's whilst storing adequate thermal energy for the system operation and maximising stratification within the tank(s).

Condensate from each ASHP shall be installed to local drain / soakaway away from all walkways or working / access areas to prevent the risk of condensate pooling and freezing.

Provide suitable power supplies and control interfacing from the central control panel. Volt free contacts will be provided as part of the manufacturer's packaged controls assembly to allow status monitoring/reporting of:

- ASHP enable/disable signals
- ASHP common fault status alarm.
- ASHP Primary flow and return temperature sensors
- ASHP Thermal Store High- and Low-level Immersion Temperature sensors.

The LTHW ASHP system shall be designed to operate at temperatures of 55°C flow and 50°C return to recharge the heating thermal store and to serve the projects underfloor heating design via a variable temperature heating circuit.

Where ASHP technology is to be utilised the heating system to be configured in accordance with all manufacturers recommendations. This to include a ASHP primary circuit to the heating

thermal store, a primary ASHP heating circuit pump and a VT Pumped secondary heating circuit to the route to underfloor heating manifolds throughout the building.

The contractor is develop a suitable ASHP schematic including all required equipment including a thermal heating store, valves, Primary & Secondary heating pumps and Air/dirt separator & dosing pot etc.

The contractor to confirm the suitability of the external condenser location and any primary pump selections to achieve required flow rates and pressure drops.

The ASHP heat pumps are to be suitable externally mounted within external compound & in accordance with manufacturers clearances for installation, operation and maintenance. The contractor is to ensure the external compound location is suitably & the noise output of the condenser to attenuated as required.

All external HWS water pipework routing from air source heat pumps to be electrically trace heated.

4.2.5 Pumps

Twin head pumps shall be provided on the primary and all secondary circuits, complete with isolating valves, non-return valves, strainers, flexible connections, inverters and auto-changeover with duty sharing operation based on head failure and time scheduling.

Connect each pump to adjacent pipework using a line sized flexible connection suitable for the temperature and pressure of the system and fully in accordance with manufacturer's recommendations. Provide valved universal test points on pump inlet and discharge.

Where appropriate, mount each pump on a fully matched inertia base provided by the pump manufacturer. Mount the inertia base on spring vibration isolators to a plinth upon the plant room slab. Inertia base frames shall be manufactured from mild steel channel and plate and shall incorporate reinforcing mesh welded into place together with drilled steel members. Suitably sized spring isolators shall be located at each corner. Supply and install mass concrete to the frame base.

All pumps shall be capable of their specified output under operational conditions and shall be resistant to erosion, corrosion or attack from the fluids being pumped. Select a single common pump manufacturer to provide all pump units for the entire mechanical engineering systems. The pump shall not be selected on a flat head part of the curve and the static head at no flow (closed head valve) shall be at least 20% greater than that at design condition. No part of the pump curve shall have a negative gradient

4.2.6 Control Requirements

Provide all necessary control devices to meet the requirements of the automatic controls section of this specification and to ensure efficient and safe operation of the system to meet the design parameters. For the LTHW installation, this shall include, but not be limited to, the following:

Provide primary frost protection using outside temperature detectors to initiate pumps with control valves open to circulate through all components.

Provide secondary frost protection using space detectors to initiate ASHPs and pumps to protect the building fabric and finishes.

Provide tertiary frost protection using immersion sensors to initiate ASHPs, pumps and open valves to circulation, to prevent system water freezing.

Provide optimum start control for the ASHPs, utilising a room mounted sensor in a representative location within the building, via the BMS.

Provide every underfloor heating circuit with a local room mounted thermostat and associated actuator.

Provide heating pump sets with auto changeover and duty sharing operation based upon pump failure and hours run via the BMS. Provide indicator lamps on the control panel for duty pump operation and trip/failure indication with suitable alarms to the BMS.

4.3 Domestic Cold-water Services Installation

4.3.1 Requirements of Service

Provide, install, test and commission and set to work a domestic cold-water system to meet the functional needs of the building.

The Contractor shall provide a suitably sized incoming main to serve the building. The Contractor shall be responsible for all necessary liaison, coordination etc. associated with the water supply. The water main connection shall be provided with a water meter and all necessary valves to comply with current regulations. The main shall serve the entire building cold and drinking water requirements.

Cold-water shall be provided to all water fittings in the premises, without waste, misuse, undue consumption or contamination (including degradation of the 'fluid category' as defined by the Water Regulations Guide) of the water supply or the cold-water system.

A potable combined sprinkler and cold-water storage tank serving both domestic cold-water loads and the storage and booster capacity for the sprinkler system shall be provided with a priority demand valve on the domestic water supply from the booster set in line with the requirements set out in BS 9251 (Sprinkler systems for residential and domestic occupancies). The cold-water tank will be provided with two sections to allow phased cleaning and chlorination of the tanks, without losing the water supply to the home. The tanks will be provided with all the associated ancillaries such as temperature gauges, insulation, high- and low-level water sensors, low-sprinkler water level alarm with audible output through BMS, temperature sensors connected to BMS, etc. The tanks shall also be provided with fully adjustable ball valves to permit the volume of the tank to be adjusted to match the occupancy of the building, ensuring the water is of potable standard at all times especially at first hand-over where building occupancy can be as low as 5%.

Cold-water Storage shall be based on the water storage requirements set out in BS 9251 (Sprinkler systems for residential and domestic occupancies) including a storage of water for building use above the minimum sprinkler level sized to cover the building peak demand for 10 minutes.

Pressure boosting equipment shall be provided as required to maintain a minimum operating pressure of cold-water of 1Bar head to all outlets.

Electromagnetic water conditioners shall be installed to the boosted cold-water supply to the building, boosted cold-water supply.

Suitably sized duplex salt water softening equipment shall be provided to service the entire domestic hot water system, as well as the cold-water supplies to the Laundry appliances and Kitchen Dishwashers. Water softening plant shall be installed in accordance with the manufacturer's recommendations where appropriate.

4.3.2 Design Parameters

The cold-water services shall comply with current and relevant statutory requirements and regulations. This shall include, but not be limited to, complying fully with the edition (including amendments) of each of the following, current at the time of installation:

- The Building Regulations
- The Water Supply (Water Fittings) Regulations
- BS EN 806 Specifications for installations inside buildings conveying water for human consumption (all parts)
- BS 8558 Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.
- BSRIA AG4/94 Guide to Legionellosis – temperature measurements for hot and cold-water services
- CIBSE TM13 Minimising the risk of Legionnaire's disease
- CIBSE Design Guides
- IOP Plumbing engineering services design guide
- WRAS Water Regulations Guide
- Wrc Water Fittings & Materials Directory by the Water Research Centre (Updated every six months)
- HSE AcoP L8 and HSG274

The systems shall be sized utilising CIBSE Guide G design data for hot and cold-water simultaneous demand.

Pipework velocities shall be limited to 1.5m/sec, where installed in noncritical areas and 1.0m./sec in noise sensitive areas.

The cold-water temperature shall be limited to a maximum of 2°C above the water temperature provided by the Water Supply Company/Authority, without exceeding the maximum permitted cold-water temperature of 20°C.

4.3.3 System Description

Liaise and make arrangements for the Water Authority to install a new external mains cold-water supply including pipework, valves and connections to serve the main potable cold-water storage tank and associated booster pumps located in the plantroom. The pipework arrangement shall incorporate a suitable valve arrangement including a new principal stop valve, a double check valve and test point, and a new pulse output water meter which shall be the water authority meter, suitable for connection to the BMS system.

The main contractor shall allow and include for all costs associated with the new incoming water supply installation, including infrastructure charges and liaison with the Statutory Authorities.

Obtain formal approval from the local Water Supply Company/ Authority for the complete installation to allow provision of water supply to premises.

A main pressure reducing set shall be provided if the incoming water pressure exceeds 4 bar.

Provide a potable standard (as defined in the Water Regulations) main cold-water storage tank located in the plantroom. The water storage tank shall be constructed in sectional fibre glass suitably stiffened with at least 2 compartments and be mounted in accordance with the manufacturers recommendations, on plinths/structural piers sufficient to ensure pumps are continually flooded. Any bolts in contact with water shall be manufactured from stainless steel. Delayed action ball valves shall be utilised to maximise water turnover and avoid stagnation.

Supply and install a packaged cold-water booster set in the water tank room to provide a pressurised cold-water supply to serve all water outlets in the building, including sanitary fittings, cleaner's sinks and mechanical plant (i.e. pressurisation units) and hot water generators.

A secondary meter shall be provided on the feed to the hot water system, with connection to the BMS system to produce a readout of water consumption. An electromagnetic water conditioning unit shall also be provided on this supply to provide protection against the build-up of scale within the hot water generation equipment and distribution system.

Ensure that the system arrangements make adequate provision for filling and refilling of the heating system, incorporating the appropriate level of backflow prevention in accordance with local water authority requirements and current Water Regulations.

The mains cold-water service pipework shall be distributed through the building and shall then rise and/or drop-in locations to be agreed with the Architect to supply the various appliances being provided with mains cold water.

Within the pipework distribution isolation valves for ranges of fittings shall be provided, together with individual service valves to all appliances.

The cold-water services pipework shall incorporate pressure reducing valves as necessary to ensure appropriate pressures are achieved at all appliances.

All cold-water services shall be run in copper pipework to lever operated ball-o-fix valves located as close to each fitting as possible and then connected to the sanitary ware. Where pipework is exposed, all pipework and fittings shall be stainless steel or chromium-plated copper pipework, and it shall be run in a neat and tidy manner to be as unobtrusive as possible.

All concealed cold-water pipework within ceiling voids and risers etc. shall be insulated.

All cold-water pipework running in external areas shall be trace heated.

WC overflows shall be provided in accordance with the Local Authority requirements. Generally, integral overflow units that comply with the Water Supply Regulations shall be used to avoid the use of tundish overflow viewing units or overflow pipework being discharged externally to the building.

The system shall be designed incorporating all necessary means to inhibit the growth of Legionella bacteria.

The domestic water systems shall, in their entirety and in all respects, comply with the requirements of the current Water Regulations, and with the requirements of the local supply authority. All pipework, valves, components, plant items and materials shall be selected from the registers of water research council approved materials and components. The system shall be installed and insulated with due regard to the requirements of current Health and Safety legislation, including, in particular that relating to the prevention of legionnaire's disease. The system shall be designed and installed in accordance with good practice for access and maintenance of plant and movement around plantrooms.

Ensure all pipework systems and associated appliances are protected against backflow or back siphonage using devices appropriate level of backflow prevention in accordance with local water authority requirements and current Water Regulations.

Chlorinate the system as required by current legislation. Do not make the final connection of the system to the local supply authority's main until chlorination of the system has been completed and the authority have carried out their own inspection and are satisfied.

The Contractor shall allow to chlorinate the system just prior to practical completion and shall also allow for one further additional chlorination to occur prior to occupation (date to be advised by client team).

Any flexible connectors or hoses and expansion vessels utilised in the domestic hot and cold-water systems shall be fully WRAS approved and EDPM-free. All such equipment shall be provided with manufacturers certification identifying the materials used. All materials and fittings used must be acceptable for use in water systems and listed in the directory published by the Water Research Centre.

4.3.4 Cold-water Storage Tank

Ensure that the storage cistern complies with the current water regulations in all respects, together with BS 7491 Part 3, BS 3532, BS 3691 and BS 4549 covering materials and quality control as well as all local Building Regulations, DHSS Requirements and be approved by the Water Research Council.

The water storage tank shall be come complete with the following suitably sized connections:-

- Incoming mains water supply to float operated ball valve located in an insulated accessible raised valve housing.
- Screened overflow pipe connected on opposite face of tank to incoming mains water supply.
- Screened overflow warning pipe to be located adjacent to and below the overflow connection.
- Cold-water draw off at the lowest possible level of the tank and on opposite sides to the incoming mains water supply.
- Drain connection at the bottom of the tank side wall.
- Filtered vents.
- Internal access ladders (stainless steel)
- External access ladders (stainless steel)

The tank shall only be installed after having first agreed its details and location with the Structural Engineer and Main Contractor.

The tank shall have a minimum of two compartments. Ensure that each compartment is capable of isolation and independent operation to enable maintenance and repair work without interruption of water supply to the distribution system.

Provide a 100mm diameter thermometer on the storage tank to measure cold-water storage temperature.

Fit a water level sensor to prevent the operation of the packaged booster pump and provide an alarm signal at the BMS in the event of low water level in the water storage cistern.

Fit an immersion sensor in the cistern inlet piping and another in the side of the cistern near its outlet to provide continuous monitoring at the BMS, of water temperatures.

The cold-water tank shall be sited in a thermally separate room to the plant room and insulated to ensure that cold-water tank temperatures never exceed 20°C.

4.3.5 Cold-water Booster Set

Provide packaged booster set(s) as described below.

The packaged booster sets shall be mounted on a suitable spring mounted inertia base frame and shall consist of:

- Two equal duty pumps, each rated for the full duty of the set to operate as duty/standby pumps.
- Jockey pump with a lower duty to make-up system pressure when demand is very low.
- Draw down' expansion vessel to restrict the number of starts per hour
- All pressure gauges, switches and other controls necessary for correct operation of the unit.
- Integral control panel incorporating all control and electrical equipment necessary for the safe operation of the unit

Include all safety cut outs and interlocks required for safe operation of the system.

Where boosted cold-water services are used, prevent excessive pressure at outlets by using back pressure cisterns or pressure reducing valves. Arrange the packaged booster pump with a pressure sensor in its discharge piping to control the operation of the pump.

In the event of the packaged booster pump automatic control system producing a common alarm fault signal, relay that signal as an alarm at the BMS.

4.3.6 External Irrigation System

The mechanical contractor is to allow for external taps around the perimeter of the building, allowing for 1no. every 30m, plus 1No. within the refuse store for wash-down. The final locations shall be agreed with the client/landscape architect during the detailed design process.

The external taps are to be fed from a separate water category 5 rated booster set and break tank located in the plantroom or other suitable and agreed position if required by the local water authority. All external taps shall be insulated and lockable Arrow Valves Hose Tap boxes.

4.3.7 Control Requirements

Provide all necessary control devices to meet the requirements of the automatic controls section of this specification and to ensure efficient and safe operation of the system to meet

the design parameters. For the cold-water installation, this shall include, but not be limited to, the following:

- Interlock the booster set(s) with the low-level switches in the cold-water storage tanks.
- Provide volt free contacts on the booster set to transmit a common alarm to the BMS from each individual unit.
- Provide high- and low-level switches in the cold-water storage tank to generate suitable alarms to the BMS.
- Provide high- and low-level indicator lamps on the local MCC.
- Provide pulse water meters on the incoming mains, the boosted cold-water supply and the water supply to the hot water generation equipment to permit the water consumption to be monitored by the building management systems via volt free contacts.

4.3.8 Sterilisation

The system shall be fully pressure tested, commissioned and regulated (where necessary) prior to sterilisation.

Disinfect the systems in accordance with BS 6700 and the local Water Supply Company/ Authority requirements.

Repeat disinfection and purity analysis until appropriate quality is achieved. Repeat analysis on a seven-day cycle until handover to the Employer.

The Contractor shall allow to chlorinate the system just prior to practical completion and shall also allow for one further additional chlorination to occur prior to occupation (date to be advised by client team).

4.4 Domestic Hot Water Services Installation

4.4.1 Requirements of Service

Provide, install, test and commission and set to work a domestic hot water system to meet the functional needs of the building. Hot water shall be provided for use in all areas as detailed on the room data sheets, and shall include but not be limited to toilet areas, shower rooms, kitchen and cleaner's rooms utilising HWS hot buffer. HWS buffer vessel in load shall be provided with an electric immersion heater back up to be used in the event of ASHP fault or failure.

BMS control interlock to ensure electric immersion heater only operational during ASHP fault.

Provide means to control the risks of Legionella by generating water at 65°C and distributing it at not less than 60°C for primary distribution. Ensure that the minimum temperature anywhere within the circulation system (primary or secondary) does not fall below 55°C under prolonged maximum draw off conditions. A pumped hot water return shall be provided. The hot water systems to be maintained at designated temperatures on a constant 24 hour basis.

To reduce the risks of scalding vulnerable users of the system by providing blending or thermostatic devices local to hot water outlets set to achieve 41°C at the outlet. TMV3 compliant thermostatic valves shall be utilised. Where appliances are located adjacent or back-to-back, shared thermostatic mixing valves are permissible. All showers shall be provided with a TMV3 thermostatic mixing valve complete with shower fittings and flexible hose.

4.4.2 Design Parameters

The hot water services shall comply with current and relevant statutory requirements and regulations. This shall include, but not be limited to, complying fully with the edition (including amendments) of each of the following, current at the time of installation:

- The Building Regulations
- The Water Supply (Water Fittings) Regulations
- BS EN 806 Specifications for installations inside buildings conveying water for human consumption (all parts)
- BS 8558 Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.
- BSRIA AG4/94 Guide to Legionellosis - temperature measurements for hot and cold water services
- CIBSE TM13 Minimising the risk of Legionnaire's disease
- CIBSE Design Guides
- IOP Plumbing engineering services design guide
- WRAS Water Regulations Guide
- Wrc Water Fittings & Materials Directory by the Water Research Centre (Up dated every six months)
- HSE ACoP L8 and HSG274

The systems shall be sized utilising CIBSE Guide G design data for hot and cold water simultaneous demand.

Pipework velocities shall be limited to 1.5m/sec where installed in none critical areas and 1.0m./sec in noise sensitive areas.

4.4.3 System Description

The hot water service pipework shall be distributed through the building and shall then rise and/or drop in locations to be agreed with the Architect to supply the various appliances being provided with hot water.

Appropriately sized supplies shall be provided to the kitchen to meet the specialist's requirements. Within the kitchen any water softening shall be provided by or at the individual equipment as deemed necessary by the appropriate equipment suppliers or specialist installers.

Within the pipework distribution isolation valves for ranges of fittings shall be provided, together with individual service valves to all appliances.

The hot water services pipework shall incorporate pressure reducing valves as necessary to ensure appropriate pressures are achieved at all appliances.

All hot water services shall be run in copper pipework to lever operated ball-o-fix valves located as close to each fitting as possible and then connected to the sanitary ware. Where pipework is exposed, all pipework and fittings shall be stainless steel or chromium-plated copper pipework, and it shall be run in a neat and tidy manner to be as unobtrusive as possible. Care shall be taken to ensure that vulnerable users are not able to come into contact with surface temperatures exceeding 43°C.

All concealed cold water pipework within ceiling voids and risers etc. shall be insulated. Where exposed pipework feeding Visitor and Assisted WC wash hand basins is unavoidable the domestic hot and cold pipework and waste shall be chrome plated.

All thermostatic mixing valves shall be of the TMV3 type and shall have isolating valves, double check valves and strainers fitted to the hot and cold supplies. These shall be so positioned to allow easy access.

Recessed TMV3 showers shall be used in all locations. Access for isolation and maintenance to the shower valve should be from the valve itself without the need for any access panels. Exposed pipe work for the shower will not be considered.

The domestic water systems shall, in their entirety and in all respects, comply with the requirements of the current Water Regulations, and with the requirements of the local supply authority. All pipework, valves, components, plant items and materials shall be selected from the registers of water research council approved materials and components. The system shall be installed and insulated with due regard to the requirements of current Health and Safety legislation, including, in particular that relating to the prevention of legionnaire's disease. The system shall be designed and installed in accordance with good practice for access and maintenance of plant and movement around plantrooms.

The system shall be designed incorporating all necessary means to inhibit the growth of Legionella bacteria.

Dead legs of no more than 5 metres to outlet shall be permitted. Pipework containing blended water shall not exceed 2 metres from blending device to point of discharge and to be within the 5 metre overall length from circulation mains connection.

Chlorinate the system as required by current legislation. Do not make the final connection of the system to the local supply authority's main until chlorination of the system has been completed and the authority have carried out their own inspection and are satisfied.

Any flexible connectors or hoses and expansion vessels utilised in the domestic hot and cold water systems shall be fully WRAS approved and EDPM-free. All such equipment shall be provided with manufacturers certification identifying the materials used. All materials and fittings used must be acceptable for use in water systems and listed in the directory published by the Water Research Centre.

The Mechanical Contractor shall ensure that the mechanical design and installation follows the guidance of the Health Building Note (HBN) 00-09: Infection control in the built environment. The Mechanical Contractor shall be responsible for providing a description and strategy of compliance against HBN 00-09 at Detailed Design Stage and at Practical Completion of the project for review by the Client Team.

4.4.4 Hot Water ASHP

The provision of ASHP plant for the projects hot water requirements to be provided in accordance with the projects energy strategy and part L compliance requirements as required.

Minimum of 3No. units each sized at 50% and multi directional thermal store(s) for the domestic hot water generation. Thermal stores shall be sized and arranged to provide optimal return temperatures to the ASHP's whilst storing adequate thermal energy for the system operation

and maximising stratification within the tank(s). The required thermal storage shall be split over a minimum of 3No. thermal stores to encourage stratification. Storage tanks shall be hydraulically separated to the domestic water system by way of plate heat exchangers.

Generally, a minimum of 2no. plate heat exchangers shall be provided with 1no raising the temperature of the hot water return and 1no raising the temperature of the incoming cold water. All plate heat exchangers shall be sized, piped and controlled to provide the most optimal return temperatures to the thermal stores and heat pumps. Should additional heat exchangers be required these to improve output and/or efficiency of the system these shall be provided.

Condensate from each ASHP shall be installed to local drain / soakaway away from all walkways or working / access areas to prevent the risk of condensate pooling and freezing. Provide suitable power supplies and control interfacing from the central control panel. Volt free contacts will be provided as part of the manufacturer's packaged controls assembly to allow status monitoring/reporting of:

- ASHP enable/disable signals
- ASHP common fault status alarm.
- ASHP Primary flow and return temperature sensors
- ASHP Thermal Store High- and Low-level Immersion Temperature sensors.

The LTHW ASHP system shall be designed to operate at temperatures of 75°C flow to recharge the HWS thermal store and return from the thermal store to be at 15°C (As low as possible) to increase the efficiency of the ASHP & Heat exchangers.

Where ASHP technology is to be utilised the hot water heating system to be configured in accordance with all manufacturers recommendations. This to include a ASHP primary circuit to the HWS thermal stores, primary heat exchangers, a HWS return pump and a HWS Flow & return system to served buildings outlets.

The contractor is develop a suitable ASHP schematic including all required equipment including HWS thermal stores, valves, any primary pump requirements, plate heat exchangers and hot water return pump.

The contractor shall provide a backup electric immersion heater for the HWS storage provision in the event of ASHP failure. The electric immersion heater to be provide on the HWS load buffer only and to be sized to provide emergency HWS storage temperature top up to 65°C in the event of HWS ASHP failure only. The electric immersion heater to be controlled by the BMS & activated by upon ASHP unit failure.

The contractor to confirm the suitability of the external condenser location and any the integrated primary pump selections to achieve required flow rates and pressure drops.

The ASHP heat pumps are to be suitable externally mounted within external compound/external roof plant space & inline with manufacturers clearances for installation, operation and maintenance. The contractor is to ensure the external compound is suitably located & the noise output of the condenser to be attenuated as required.

All external HWS water pipework routing from air source heat pumps to be electrically trace heated.

4.4.5 Hot Water Return System

Provide a hot water service distribution system linked back to the water heater, comprising hot water service flow and return pipework, hot water secondary return pump to all outlet points. In order to offset heat losses from the pipework and maintain the required flow temperature of water at each outlet, provide a return connection at each hot water service dead leg which serves a range of outlets.

Size the return hot water pump to the HWS buffer such that the flow rate is sufficient to offset all system heat losses and omissions from pipework with a maximum temperature drop of 5°C. The pump shall be mounted in a vertical position to ensure it can be completely drained, and shall be of bronze construction. The system shall be fully balanced utilising commissioning sets and double regulating valves.

As part of the installation the Contractor shall install a standby pump, wall mounted in the boiler room, which can be installed if the duty pump fails.

4.4.6 Control Requirements

Provide all necessary control devices to meet the requirements of the automatic controls section of this specification and to ensure efficient and safe operation of the system to meet the design parameters. For the cold water installation, this shall include, but not be limited to, the following:

- Hot water storage temperature to be controlled at 65°C for 24 hours per day, 365 days per year
- Provide all equipment with integral safety devices for pressure relief and high temperature cut-out, and as necessary for safe operation of the system.
- Provide volt free contacts on the hot water heater to transmit an alarm signal to the BMS. The hot water heater and pump shall be controlled via the BMS on timed routines.
- The high temperature device is to be independent to the normal temperature control system and is to be manually reset able.
- The sensors and control system, is to be capable of enabling the system set points to be altered to achieve a 70 C system water temperature at the main plant, on certain occasions when required by the user, to enable pasteurisation of the system.
- Destratification pumps shall operate at least once every 24 hours.

4.4.7 Sterilisation

The system shall be fully pressure tested, commissioned and regulated (where necessary) prior to sterilisation.

Disinfect the systems in accordance with BS 6700 and the local Water Supply Company/ Authority requirements.

Repeat disinfection and purity analysis until appropriate quality is achieved. Repeat analysis on a seven-day cycle until handover to the Employer.

Upon the domestic hot and cold water systems being chlorinated, all draw off points shall be opened in sequence, once a week until the systems are handed over. The Contractor shall record each of these operations, witnessed by the clerk of works or Engineer.

4.5 Ventilation Services Installation

4.5.1 Requirements of Service

Provide adequate supply and extract ventilation to meet the building requirements to meet statutory obligations and where required as detailed on the room data sheets.

Natural ventilation shall be utilised wherever possible.

4.5.2 Design Parameters

The ventilation systems shall be designed and installed in accordance with all appropriate standards and guides in particular: -

- British Standards and Codes of Practice
- B&ES Guides and Good Practice Notes.
- CIBSE Commissioning Guides.
- Manufacturer's Instructions.
- BS 7671
- Health & Safety Executive Guide Notes
- CIBSE Recommendations.
- British Gas Regulations and Recommendations.
- Building Regulations

The ductwork installation shall be manufactured to DW 144 low velocity standards. Due consideration shall be given to noise and vibration. All air systems shall be complete with the necessary sound attenuators sized to meet the needs of the facility.

Ventilation

Ventilation shall be required to satisfy British Regulations and requirements as stated in this performance specification, the design intent HVAC Strategy Drawings and all other documents which when combined provide the full extent of the Employers Requirements.

Natural ventilation shall be the principal approach and shall be achieved via trickle ventilators and 'purge' ventilation through window openings which shall be designed and configured to meet the requirements of AD Part F. The main contractor, project architect and the D&B mechanical contractor shall make particular reference to ensuring that, where adopted, the natural ventilation philosophy can be achieved in accordance with AD Part F of the building regulations and CIBSE AM10.

Where external noise levels, Part O requirements dictate or where occupied spaces are internal / landlocked a mechanical ventilation approach shall be adopted. Mechanical ventilation shall be provided via a balanced supply and extract system with heat recovery and an electric heating coil to ensure a minimum supply air temperature during winter of 19°C is achieved. The ventilation rates for the various areas of the building shall be as AD Part F, in line with Part O requirements, or as detailed below, whichever the greater: -

En-Suites -	Intermittent extract with 6 Ach/hr or 45l/s at 'Boost' (whichever is greater).
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Resident Day spaces -	4 Ach/hr or 10l/sec
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Hairdresser/Treatment- 4 Ach/hr or 10l/sec

Bathrooms - Intermittent extract of 6 Ach/hr or 15l/s at Boost (whichever is greater) – Makeup air via ceiling mounted transfer grilles to corridor complete with appropriate fire stopping / devices.

Offices - 4 Ach/hr or 10l/sec

WC's - Intermittent extract of 6 Ach/hr or 15l/s at Boost (whichever is greater).

Staff Change - 6 Ach/hr mechanical supply & extract ventilation c/w LTHW heating coil and heat recovery.

Cleaners/Sluice - Continuous extract of 6 Ach/hr or 15l/s (whichever is greater).

Kitchen - Kitchen ventilation to be provided by specialist

Dry St/Kitchen Office - Ventilation by Mechanical Contractor to DW/172 requirements.

Laundry - Process ventilation by specialist. General ventilation by Contractor at 10Ach/hr.

Wheelchair/Hoist St - Continuous extract of 2 Ach/hr or 15l/s (whichever is greater)

Post Room - Natural ventilation via trickle ventilators and openable windows where possible, continuous extract of 2 Ach/hr or 15l/s (whichever is greater) where not.

Staff Room - 10l/s/p. Extract from Kitchenette at 60 l/s.

4.5.3 System Description

Ventilation shall be provided to meet the functional requirements of the building as detailed on the room data sheets, design criteria section of this specification and to meet all statutory obligations.

Ventilation shall be provided by either a natural methodology, or via mechanical means subject to building configuration, window design and room adjacencies to external elevations. Where natural ventilation is employed, the Contractor shall be responsible for undertaking calculations to demonstrate the proposed design meets the required ventilation rates and complies with any limiting over-heating criterion required by the Client or under statutory obligation (i.e. Building Regulations Part L2 which sets out requirements to meet AM10).

The entire air distribution system shall be provided with volume control dampers (VCDs) as required to enable the system to be commissioned. The VCDs shall be located a minimum of 500mm from ends of ducts, grilles, bends or branches to aid commissioning.

Where possible, plant shall be mounted within the roof void and discharge through the roof or to an inconspicuous location, where a roof void is not present then the plant shall be mounted on the roof. Where plant is mounted on the roof, the plant shall not be visible from ground floor level both within the site or from the surround area. Penetrations through the facade should be avoided and shall only be permitted by agreement with the Employer and the Design Team.

Door transfer grilles shall not be utilised. If transfer is required from, adjacent spaces for the purposes of air make-up, a ducted ceiling grille arrangement shall be utilised (with the exception of doors to en-suite bathrooms which shall be provided with undercut doors).

Air handling units/units, where provided, shall be suitably sized and selected to ensure adequate access space is provided for withdrawing the filters and coils, and replacing any component as required for safe maintenance to be carried out. The supply and extract air handling units shall be mounted within roof voids or externally on suitable plinths or supports, with resilient acoustic pads to ensure airborne and structure borne noise is suitably reduced to achieve the noise levels required within the building.

The ductwork installation shall be manufactured to B&ES DW/144 low velocity standards. Due consideration shall be given to noise and vibration. All air systems shall be complete with the necessary sound attenuators sized to meet the needs of the facility.

Provide ventilation to the lift shaft to meet the requirements of the lift manufacturer and the British Standards.

If a naturally ventilated solution is not possible, install two (run and standby) wall mounted extract fans to the LV switch room controlled via a local room mounted temperature sensor, the wall mounted fans shall be mounted and powered via the BMS. Make-up air shall be via louvres to outside.

Specific requirements for typical room types are described below.

All grilles are to be 4-way blow ceiling diffuser type for general mechanical ventilation systems throughout the building, with the exception of 'dirty' extract systems which shall be lockable white PVC air valves.

Resident Bedrooms

Resident bedrooms shall generally be naturally ventilated via opening windows with trickle ventilators, providing internal noise criteria can still be met. Where this is not the case, then local mechanical heat recovery c/w heating coil shall be provided.

En-suite Shower Room Extract Ventilation Systems

The resident bedroom en-suite shower rooms shall be ventilated by mechanical extract ventilation systems.

To assist demonstration of compliance with Approved Document Part O via passive measures as far as practicable, all en-suite extracts shall be provided via ceiling void mounted, concealed extract fans with associated access hatch within the ceiling of each ensuite. The fans shall each be capable of at least 30 l/s in boost.

The contractor is to ensure the noise level within the shower rooms does not exceed NR30, and that the noise level within any bedroom located beneath the extract fan position does not exceed NR25.

Assisted Bathroom Extract Ventilation Systems

The individual assisted bathrooms shall be ventilated by independent semi-recessed ceiling mounted mechanical extract fans. Each system shall incorporate an extract fan positioned in

the roof void connected via ductwork to each assisted bathroom. Make up shall be via ceiling void to corridor transfer ductwork, including grilles and fire and smoke damper.

Within the ductwork distribution system individual branch volume control dampers shall be provided in order to ensure that the system can be balanced and commissioned in accordance with the CIBSE Commissioning Code.

The assisted bathroom extract ventilation fans shall run at the dictate of a seven-day time switch, or via the operation of the lighting circuit with an adjustable (0-30 minute) run-on timer.

Miscellaneous Toilet Extract Ventilation Systems

The individual miscellaneous toilets throughout the facility (i.e. disabled toilets, staff toilets etc.) shall be provided with very low noise individual semi-recessed ceiling mounted local extract fans within each room terminating at façade. The fans will operate continuously in trickle mode and boost via the lighting PIR and shall have an adjustable overrun timer for the boost function. Make up shall be via undercut doors.

Within the ductwork distribution system individual branch volume control dampers shall be provided in order to ensure that the system can be balanced and commissioned in accordance with the CIBSE Commissioning Code.

The toilet extract ventilation fans shall run at the dictate of a seven-day time switch, or via the lighting circuit with an adjustable (0-30 minute) run-on timer.

Sluice/Cleaners Extract Ventilation System

The individual sluice rooms shall be provided with very low noise individual semi-recessed ceiling mounted local extract fans within each room terminating at facade. The fans will operate continuously, make up shall be via undercut doors.

Within the ductwork distribution system individual branch volume control dampers shall be provided in order to ensure that the system can be balanced and commissioned in accordance with the CIBSE Commissioning Code.

The sluice room extract ventilation fans shall run at the dictate of a seven day time switch, or via the lighting circuit with an adjustable (0-30 minute) run-on timer.

Kitchen Ventilation System (By Specialist Contractor)

The main kitchen shall be provided with an independent supply and extract ventilation system. Air shall be extracted via the central ventilation canopy within the kitchen, which shall be provided as part of the kitchen equipment. The canopy shall incorporate integral lighting and grease filtration.

The kitchen suppliers cost package and scope of works ends at the spigot connection on the canopy. All ductwork from this point should be designed to B&ES DW 172 and all appropriate standards, plus any project specific requirements stipulated by Building Control or the local Environmental Health Officer and shall be provided by the Mechanical Contractor.

The extract ventilation shall incorporate a suitable axial or bifurcated extract fan located in the roof void, or similar suitable position. The extract ventilation system shall be designed to achieve a minimum of 20 air changes per hour extraction rate from the kitchen, minimum

0.35m/s capture velocity across the canopy area or as recommended in DW/172, whichever is the greater.

Make-up air to the kitchen shall be provided via outlets integrated into the extract canopy. The method of delivering the make-up air including supply air fan, filtration, heating, etc. shall be designed by the Contractor to suit the particular application in line with the specified standards.

Within the kitchen extract ventilation ductwork, access panels shall be provided at maximum 3m centres for cleaning purposes.

The kitchen ventilation shall be controlled by a wall mounted tamperproof switch positioned in the kitchen which shall be clearly labelled.

If the kitchen extract ductwork passes through any other fire compartment, the ductwork shall be suitably fire rated for stability, integrity and insulation with appropriate supports suitable for the specified fire rating of the ductwork.

Any attenuators utilised in the kitchen ventilation system shall be Melinex lined and fire rated as appropriate.

The kitchen ventilation system shall comply fully with B&ES DW/172 Specification for Kitchen Ventilation Systems.

Kitchen Dry Store Ventilation System (By Specialist Contractor)

A kitchen dry store ventilation system shall be installed to provide a ventilation rate of 10 air changes per hour. Mechanically introduced tempered supply air and a transfer grille at low level in the door should be provided to relieve the air for capture by the kitchen exhaust system.

The Dry Store ventilation system shall comply fully with B&ES DW/172 Specification for Kitchen Ventilation Systems.

Laundry Ventilation System (By Mechanical Contractor)

The Laundry shall be ventilated by independent mechanical ventilation system, which shall incorporate a heat recovery ventilation unit positioned in the roof void connected via a ductwork riser to individual supply and extract grilles in the space. The ventilation system shall be designed to achieve a minimum ten air changes per hour, or to the minimum requirements of the laundry equipment, whichever is the greater.

Heat recovery units shall incorporate supply and extract fans, filters, electric heating coils and a heat recovery device. The system shall be fully ducted to supply and extract grilles located appropriately throughout the spaces. The unit shall be sized to maintain the room design conditions with respect to both temperature and fresh air provision.

The heat recovery unit shall be controlled by a wall mounted switch positioned in the laundry which shall be clearly labelled.

Laundry Process Ventilation (Where applicable)

Exhaust ventilation to the laundry equipment shall be provided to suit the installed FF&E and the laundry equipment supplier's requirements. All ductwork shall be the responsibility of the Mechanical Contractor and should be designed to all relevant standards, including the requirements of Gas Safe, Planning requirements and the local Environmental Health Officer. Where duct runs necessitate the provision of additional fans, these shall be provided by the

Contractor complete with all controls and monitoring system as necessary to comply with the operational and Gas Safe requirements.

Make-up air shall typically be provided by the use of grilles/louvers in the laundry external walls.

Where external grilles and louvers are utilised for make-up air the Contractor shall ensure that the space temperature is maintained at an internal dry bulb winter air temperature of 21°C. Combustion air for the tumble dryers shall be provided via a weather louver complete with thermally sealed actuated damper linked to the gas proving system. An electric heater battery shall be provided by the Laundry specialist at the makeup air intake point to assist in the maintenance of the space temperature. The controls should ensure that the air path is only used when required for dryer operation, thus reducing heat loss from the laundry during non-operation. The louver shall be sited directly to the rear of the dryers and be sized to meet the equipment manufacturer's requirements. The weather louver finish shall be agreed with the Architect.

Within the laundry ventilation ductwork, access panels shall be provided at maximum 3m centres for cleaning purposes.

4.5.4 Grilles and Diffusers

Supply, deliver, install and commission all supply and extract air terminals.

All grilles and diffusers shall have a standard B.S. colour polyester powder finish, final colour to be advised by architect prior to order. No grilles or diffusers shall be ordered until the Installer has received an approved Colour Schedule from the Architect. Samples of grilles for all areas shall be provided for approval by the design team prior to ordering.

All supply and extract grilles shall be complete with plenum boxes that are factory fitted complete with acoustic and thermal linings, and shall be constructed generally in accordance with the manufacturer's recommendations. All edges are to be sealed and finished to prevent material migration.

All ceiling grilles and diffusers shall be complete with the necessary flange to enable full integration into the specified ceiling type. For details of the ceiling type refer to the Architect specification. All grilles and diffusers shall be independently supported of the ceiling grid.

Terminations to façade shall be provided in accordance with the Architects elevation details and shall generally be either an airbrick or slimline louver. Final selection must be colour matched to the façade and agreed with the client and architect prior to procurement and installation.

4.5.5 Fire Smoke Dampers

Fire dampers and Fire Smoke Dampers shall be fitted as required by Building Regulations requirements, the fire officer and the agreed fire strategy to maintain fire compartmentation. Consultation with Building Control shall take place early in the design process and a submission made by the Contractor to confirm that the ventilation design meets the requirements of building regulations. The Contractor shall allow for the provision of Fire Smoke Dampers as necessary. Refer to the architectural documentation to establish the location of all fire compartments. Damper access shall be from within stores wherever possible with access hatches in corridors avoided.

Where more than forty-five dampers are provided a fully addressable control system that is compliant with EN54-4 and capable of control/monitoring all damper interface devices. The panel shall use the most advanced microprocessor technology to provide a control system of extremely high integrity. An LCD display shall ensure that information is presented in plain language.

Where less than forty-five dampers are installed a basic monitoring panel showing either closed or open status of each damper is to be provided. The mechanical contractor is to provide the panel with the electrical contractor providing interconnections and supply wiring

4.5.6 Control Requirements

Provide all necessary control devices to meet the automatic controls section requirements of this specification and to ensure efficient and safe operation of the system to meet the design parameters. For the ventilation installation, this shall include, but not be limited to, the following:

Heat Recovery Units shall operate as a full outside air supply system. The main heater batteries shall maintain an air off temperature set point of 19°C. Each heater shall have an associated temperature sensor.

4.5.7 Testing and Commissioning

Test operation of controls and alarms for each system and demonstrate to Client.

Commission all plant in accordance with this specification and manufacturers recommendations.

Pressure test air handling units and extract fans at the factory to the requirements of B&ES DW144.

Test, commission and balance ductwork systems in accordance with CIBSE and BSRIA guidelines. Ensure all final volume control damper settings are clearly marked.

Check operation of all filters, dirty and fan fail pressure switches.

Test all fire dampers and fire smoke dampers in ductwork systems and provide certification for O & M manuals.

Test air flow failure switches and BMS indication, including LV switch room extract fans.

Test the operation of the heating and cooling coils.

4.6 Comfort Cooling Installation

4.6.1 Requirements of Service

Provide comfort cooling to the areas as specified in section 2.4 of this document via either individual/multi-split or VRF/VRV simultaneously heating and cooling system/s. Cooling shall also be provided to the communications room(s) as appropriate to meet the requirements of the installed equipment and the Clients agreed IT strategy (including any futureproofing).

4.6.2 Design Parameters

Equipment shall be selected on external ambient temperatures of 35°C. Internal room design conditions shall be as stated within the design criteria on this specification, unless stated otherwise in the room data sheets.

The system shall use refrigerant type R32 or R410a.

The design and installation shall comply with the recommendations of British Standards, CIBSE and BSRIA Guidelines.

The Contractor shall submit full details of the proposed installation including drawings, calculations and equipment technical details for comment prior to any works taking place.

4.6.3 System Description

Cooling units shall generally be of the cassette type and fully recessed into the ceiling. In reception areas the cooling units will be chassis type void mounted serving linear slot supply grilles mounted in the depth of the ceiling coffers (where coffers size permits). Wall mounted units will be acceptable in areas such as kitchen, comms rooms and drug rooms subject to agreement with the Architect.

Concealed, ducted Fan Coil Units shall be provided to the reception and welcoming area. Wall mounted units in front of house spaces will not be permitted.

Both the drugs and communications cooling units shall comprise wall mounted internal units with remote controllers housed within holsters adjacent to the units.

All units are to be provided with fixed wall mounted controllers. The final locations are to be agreed with the client/and or Employers Agent and coordinated on the relevant room 1:20 elevations.

The outdoor and indoor units shall be connected by refrigerant grade copper pipework routed to suit the internal building layout and finishes. All pipework shall be insulated in closed cell Armaflex insulation.

The external units shall be completely weather-proof, corrosion resistant, factory assembled, pre-wired and complete with all necessary controls for easy installation. Condensers will be located in positions to be agreed with client but generally shall be roof mounted where possible or sympathetically located within the external landscaping where they present least impact in terms of noise for neighbours, residents or visitors. The Contractor should not assume that the external units are to be located at locations to suit their most economical equipment selections. The units shall be mounted on suitable structural supports with 15mm Tico pad anti-vibration pads mounted to prevent vibration being transmitted to the building structure.

The external units shall incorporate a heat exchanger made from seamless solid drawn copper tubes bonded by expansion onto preformed collars onto continuous plates of aluminium waffle louvre fins. The heat exchanger shall have an acrylic resin corrosion resistant type E1 coating to reduce the effects of atmospheric corrosion. All tubes with the heat exchanger shall be brazed in copper headers.

The external unit fans shall be of the direct drive propeller type manufactured from aluminium with plastic coated wire guards. The fan motors shall be totally enclosed incorporating thermal safety fuse cut-out facilities.

The external unit shall include high pressure switches, control circuit fuses, thermal protectors etc.

The comfort cooling units shall be provided with independent controllers providing room temperature set-point and fan speed adjust along with fault diagnostic facility. Each system will be able to act independently of each other i.e one room may be in heating mode while another may be in cooling. Room Controllers will be mounted with the top of the controller level with the top of adjacent electrical accessories i.e switches, audio controllers, break glass units etc.

All interconnecting control wiring associated with the comfort cooling installation shall be provided, and shall be installed as per cabling requirements in later sections of this specification. The interconnecting control cabling shall be clipped to the refrigerant pipework and shall be carried out strictly in accordance with the manufacturer's recommendations.

All pipework shall be carried out in refrigerant quality soft/medium drawn copper tubing complying with BS EN 1057, ASTM 280 and DIN 1754/8905 and complete with the appropriate fittings. All pipework and fittings shall be sized strictly in accordance with the manufacturer's recommendations. All refrigerant pipework shall be carried out by an approved Engineer in accordance with the latest edition of BS EN 378.

The longest possible lengths of copper tube shall be utilised to minimise faults on site and appropriate refrigeration installation tools (i.e. machine bender) must be utilised to avoid the use of elbows. Dry nitrogen must be passed through the pipework during brazing (no cold brazing allowed). All copper pipework shall be delivered to site with end caps, and the pipework shall be adequately protected during installation to prevent the ingress of dirt and moisture.

All pipework shall be pressure tested to 28kg/cm² with nitrogen, held for 24 hours and checked for leaks, vacuumed/dehydrated to (-752mm Hg) and held at that setting for (1 hour minimum) 4 hours depending on pipe length.

The refrigerant charge weights must be calculated to the actual installed length of pipework and in accordance with the manufacturer's recommendations and instructions.

The refrigerant pipework shall be installed on galvanised cable tray or fixed using hydrozorb clips supported from Unistrut or similar.

The comfort cooling units shall be provided with a plastic or copper condensate drainage system that discharges in a location to suit the building layout.

The electrical supply to the comfort cooling installation shall be installed to match that of the general small power installation throughout the building. The supply shall be derived from a suitable distribution board with appropriate forms of isolation at the internal and external units respectively.

The comfort cooling installation shall be interfaced with the BMS to provide full alarm and reporting at the MCCs.

4.7 Above Ground Drainage Installation

4.7.1 Requirements of Service

An above ground sanitation pipework system shall be provided, comprising a modified single stack system commencing at ground floor slab level from the stub stack locations by others and terminating with air admittance valves and roof vent terminations.

4.7.2 Design Parameters

The design of the foul drainage above ground systems shall be to meet the requirements of BS EN 12056 and the design shall be based on the discharge unit method (DU). The frequency factor used in the calculations will be taken from BS EN 12056-2 Table 3, using the tabulated discharge units as shown in Table 2.

The design of the foul drainage above ground systems shall be to meet all relevant British Standards, including in particular the requirements of BS EN 12056. The system shall be designed in accordance with all current guidance, including, but not limited to, the following:

- CIBSE Guides
- Institute of Plumbing Design Guide.
- Building Regulations.

4.7.3 System Description

The system shall comprise uPVC/muPVC vertical soil and waste pipework and waste and ventilation branches. Generally, all effluent from various sanitary appliances etc. shall be conveyed by gravity to the connection to the underground drainage systems at ground floor level. The system shall be installed using the minimum pipework and fittings necessary to carry away all foul discharges from the building to the below ground drainage system, quickly, quietly and with freedom from nuisance or risk of injury to health. It is essential that air from the discharge pipes be prevented from entering the building.

Where exposed pipework feeding Visitor and Assisted WC wash hand basins is unavoidable the waste pipework and trap shall be chrome plated.

Drainage shall be provided to the kitchen and laundry areas to suit the specialist installer's requirements. Any grease treatment or dosing shall be provided by the specialist kitchen Contractor.

All sink/basin traps shall be 75mm deep seal two-piece tubular type. All visible waste pipework and traps in areas with applied finishes shall be chromium plated with suitable fixings. Pipework to be boxed in within all sluice rooms and any other rooms of significant infection control.

All branches to horizontal discharge pipework at high level any floor, shall be made using 45° branches swept in the direction of flow, where possible. All bends used in the foul drainage above ground system shall be long radius. Short radius bends are strictly prohibited. All connections to WCs and other appliances shall be via the use of rigid connectors, no flexible connections will be permitted.

Gradients of all discharge pipework shall be in excess of the minimum requirements of BS EN 12056.

All discharge and ventilation pipework shall be designed for installation within designated service ducts or integrated ceiling voids. Removable access panels shall be co-ordinated with the drainage access points to enable maintenance to discharge pipework. Where pipework is designed to be exposed, it shall be installed to a high standard, true to line, with adequate support fixings.

WC overflows are to be the internal type as permitted within the current Water Regulations.

Discharge stacks located in areas that have been determined as being “sensitive to noise” shall be acoustically insulated, all to comply with the noise levels stated within this report and building regulation requirements. Particular attention shall be paid to bedroom areas.

Access shall be provided at each floor level on the vertical pipework and where necessary on branch pipework to allow the rodding of the whole system. As a minimum, this shall comprise of:

Vertically

- At each floor level plus 1200mm.
- On stub stack connections at floor level plus 1200mm or above the fittings spill-over level.

Horizontally

- Where shown on the public health systems drawings.
- All changes in direction.
- On all horizontal floats.

The installation shall include adequate drainage facilities for the mechanical services equipment and plant. Drainage from plant rooms and mechanical equipment shall be discharged into trapped floor gullies, which will connect to the foul drainage above ground system.

Traps to appliances will have deep seal traps in compliance with BS EN 12056-2 and the Building Regulations.

Where ventilating pipework is necessary to suit either the below or above ground drainage systems, it is proposed to terminate through the roof to meet architectural and technical requirements.

All plastic soil and waste or ventilating pipework passing through floors or fire compartmentation shall be fitted with a proprietary intumescent fire collar to prevent the spread of fire in accordance with Building Regulations.

All discharge and ventilation pipework will be air tested at various stages and on completion of the installation to ensure compliance with the requirements of the Building Regulations and BS EN 12056.

4.7.4 Testing and Commissioning

Carry out all tests and inspections to prove that the installation meets with the requirements of the Building Regulations and BS EN 12056.

The installation shall be inspected and tested at agreed stages to ensure that the pipework is properly secured and clear of obstructing debris and superfluous matter and that all work which is to be concealed is free from defects before it is finally enclosed.

Testing of all stack pipes and branches, including gullies and all fitted appliances, shall be by air pressure equal to 38mm on the water gauge which shall remain constant for three minutes. Before commencing air tests all water seals of all sanitary appliances and floor gullies must be fully charged with water and all open ends of pipe, i.e. vents and outfalls, must be plugged off.

The Contractor shall provide annotated copies of the drainage schematic drawings indicating each test and result for review by the Clients Building Services Engineer and Building Control.

All traps must retain not less than 25mm of seal when subjected to the appropriate discharge tests. The number of appliances to be tested shall be as detailed in BS EN 12056-2 Table NG.1.

4.8 Automatic Controls / BMS Installation

4.8.1 Requirements of Service

The Contractor shall design, supply, install, test and commission a fully automatic controls installation which shall maintain the design temperatures as well as sequencing the operation of central plant to achieve optimum control of the heating and hot water service systems. The control systems shall be designed to provide the maximum possible energy efficiency such that the operation of plant and equipment is in an energy conscious and efficient manner.

The Contractor shall employ a Control Systems Specialist to undertake the automatic controls installation works, including the provision of the mechanical control panels.

The automatic controls installation shall utilise microprocessor based controllers or stand-alone DDC outstations to achieve all time control, modulating control, sequence control, monitoring, etc. requirements in order to achieve the control principals described in this Specification. All control loops shall be either proportional or proportional plus integral action depending upon the particular application. The controller / outstations shall be located in the mechanical control panel control sections, or alternatively within purpose made enclosures adjacent to the main plant equipment items which are being controlled and/or monitored. The installation shall achieve a fully integrated and co-ordinated automatic controls installation.

As part of the works the Contractor shall ensure the Control System Specialist submits point schedules, strategy drawings, outstation schedules, power and control schematic drawings, etc. associated with all aspects of the automatic controls installations, along with a fully detailed automatic controls description based upon the general principles contained in this Specification.

4.8.2 Design Parameters

All outstations shall be addressable and networked back to the central supervisory unit mounted on the Motor Control Centre (MCC).

All outstations shall be arranged for and capable of standalone operation.

Base the BMS on the principle of direct digital communication (DCC) controllers in a communications network mode with all the necessary outstations, cabling, interfaces etc., to provide a fully addressable (local and remote) control system.

Carry out the whole of the Contract installation works strictly in accordance with British Standards and the latest Edition of the Requirements for Electrical Installations IET Wiring Regulations issued by the Institution of Engineering Technology and BSI and the Standards laid down by the National Inspection council for the Electrical Contracting Industry.

Refer to all other sections of this specification for particular and design parameters for each system.

Submit with the tender, the name(s) of the proposed control specialist (systems house) and the manufacturer of associated items such as motorised valves and sensors etc.

4.8.3 System Description

The building shall be controlled and monitored by a building management system incorporating distributed intelligent outstations controlling main plant items.

Provide detailed written controls descriptions in good time for comment by the Design Team and CI including:-

- Detailed mode of operation statements.
- Control logic diagrams.
- Network topology schematics.
- Panel diagrams and drawings.
- Method statements for testing and commissioning.
- Method statements for witness testing.
- Graphics including all slides and all information presented thereupon.
- Any further information to fully convey the scope of the specialist's proposals.

A network display panel shall be provided in the plant area.

Utilise networked, microprocessor, intelligent programmable outstations in each control panel all linked via the network back to a central supervisor unit.

Provide a system able to collect data for processing into trend logs by a portable or fixed PC. The buildings energy usage shall be monitored by the BMS, to comply with the requirements Part L of the Building Regulations.

All controls shall be digital / electronic and suitable for connection to a UPS and standby generator if provided by the tenant.

Control of BMS should allow for the simple addition of further out-stations.

It shall enable the monitoring of all general packaged items of plant.

At the design stage a full description of the method of control for each and every plant item shall be provided.

Maintenance and operational manuals to be in an agreed form prior to or at practical completion.

Training shall be provided for the landlords and future tenants in the operation of the BMS.

Supervisor station ports shall be provided as detailed on the drawings within the building with one monitoring point.

Provide a system, which collects and stores management information for the operation of the building.

Utilise one company for all control items. The system design, installation and commissioning shall be carried out by a suitably qualified and experienced software house/controls specialist. Refer to preferred manufacturers list of details of controls specialist.

Provide all necessary interfaces and safety interlocks together with monitoring and control functions to form a fully functioning system, which meets all of the needs, detailed throughout this specification.

Provide and install all necessary control panels.

4.8.4 Mechanical Control Panel

The LTHW and hot water service installation shall be served by a mechanical control panel located in the plantroom. The control panel shall be of the wardrobe type and shall be

constructed to comply with BS EN 60439. The control panel shall be constructed in a pressed and welded form manufactured from 2.0mm thick sheet steel. The control panel enclosures shall provide a robust and rigid finish and shall be provided with a minimum IP54 protection. All other aspects of the control panel construction shall be as detailed in the general specification clauses.

The control panel shall incorporate the following facilities:

- A suitably rated incoming triple pole and neutral 3 phase door interlocked isolator for the power section.
- Appropriate fuses for all circuits.
- Hand/off/auto rotary switches for each LTHW pump and each ASHP module.
- Starting provision for all mechanical plant and equipment items to be served by the panel.
- Control circuitry and interconnecting relays where appropriate.
- Run and trip lamp indication for each individual LTHW pump.
- Run and fault indication lamps for each individual boiler module.
- All starters shall be provided with push button manual re-set overload settings which shall be suitable for the load and installed cable size.
- Terminal strips for all power and control wiring of suitable size for the appropriate cables.
- Fire alarm hard wired interlock to disable the plant and gas solenoid valve in event of a fire alarm condition.
- Panel live lamp indication.
- Individual control circuit fused failed lamp indication.
- Control step down transformers.
- Separate power and control sections, i.e. with individual doors.
- Power supplies to the LTHW pressurisation units and all ancillary items such as motorised valves, gas solenoid valve, etc.
- Water flow failure lamp indication for each set of LTHW pumps.
- LTHW and chilled water pressurisation unit general fault condition individual lamp indication.
- Panel lamp test push button.
- AHU/HRU fault and enable
- Cold-water storage tank high level, low level, sprinkler level and tank temperature alarms.

4.8.5 ASHP Plant and LTHW System

The ASHP plant and LTHW systems shall be energised at the dictate of the following routines:

ASHP Plant

Optimum start/stop control routine.

Primary LTHW System

Optimum start control routine.

Secondary Variable Temperature System

Optimum start control routine.

The optimum start/stop control routine shall be based upon the required time schedule occupancy period during which the required internal temperature shall be achieved. The

optimum start/stop routine shall be based upon a temperature sensor located on the inside wall at ground floor level, along with a suitably positioned outdoor air temperature sensor.

The individual ASHP modules shall have their own integral controls, including water temperature and limit controls. The number of boiler modules which are energised shall be determined by common flow temperature sensor. This sensor shall enable the required number of modules in order to achieve the required set point. Within the software control arrangement there shall be variable time delays which shall prevent additional modules being enabled or disabled before the time lag of the heating system has influenced the primary heating flow temperature. This arrangement shall be carefully set up to ensure minimum fluctuation of the primary heating flow temperature.

The ASHP sequence shall be fully rotated on a duty cycle arrangement. The duty cycle arrangement number of permutations shall equal the number of boiler modules. The duty cycle changeover shall be initiated on a time period basis which shall be initially set up to changeover on a weekly cycle.

The ASHP primary circuit duty pump shall run whenever any aspect of the LTHW system is operational, i.e. ASHP plant, secondary variable temperature circuit or secondary constant temperature circuit.

The secondary variable temperature heating circuit shall be controlled overall by the optimum control routine as previously described. Within the controls arrangement there shall be an outside air temperature limit routine such that if the outside temperature value exceeds a set point (initially set at 18°C) the variable temperature heating circuit shall not be operational.

The variable temperature secondary LTHW system shall be of the compensated type. The flow water temperature shall be scheduled against the outside air temperature and a three port mixing valves shall be modulated accordingly to achieve the required flow temperature value in conjunction with a flow pipe mounted temperature sensor. The compensated control schedule shall be set up to ensure the required flow water temperature is available depending upon the heating requirements in the building at different ambient air conditions.

When the ASHPs are disabled at the end of the required operational period then the duty ASHP boiler primary pump and variable temperature secondary pump shall run on for a minimum 10 minute period (provided they were running at the time when the boilers were disabled).

Each individual LTHW pump set shall be provided with a differential pressure switch to monitor flow conditions. Should flow failure occur when the duty pump is operational as detected by the pressure switch then the duty pump signal shall be disabled, and the stand-by pump shall be made operational. Once this occurs a software lockout routine shall operate such that the stand-by pump shall remain operational until such time as the software lockout routine has been re-set. Once the routine has been re-set then the duty pump shall be re-enabled (provided the duty cycle routine has not changed over).

Each set of LTHW pumps shall be provided with an automatic duty cycle routine which shall be initiated on a time period basis, and shall be initially set up to changeover on a weekly cycle.

The variable temperature secondary LTHW circuit pumps shall be controlled via appropriate pressure sensors such that the flow rate matches the heating demand within the secondary circuit in order to minimise pump motor energy consumption.

Pressurisation Unit

The LTHW pressurisation unit shall come complete with its own integral controls. Interlock boiler and LTHW water pump operation with the pressurisation unit such that no ASHP or pump can operate when the booster set is in high or low pressure alarm condition.

Configure the control panel to provide a common alarm via volt free contacts back to the (plant room motor control centre panel or BMS), via terminal strip, for the following signals:-

- Common unit fault
- Normal system status.

The following status items shall be displayed on the control panel:

- System pressure
- High pressure setting
- Low pressure warning
- Low pressure danger
- Minimum run time

Provide a BMS interlock between the set and the pump and ASHP control circuit to prevent ASHPs or pumps from running when the set is in high or low pressure alarm.

Comfort Cooling

Each comfort cooling unit shall provide fault indication and alarms via the hard-wired connection to each controller

Heat Recovery/Air Handling Units

HRU's are to be provided with local seven-day controllers and timer. Kitchen HRU's are to have independent control with gas interlocks provided where applicable.

Frost Protection

First stage frost protection shall enable all duty LTHW pumps (if they are not already enabled) when the external temperature drops below 2°C. The pumps shall remain operational until the external temperature value has increased to 3°C.

Second stage frost protection associated with the building shall enable the ASHP plant to operate if the internal air temperature sensor drops below 15°C. If this occurs then the boiler plant, duty primary LTHW pump, duty secondary variable temperature LTHW pump shall be enabled to run. The plant shall remain operational in this mode until the internal air temperature has increased to 20° C.

Fire Alarm Interlock (where applicable)

Upon receipt of a fire alarm condition the following shall occur, all via hard-wired interlocks:

- The gas solenoid valve serving the kitchen and laundry equipment shall be automatically closed.
- The LTHW plant shall be disabled.
- The ventilation systems in the building shall be disabled, where required by Building Regulations or local Fire Authority.
-

Plant Shut-Down Buttons

Within the plantroom emergency shutdown buttons shall be provided adjacent to all exit doors. Upon activation of a shutdown button, all plant within the plantroom shall be disabled (with the exception of the pressurisation units) and the gas solenoid valve shall be closed.

All emergency plant shut down buttons shall be clearly labelled as to their purpose, and shall be of the turn to re-set type (without the use of keys).

Remote Alarm

The automatic controls installation shall incorporate a remote alarm facility whereby if any item of plant/equipment fails then an audible alarm and red indication lamp unit shall be activated in an agreed location. The audible alarm shall also have an associated mute button.

4.9 Sprinkler System

4.9.1 Requirements of Service

To provide a complete, fully integrated automatic wet residential sprinkler system to serve all parts of the building, including all stairs and store regardless of floor area.

4.9.2 Design Parameters

A fully automatic residential sprinkler system shall be provided in accordance with BS 9251 and all other relevant standard, including but not limited to, complying fully with the edition (including amendments) of each of the following, current at the time of installation:

- The Building Regulations, Part B
- The Fire Precautions Act
- The Fire Precautions (Workplace) Regulations
- The Local Authority Acts and Byelaws
- The Water Supply (Water Fittings) Regulations
- BS 9251 Sprinkler systems for residential and domestic occupancies - Code of practice
- CIBSE Guide E Fire Engineering
- FPA LPC Rules for automatic sprinkler installations
- GFSS Guidelines for the supply of water to automatic sprinkler systems (by the FPA)
- PD 7974-7 Application of fire safety engineering principles to the design of buildings. Probabilistic risk assessment.

The system shall comply fully with the requirements of the Client's Insurers, the Clients appointed Fire Specialist/Engineer, and the local Fire Authority/Building Control.

The minimum duration of water supply discharge shall be determined by the Fire Engineer as part of the overall fire strategy for the building.

4.9.3 System Description

The Contractor shall employ an LPC, FIRAS and BAFSA approved sprinkler contractor who shall be solely responsible for the complete design, supply, installation, testing, commissioning, certification, setting to work the system. Prior to commencement of installation, the contractor shall obtain approval of his design drawings from the Client's Insurers, the Clients appointed Fire Specialist/Engineer and the local Fire Authority/Building Control of the entire system to meet the requirements of the building and the relevant statutory requirements.

The design of the sprinkler installation shall be the sole responsibility of the installer.

The system shall be complete with all storage, pipework, sprinkler heads, valves, switches and gauges to ensure correct operation.

Unless directed otherwise by the fire strategy, the system shall be configured using quick response frangible bulb elements, so that only those heads/nozzles in the immediate vicinity of a fire operate. Heads/nozzles shall be located in a regular arrangement as far as practicable.

The system shall be fed from a dedicated cold water sprinkler tank sized to comply with the requirements of BS 9251. The Contractor shall include for installing a demand valve to the MCWS supply after the tee from the sprinkler network to the domestic cold water storage tank. The demand valve shall be held open, energised via a controlled link to the sprinkler flow switch. Upon sprinkler activation the demand valve will isolate the MCWS feed to the domestic supply providing full storage and in-fill water for fire purposes

Additionally, a low level alarm should be installed on the tank by the Contractor. This low level switch should be set at a level just below the normal low level of the tank under the peak domestic draw acting as a warning for failure of tank infill.

The booster set should be on a dedicated electrical circuit in fire rated cable and must not be linked to a shutdown from the BMS or fire alarm panel.

The system design shall be co-ordinated with all other mechanical and electrical services, building structure and fabric.

4.9.4 UPS

The contractor shall design, supply, install and commission a UPS system that is in accordance with Approved Document B and BS 9251 for Sprinkler Pumps.

It shall be the contractor's responsibility to have the proposed system checked and reviewed with Building Control and the Fire Consultant.

The contractor shall contact a UPS specialist to provide a UPS system that allows back up supplies to operate for the duration as required by the sprinkler category if power fails for the following:

- Sprinkler pump

The contractor shall utilise KVA Power for a UPS quotation, details as below.

Gary Mcilvain

KVA Power Installations Ltd

07749101783

01942 386237

sales@kvapower.co.uk

The system shall consist of:

1. UPS
2. Battery Bank
3. Battery Isolator
4. DC cabling
5. Backfeed arresting unit – will be required if regen lifts are used.

The contractor shall provide automatic changeover switches of suitable rating for each system mentioned above. A separate distribution board shall be provided specifically for the UPS supplies. Each system shall have its own primary supply from the main panel board and a secondary supply another distribution board (DB/UPS) within the UPS room.

4.10 Firefighting Supplies

The Contractor shall ensure full compliance with AD Part B of the Building Regulations in relation to provision of water for fire-fighting purposes, by way of either fire hydrant or on-site permanent water stored volume of 45m³. The design proposals shall be submitted and approved by both the appointed Building Control Officer and Local Fire Authority.

4.11 Pipework Distribution

4.11.1 General Installation

All pipework systems will be installed in accordance with requirements of the manufacturer and good trade practice to ensure satisfactory performance in use.

All pipework shall avoid running over bed areas/patient positions in order to reduce the risk of scalding or burns in the event of a leak.

All piping shall be installed to achieve a neat and orderly appearance; where visible it shall be arranged parallel to or at right angles to structural members of the building.

Provide local and main branch isolation valves throughout the system. Valves shall be provided for each section or wing of the building in order to avoid the need for complete draining and for commissioning of the system. The position of these valves shall be carefully co-ordinated with the building design and suitable access hatches provided for access. Each isolation valve shall be positioned in a 'back of house' area with access agreed with the Architect. Isolation valves shall not be positioned in areas deemed 'front of house' unless agreed with the Architect and client team.

4.11.2 Pipe materials and manufacturers

All pipework and components shall be selected from the 'Pipework Materials & Manufacturers Selection Table' on the following page, in respect to the type of materials required. Only pipework shown as acceptable, with a '✓', for a given system type in the table below shall be considered for installation. For the purposes of Tender, the pipework materials shown as '✓ ✓' shall be used unless advised otherwise within the Tender clarifications. Any materials and manufacturers not mentioned in the below table shall not be considered.

Pipework Materials & Manufacturers Selection Table:

	LTHW	LTHW Drops	DHWS	MCWS	BCWS	TCWS	Int. Nat. Gas	Ext. Nat. Gas	Ext. Water
Mild Carbon Steel Heavy Grade to BS 1387 & BS 3600	✓ ✓	✓ ✓	×	×	×	×	×	×	×
Galvanised Mild Carbon Steel Heavy Grade to BS 1387 and BS 3600	×	×	×	×	×	×	×	×	×
Copper Half-Hard Tube to BSEN 1057 R250 (BS2871 Part 1, Table X)	✓	✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓	×	×	×
Grooved Mild Carbon Heavy Steel to BS 1387 and BS 3600	✓ ✓	✓	×	×	×	×	×	×	×
Stainless Steel 316L and 304L	✓	✓	✓	✓	✓	✓	×	×	×
Copper Annealed Tube to BSEN 1057 R220 (BS2871 Part 1, Table Y)	×	×	×	×	×	×	×	×	×
Geberit Pressfit (Stainless Steel) Sealed Systems Only	✓	✓	×	×	×	×	×	×	×
Yorkshire "Xpress" (Copper Half-Hard Tube to BSEN 1057 R250 & R290 (BS2871 Part 1, Table X)	×	×	✓	✓	✓	✓	×	×	×
PE80 Polyethylene	×	×	×	×	×	×	×	✓ ✓	✓
Protected Polyethylene (Contaminated Ground Conditions) PE80	×	×	×	×	×	×	×	✓	✓ ✓
Ductile Spun Iron Cement Lined to BSEN 545, 598 & 969	×	×	×	×	×	×	×	×	×
Copper Annealed Tube to BSEN 1057 R220 (BS2871 Part 1, Table Y) Polythene Covered	×	×	×	×	×	×	×	×	×
Carbon Steel Pipe with the use of Yorkshire Carbon Xpress and Carbon Tektite Fittings	×	×	×	×	×	×	×	×	×
Copper Table X with the use of Yorkshire Xpress and Yorkshire Tektite	✓	✓	✓	✓	✓	✓	×	×	×
Multi Layer Composite Pipe (MLCP) systems and fittings	×	✓	×	×	×	×	×	×	×
Aquatechnik pipe and Safety fittings	×	×	✓	✓	✓	✓	×	×	×
JG Speedfit Pipework and fittings	×	×	×	×	×	×	×	×	×
Durapipe HTA pipework and fittings	×	×	×	×	×	×	×	×	×
Instaflex (George Fischer)	×	×	×	×	×	×	×	×	×
Wavin HEP20 pipework and fittings	×	×	×	×	×	×	×	×	×

Crimped carbon steel pipe systems	×	×	×	×	×	×	×	×	×
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4.11.3 Pipe Spacing & Clearance

Pipes will be spaced in relation to one another and to the building structure to allow for the required thickness of thermal insulation. The combined insulation of two or more pipes in one composite casing will not be permitted.

The clearance between pipework and finished wall and ceiling and other fixtures will be 40mm for uncovered pipes less than 50 bore, 50mm for uncovered pipes 50mm bore and over and 25mm for covered pipes.

Unless otherwise directed, the underside of all horizontal pipes will be at least 75mm above finished floor levels.

4.11.4 Location of Joints

Unions or flanges will be provided at all valves and equipment to enable these to be dismantled.

No joints will be formed within the thickness of walls, floors or ceiling.

The installation will be erected so that it is accessible for repair and replacement. In this context accessible means that the provision for dismantling (the flange or union etc.) can be reached and worked upon wither in the open or else by removal of a purpose made duct cover, manhole or similar. The fitting is not accessible if, as fixed, it cannot be manipulated.

Where pipework is, of necessity, inaccessible, such as in sealed shaft, it will be welded or brazed.

4.11.5 Changes of Direction

The Contractor will bend pipes around piers, all other projections, recesses and all off-sets due to varying thicknesses of plaster, walls, floors, ceilings and other structural works, whether such changes in direction of piping are indicated on the drawing or not.

4.11.6 Prevention of Dirt Entering Pipes, Valves, Etc

The Contractor will ensure that all pipes, fittings, valves, etc., are free from corrosion and internal obstruction. Pipes and fittings showing signs of corrosion will not be fitted.

The Contractor will protect the open ends of all pipework. Blank flanges, screwed caps, plugs or plastic covers only will be used to cover open ends. Wood, rag or paper plugs will not be used.

4.11.7 Air Venting

No air locks will be allowed. Open air vents, air bottles and automatic air valves will be fixed in all necessary positions as required on water services, utilising square tees to connect to the pipework system.

At all high points in the crown of the vented pipelines, and any other point that may be considered necessary, air collecting bottles and release valves are to be provided fixed either horizontally or vertically above the level of the pipe to be vented.

From the outlet of each bottle, a 12mm bore air release pipe to 12mm bore air release needle valve will be installed in an accessible location.

Automatic air valves will be fitted only in exceptional circumstances where manual venting is not practicable. Automatic vents shall be installed in an accessible location for maintenance/replacement and shall not be fitted where they are likely to allow air ingress due to the suction condition. These will be as WINN Type B or equivalent with lockshield isolating valve and 12mm bore copper piping to discharge over the nearest drain, basin or lavatory, or any other position where damage will not be caused by any overflow of water.

4.11.8 Air Separators

A cast iron or purpose made mild steel air separator with flanged ends complete with two screwed bosses at the top of the separator each complete with automatic air vents air separator shall be installed on the main LTHW Heating flow from the boilers.

4.11.9 Draining & Flushing Systems

Drain cocks will be fitted on or adjacent to all items of equipment, e.g. - boilers, chillers, heating and cooling coils, fan coil units, hot water cylinders/heaters and calorifiers, pumps, tanks, cisterns, etc. and all low points of the heating, hot water, cold water, firefighting, chilled water and condenser water service and on the 'dead' side of all isolating valves and cocks whether shown on the drawings or not.

Drain cocks will be positioned as unobtrusively as possible. If a drain cock must inevitably be positioned where it may prove a danger or nuisance, one elbow will be fitted so that the drain cock lies parallel to the pipe drained and hence is protected by it.

Flushing valves will be provided in all positions necessary to enable satisfactory phased sequential cleaning of the systems in locations where shown on drawings and generally in accordance with BSRIA/CIBSE Commissioning Codes. Drain cocks will not generally be regarded as satisfactory substitute for flushing purposes.

4.11.10 Pipe Sleeves

In all cases where pipes pass through walls, floors, ceilings and footings, the Contractor will build-in sleeves. Sleeves will not be used as pipe supports, a free annular space always being provided.

Puddle flanges will be provided where pipes pass through water-proofed membranes.

Sleeves in load bearing walls or footings will be galvanised mild steel.

Sleeves will be pipe cuttings properly reamed, cleaned and trimmed at 90° to bore.

Sleeves in non-load bearing walls, floors, ceilings and partitions will be of the same material as the pipe.

The inside diameter of sleeves will be not less than 15mm larger than the outside diameter of the pipe or, in the case of insulated pipes, the equivalent bore of the overall diameter of the pipe including fire retarding insulation.

The space between the pipe enclosed and its sleeve to be caulked with suitable fire retarding fibrous material, with an intumescent plastic seal on each side of the sleeve.

Sleeves will protrude not less than 1.5mm and not more than 3mm proud of the finished face of the wall. Sleeves in the vertical position will project 15mm above the floor level except in

toilets, kitchens and all other situations where the floor may be swilled, where the sleeve will project 30mm above the finished floor level.

Pipes passing through walls, floors, ceilings, partitions and false ceilings of occupied rooms will be fitted with a masking plate. Where the pipework to which it is attached is specified as being of chromium plated finished the plates will be of the Heavy chromium plated type oxy copper treated on all faces. Elsewhere the plates will be of the hard plastic type.

All wall plates will be split on the diameter, be a snug fit to the pipe concerned and be provided with counter sunk holes for screws.

The Contractor will position such plates, drill and plug to the wall for the attachment and finally screw on with substantial screws having oxy-copper treated countersunk.

4.11.11 Building Expansion & Settlement Joints

Two number flexible jointed couplings will be installed within all pipelines that cross building construction/movement joints to accommodate the building movement and/or settlement whether such joints are detailed on the drawings or not.

The first coupling will be located immediately before and the second immediately after the pipe crosses the building joint. The pipe between these couplings will be arranged and installed in a manner that will accommodate the maximum building settlement and/or movement without fracture, distortion or damage of pipework or joint failure occurring.

The Contractor will submit fully detailed drawings indication their proposals for these joints to Employer's Agent for approval.

4.11.12 Pipework Supports

The Contractor will take due note of the type of building and in selecting and detailing all supports and fixings, anchors and guides, will comply with the maximum services loading requirements.

The supports and fixings accessories described in this section are those required in connection with piping and tubing throughout the works. The type of fixing required will generally be as herein described but the Contractor will prepare and submit detailed workshop drawings of all supports and accessories as they are prepared.

The contact of dissimilar metals must be avoided and, to this end copper piping will be carried exclusively from contact members constructed from copper or brass or, where mild steel clamp saddles are used, a non-ferrous lining will be interposed.

The use of wire rope suspension systems shall not be permitted to hang any services in corridor areas or main access/egress routes from the building. Wire rope suspension systems shall not be used to hang any services related to life safety (i.e. fire alarm containment etc.) unless the manufacturers can provide evidence that the system is demonstrably rated to a standard no less than the service being carried under proprietary fire test conditions such as those detailed in BS 476.

Supports should be arranged as near as possible to pipe joints. Brackets or supports will be set out so that they do not obstruct the access to valves, flanges or other fittings requiring maintenance.

Supports for pipes in ducts and trenches will be so spaced as to allow access to any pipes without disturbing the remainder. Where required supports will be adjustable.

Mains in subways and trenches will be carried on purpose-made angle or channel "r"n section with "U" bolts. There will be a clearance of approximately ". "mm between the "U" bolt and all pipes carrying water above 10°C.

Services laid in the ground will be assembled with care and in such a manner that pipework and fittings will not be damaged by movement of the ground. Where pipes pass under roadways carrying vehicles they will be fitted inside sleeves or conduits prepared by the Builder.

Where a common pipe hanger is used provision will be made for unequal expansion.

On all insulation with vapour seal, the pipe split ring or clamp will be outside the insulation.

Maximum spacing of supports for mains will not exceed the centres given in the following table:

Nominal Bore (mm)	Pipework Material (mm)	Horizontal Runs (mm)	Vertical Runs (mm)
15	Steel	1800	2400
20	Steel	2100	3000
25	Steel	2400	3000
32	Steel	2400	3000
40	Steel	2400	3000
50	Steel	2400	3600
65	Steel	3000	4500
80	Steel	3000	4500
100	Steel	3000	4500
125	Steel	3700	4500
150	Steel	3700	4500
200	Steel	4500	4800
15	Copper	1200	1800
22	Copper	1200	1800
28	Copper	1500	2400
35	Copper	1800	3000
42	Copper	1800	3000
54	Copper	1800	3000
67	Copper	2400	3000
76	Copper	2400	3750
108	Copper	2400	3750

In all cases of multiple supports where pipes etc. of differing sizes are to be supported from a common point attached to the building structure, such common points will be spaced at the intervals required for the smallest pipe concerned.

The type of pipe hanger clip or loop used will be selected according to the application, special provision being made in instances where the piping or tubing is subject to axial movement due to thermal expansion and/or contraction.

4.11.13 Anchors & Guides

Generally, anchors and guides will be constructed using proprietary systems and methods or purpose designed to suit the particular application.

The Contractor will submit to the Architect, prior to manufacture, details of anchors and guides and anticipated thrust loads.

Pipes will be rigidly anchored to the structure and, in ducts or other parts of the premises, in suitable positions, by flat clips and/or "U" bolts threaded at both ends and pulled tight onto the pipe and with a metal block welded to the underside of pipe and butting up to angle and/or channel iron support on each side. The diameter of the rod from which the anchor bolts are made will be 3mm greater than that for "U" bolt guides. Flat iron clips will be 38mm and 9mm.

The supports for the anchors will be formed from channel iron or two equal angles back to back, adequately sized to take the maximum thrust load bolted to wall or built into sides of ducts.

In the case of copper pipes, anchors will generally consist of two female flange to copper adaptors interposed in the pipe run at the anchor point, mild steel sections being bolted to either side of the flange joint and attached to the building structure.

Anchors will, in all cases, be provided complete with the necessary sections pre-cut to length and drilled, backing plates, holding down bolts, nuts, washers all for attachment to the building structure. The Contractor will set out each anchor point, lining up accurately into positions for grouting in.

Tubular type guides will be provided on either side of the expansion joint, approximately 1.5 pipe diameters distance, with further guides on each side approximately 20 pipe diameters distance. The Contractor will, however, check with the manufacturer of proprietary expansion systems that the guides and distances in accordance with his recommendations.

Generally, guides will be fixed at points between the anchors and expansion devices to ensure that the thrust is along the axis of the pipe.

Special supports and fixings accessories will be provided at all heavy items of pipeline equipment i.e. valves, etc., to ensure that no undue strain is placed upon the pipeline at their incidence.

After fabrication all ferrous fixings and supports will be thoroughly wire-brushed to remove dirt, scale, rust, etc. and then given two coats of red oxide primer to bolting to or building into the building structure.

4.11.14 Methods of Fixing

The Contractor will submit to the Architect/Engineer his proposals for the various fixing methods and devices he wishes to employ and obtain approval prior to commencing installation.

4.11.15 Expansion of Pipework

Wherever possible, provision for expansion and contraction of pipework will be made by changes in direction and utilise the natural flexibility of the network within accepted stress limits. Otherwise, adequate expansion loops or expansion compensators will be provided as detailed on the drawings and/or in the specification. Hangers and other supports will be

designed to accommodate movement satisfactorily. Expansion compensators will be suitable for the working conditions to which they will finally be subjected, and manufacturer's guidance and recommendations will be observed in all aspects of erection and commissioning to this equipment.

Axial compensators on steel pipework may be of screwed, welded or flanged type depending upon service and pipe size on which they are to be installed. Those for installation on copper services will have stainless steel flanges.

Axial compensators will be installed in line with the axis of the pipe and will not be subjected to any tension during installation other than that approved by the manufacturers.

Where welded ends are used each joint between bellows and pipework will be aligned prior to and during welding by means of welding clamps.

Design drawings will show anticipated expansion between anchors and expansion devices or pipework may be cold drawn during installation to an agreed amount not exceeding the manufacturer's recommendations and indicated on the design drawings.

Flanged compensators will be pulled up diagonally across the flanges by means of long bolts, after the joints are made the long bolts will be removed diagonally one at a time and replaced with standard bolts, nuts and washers.

All compensators will be securely locked in position prior to and during hydraulic testing.

Guiding and anchoring of axial compensators will be in accordance with the requirement of the relevant part of this specification.

4.11.16 Flexible Connections on Pipework

Flexible connections either of the reinforced rayon neoprene rubber type or the braided hose type will be installed at the interconnection between pipework and rotating or vibrating equipment. Bellows must be flanged, hoses will be screwed or flanged according to service and size.

All connections will be installed in a straight line without offset and when installed connecting pipework will be adequately supported and anchored immediately adjacent to each bellows and/or hose to prevent undue strain and to ensure that the weight of the pipework does not rest on the connection.

Rubber bellows will be isolated from piped systems during hydrostatic pressure testing.

Flexible connections for use on fan coil units, fan convectors, chilled ceiling panels, cooler and heater batteries with connection sizes up to and including 25mm nominal bore I comprise of

- A liner of smooth bore extruded nitrile rubber with an outer cover of galvanised steel wire braid, or
- A liner of smooth bore extruded PTFE, with an outer cover of high tensile stainless-steel braid.

The type of liner, outer cover and end couplings will be selected to be suitable for the medium, pressure and temperature of the system in which they are to be installed.

The flexible braided connections are to have a maximum length of 450mm and be provided with a screwed brass female union on one end and a quick release self-sealing two way coupling on the opposite end.

The quick release self-sealing couplings will have the following features:

- Be capable of being operated with one hand.
- Provide instant shut-off when plug-in-nipple is removed from coupling body.
- The valves in the coupling body and plug-in-nipple to be identical and be designed to reduce pressure drop to a minimum by giving a free through flow.

The plug-in-nipple to be connected or disconnected under pressure with no leakage.

All materials used in the manufacture of the couplings to be non-rusting.

Any flexible connectors or hoses and expansion vessels utilised in the domestic hot and cold-water systems shall be fully WRAS approved and EDPM-free. All such equipment shall be provided with manufacturers certification identifying the materials used. All materials and fittings used must be acceptable for use in water systems and listed in the directory published by the Water Research Centre.

4.11.17 Pressure Testing of Pipework

All pipework will be hydraulically pressure tested either in sections or as complete circuits prior to insulation being applied and prior to concealment.

The execution of hydraulic pressure testing of pipework will be in accordance with all BSRIA, CIBSE and B&ES guidelines.

The test pressure when attained will hold for a minimum of 2 hours (unless otherwise dictated) prior to signature of acceptance of the test by the Employer's Agent.

A minimum of two days' notice will be given to the Employer's Agent of intent to test section of piping.

Where items of equipment such as boilers, chillers, heater coils etc. form part of a system, they will be connected to that system during testing.

Any instrument or item of equipment not capable of withstanding the test pressure or procedure specified will be temporarily removed or bypassed, subject to the Employer's Agent's prior approval in each instance.

Upon completion of each whole installation and before any insulation is applied or encasing or buying of any section of pipework, the Contractor will subject each system to an hydraulic test as per the schedule and demonstrate to the satisfaction of the Employer's Agent that the system or section is sound and watertight. Pipework encased or buried will be subjected to a similar test at a time to suit the progress of the work.

The Contractor will allow for site testing of the works to be carried out in sections as the work progresses, to suit the requirements of the works programme. The Contractor will allow for all isolation and other temporary work, including the provision of all plugs, caps, tees, drain fittings etc. to facilitate such tests.

The Contractor will maintain a schedule of all tests. Upon completion of each test, the Contractor will issue a test certificate

All pressurised pipework will be tested by filling the pipework section to be tested with water and raising its pressure to the pressure specified below. The pipework section will then be left without further strokes of the pressurisation pump and with the test pump disconnected. All joints must remain tight for a period of at least two hours.

All drain piping will be tested by running water through to waste. Air vents will be tested when the heating installation is put into operation, with air vents and piping examined for signs of leakage and malfunction.

On completion of each hydraulic test, the water will be released and drained then thoroughly flushed through to ensure the removal of as much dirt and dross as possible, before being refilled and put into service.

The test pressures to be applied to the various services are to be 1.5 times the maximum pressure imposed in the system under working conditions or the minimum pressure as indicated below (whichever is the greater value). The pressure gauge readings for these tests will be taken at the lowest points of the respective systems:

Service Test Pressure:

Condensate Cooling Coil Drains & General Plant Drains exposed or accessible	Wet Fill Test Only
Condensate Cooling Coil Drains & General Drains where non-accessible	7.5 mbar
Soil, Waste and Vent Pipes	Air Test 7.5 mbar
Branch Waste and Vents	Air Test 7.5 mbar

Natural gas systems will be pressure tested to meet the recommendations of IGE UP/1 'Soundness testing and purging of industrial and commercial gas installations.

Water required for testing purposes will be deemed to be free issue under the contract. The Contractor will provide any temporary pipework necessary between test sections and water outlet points provided they are within 50m of the works.

4.11.18 Chemical Cleaning

Following the completion of installation or any individual system or major section of a system, the Contractor will thoroughly flush that system to remove all dirt, debris and mill scale, etc.

The Contractor will, in addition, chemically clean (in the manner stated below) and flush the following systems:

- Domestic water systems including incoming mains, storage tanks, drinking water mains, hot and cold-water mains and fire mist systems will be chlorinated, sterilised and flushed prior to handover. The requirement of CIBSE technical memorandum TM13 will be strictly adhered to.
- The Contractor shall allow to chlorinate the system just prior to practical completion and shall also allow for one further additional chlorination to occur prior to occupation (date to be advised by client team).

- LTHW heating, chilled water and closed-circuit condenser cooling water to be cleaned with de-scaling agent and flushed.
- Open circuit condenser water and the open evaporative circuit in a closed-circuit condenser system will be descaled flushed and sterilise prior to handover. The requirements of CIBSE Technical Memorandum TM13 will be strictly adhered to.

The Contractor will allow for cross connecting ALL flexible connections to heating and cooling coils to prevent their blockage during testing, flushing and chemical cleaning. Particular care shall be taken with motorised control valves with small clearance orifices to prevent blockage.

The Contractor will allow the provision of suitable tapping points for chemical introduction and all necessary drain/flushing connections, including large bore dirt/drain pockets at the bottom of all risers.

4.11.19 Electric Trace Heating Cables

The Contractor will provide and fix on all external pipework, weather-proof electric trace heating tapes to protect the pipe contents from freezing.

The tapes will be fitted to externally exposed insulated pipework and fittings including control valves, isolating and balancing valves, non-return valves, strainers, orifice plates, flanges, etc.

The tapes will be adequately sized to compensate for the heat losses from the pipes to ensure that the exposed pipelines do not freeze during extended cold periods when the ambient air temperature is -10°C.

4.11.20 Sterilisation

All hot and cold-water installations, both existing and new, shall be sterilised by the application of chlorine and proprietary preparations, in accordance with BSRIA guidelines, local Water Authority requirements and those of the manufacturer to the satisfaction of the Contractor, the Employer (or their representatives).

On completion, certificates recording the results shall be provided and incorporated within the Operating and Maintenance Manuals.

4.11.21 Water Treatment

Once the LTHW system flushing and cleaning works have been completed then the systems shall be dosed with appropriate water treatment chemicals. At no time shall the system be left filled with raw or non-dosed water due to the risk of corrosion. The water treatment chemicals shall include both corrosion inhibitor and biocide dosing. The chemicals shall be purchased from a recognised water treatment chemical supplier. Both the corrosion/scale and biological growth inhibitor chemicals added shall be of neutral pH rating and shall be biodegradable. Only the minimum amount of chemicals shall be used, to meet the manufacturers recommended concentration levels. Take care not to spill any chemicals during their application.

Before and after the water treatment chemicals have been dosed into the systems the Contractor shall carry out a chemical analysis of two independent water samples from the LTHW system taken at ground floor level and roof levels respectively. The chemical analysis shall cover items such as PH level, TDS level, suspended solids level, M alkalinity, P alkalinity, hardness, iron content, copper content, corrosion inhibitor level, pseudomonas, nitrate reducing bacteria, colour, clarity etc. The test shall also cover a bacteriological analysis including a one day and

three-day total viable count. Based upon the analysis results the Contractor shall dose the system with additional water treatment chemicals as necessary. Following any further dose, the sampling procedure shall be repeated to demonstrate that the required inhibitor levels, chemical analysis etc. have been achieved.

Once the LTHW system has been dosed with water treatment chemicals and the necessary chemical, bacteriological and pseudomonas analysis results are issued then the Contractor shall be responsible for maintaining the water quality levels within these dosed systems.

During this period between completion of the flushing and cleaning and practical completion the Contractor shall be responsible for maintaining the water quality levels within the LTHW system. If at any time any of the test results indicate a deterioration in the water quality, then this shall be immediately rectified by the Contractor at no cost to the Client. The Contractor shall note that unless the required water quality levels are achieved then practical completion will not be granted.

4.12 Thermal Insulation

4.12.1 General

The Contractor will include for all thermal insulation work to be carried out by an approved specialist thermal insulation Sub-Contractor. Only skilled operators will be employed.

The thermal insulation work shall not be commenced until the whole of the agreed section of the installation has been completed and tested as set out in the relevant pipework, plant and air distribution section of the specification and witnessed.

Thickness of insulation shall be to meet the maximum heat losses as stipulated by BS 5422 (current version at time of installation), current Building Regulations Part L and associated compliance guides, but shall be no less than as specified in the following tables.

4.12.2 Pipework

All surfaces to be insulated shall be clean and dry. Untreated ferrous metal surfaces shall be rust-free and treated with proprietary anti-corrosion paint in accordance with the manufacturer's recommendations. Copper pipework shall be cleaned thoroughly to remove all surplus flux, building material debris and dust.

Particular attention will be given to the finished appearance of all thermal insulation which must present a neat and symmetrical appearance running true in line with pipe layouts. Any rough, irregular or badly finished surfaces will be stripped down and re-insulated.

All pipework will be insulated separately. Adjacent and parallel pipes will not be married together with insulating materials. Pipework installation will make due allowance.

All Insulation materials with and without facings will be rated "Class O" as defined in the Building Regulations (England and Wales), Approved Document B, Appendix A12 All finishes shall have a "Class 1" surface spread of flame rating when tested in accordance with BS 476 Part 7.

Thermal insulating materials used within the building will achieve a Smoke Emission Rating of 5% in accordance with BS 5111 and free from substances which in the event of a fire would generate appreciable quantities of smoke, noxious or toxic fumes. Insulation materials and their finishes will be free from asbestos.

Where an obstruction occurs in the pipeline, e.g. a bracket, or pipe sleeve, the insulation will terminate at each side of the obstruction. In the case of chilled pipelines, the insulation will finish flush with high density phenolic foam inserts located within the pipe bracket and sleeves, refer to details at the end of this section.

Where pipe clips with neoprene inserts are used, the insulation will be carried over the clip with the next size of section. Pipe clips with neoprene insulation inserts will only be used on pipe sizes up to 32/35mm diameter.

4.12.3 Pipe Insulation Materials

Phenolic foam pipe insulation shall be cfc-free "Class O" pre-formed, bore-coated pipe sections having a nominal density of 35 kg/m³, a thermal conductivity of 0.018 W/m·K at 10°C mean temperature and a factory applied facing "f" "Bright Class O" reinforced aluminium foil.

Mineral wool pipe insulation shall be rigid bonded "Class O" pre-formed pipe sections having a nominal density of 80 kg/m³ and thermal conductivity of 0.034 W/m·K at 10°C mean temperature and a factory applied facing "f" "Bright Class O" reinforced aluminium foil.

4.12.4 Cold-water Services (BCWS, CWS, TCWS, Etc)

In Plantrooms:

The pipework system will be insulated with foil-faced preformed phenolic foam sections applied in 1 metre lengths cut longitudinally in halves and secured with 50mm wide self-adhesive aluminium foil tape at approximately 350mm centres, or where sections terminate around pipe clips, unions, flanges, etc. All bends, sets, tees, etc., will be insulated. All valves, strainers and similar shall be insulated.

In Services Ducts & Ceiling Voids

The pipework system will be insulated with foil faced preformed phenolic foam sections applied in 1-metre lengths cut longitudinally in halves and secured with 25mm wide self-adhesive aluminium foil tape at approximately 150mm centres, or where sections terminate around pipe clips, unions, flanges, etc. All bends, sets, tees, etc., will be insulated. All valves, strainers and similar shall be insulated.

Externally

As (In Plantrooms) above but the whole system will be continuously insulated regardless of pipe size. Isogenopak will not be applied. Weather protection will be provided by 0.8 mm PIB sheet applied to give continuous cover with all lap joints solvent sealed.

Where considered necessary, electric trace heating tape will be fixed under insulation.

4.12.5 Hot Water Services

In Plantrooms:

The pipework system will be insulated with foil faced preformed phenolic foam sections applied in 1 metre lengths cut longitudinally in two halves and secured with 50mm wide self-adhesive aluminium foil tape at approximately 350mm centres, or where sections terminate around pipe clips, unions, flanges, etc. All bends, sets, tees, etc., will be insulated. Valves, strainers, and similar shall be insulated.

In Service Ducts & Ceiling Voids:

The pipework system will be insulated with foil faced preformed phenolic foam sections applied in 1 metre lengths cut longitudinally in two halves and secured with 50mm wide self-adhesive aluminium foil tape at approximately 350mm centres, or where sections terminate around pipe clips, unions, flanges, etc. All bends, sets, tees, etc., will be insulated. All valves, strainers and similar shall insulated.

Externally:

As (In Plantrooms) above, but the whole system will be continuously insulated. Isogenopak will not be applied. Weather protection will be provided by 0.8mm PIB sheet applied to give continuous cover with all lap joints solvent sealed. Where considered necessary electric trace heating tape will be fixed under insulation.

4.12.6 Low Temperature Hot Water Heating

In Plantrooms:

The pipework system will be insulated with foil faced preformed phenolic foam sections applied in 1 metre lengths cut longitudinally in two halves and secured with 25mm wide aluminium straps or equal at approximately 300mm centres, or where sections terminate around pipe clips, union, flanges, etc. All bends, sets, tees, etc. will be insulated. Valves, strainers and similar will be insulated with removable insulation mats having Velcro strip and drawstrings.

In Service Ducts & Ceiling Voids:

The pipework system will be insulated with foil faced preformed phenolic foam sections applied in 1 metre lengths cut longitudinally in two halves and secured with 25mm wide aluminium straps or equal at approximately 300mm centres, or where sections terminate around pipe clips, union, flanges, etc. All bends, sets, tees, etc., will be insulated. Valves, strainers and similar will be insulated as for plantrooms as stated (In Plantrooms), above.

In User Spaces:

Where providing useful heating surface pipework will not be insulated, otherwise as (a) above, but excluding Isogenopak finish.

Externally:

As (In Plantrooms) above, but the whole system will be continuously insulated. Isogenopak will not be applied.

Weather protection will be provided by 0.8mm PIB sheet applied to give continuous cover with all lap joints solvent sealed.

Where considered necessary, electric trace heating will be fixed under insulation.

4.12.7 Cold-water Storage Tanks

Cold-water storage and feed tanks will be insulated with foil faced phenolic foam slabs or fibreglass slabs when called for by the Fire Officer, securely fixed to the tanks by a suitable adhesive. After completion, the insulation will be wrapped with canvas, securely fixed and sealed with poly-vinyl acetate adhesive/sealer, suitable for painting. The corners will then have

aluminium or galvanised mild steel corner bends fitted, secured in position by aluminium bands at not more than 300mm centres.

4.12.8 Ductwork

Phenolic foam insulation shall be cfc-free "Class O" with a thermal conductivity of minimum 0.021W/m·K at 10°C mean temperature and a factory "applied facing" of "Bright Class O" reinforced aluminium foil.

Mineral wool pipe insulation shall be rigid bonded "Class O" with a nominal density 45kg/m³ on circular ductwork and 60kg/m³ on rectangular, and shall have a thermal conductivity of 0.034 W/m·K and a factory "applied facing" of "Bright Class O" reinforced aluminium foil.

High density load bearing phenolic foam duct support strips shall be installed between the duct and the support bracket.

Insulation will be dressed around damper arms and test holes.

Bends and tees in internal plant items and ducts will be finished neatly around all access doors, covers, pipes and instrument, etc., such that these items can be removed without disturbing the insulation surrounding them.

Plantrooms:

Thermal insulation will be as detailed above.

External Ductwork:

External ductwork will be as detailed above but enclosed in polyisobutylene sheet securely bonded to all laps.

Ductwork in Ceiling Voids, Service Ducts & Risers in Building:

All ductwork carrying tempered air, at a temperature within ±5°C of space temperature serviced to be uninsulated.

All ductwork carrying chilled air to be insulated as "Fresh Air Ductwork".

All ductwork carrying heated air to be insulated as "Fresh Air Ductwork".

Ductwork Exposed in Occupied Space:

All ductwork carrying tempered air, at temperature ±5°C of space temperature to be uninsulated.

All ductwork carrying chilled air to be insulated as "Fresh Air Ductwork" generally, but uninsulated if exposed in the room it serves.

All ductwork carrying heated air to be insulated as "Fresh Air Ductwork" generally, but uninsulated if exposed in the room it serves.

4.12.9 Minimum Thickness Tables

Table 1 - Environmental thickness of insulation for non-domestic heating installations to control heat loss.

Steel pipe size (mm)	Hot face temperature of installation (°C)		
	+75	+100	+150

NB	OD	Thickness of insulation (mm)				
		Phenolic foam	Mineral wool	Phenolic foam	Mineral wool	Mineral wool only
15	21	15	30	15	40	50
20	27	15	40	20	40	60
25	34	20	40	20	40	60
32	42	20	40	20	50	65
40	48	20	40	25	50	65
50	60	20	40	25	50	65
65	76	25	40	25	50	75
80	89	25	50	30	60	75
100	114	25	50	30	60	75
150	168	25	50	35	60	75
200	219	30	50	35	60	80
250	273	30	50	35	60	80
300	324	30	50	35	60	80
Vessels and flat surfaces		35	50	40	65	90

Table 2 - Thickness of insulation for chilled and cold-water supplies to prevent condensation on a low emissivity outer surface with ambient air conditions of 25°C and 80% RH.

Steel pipe size (mm)		Temperature of water (°C)					
		+10		+5		0	
		Thickness of insulation (mm)					
NB	OD	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool
15	21	15	20	15	25	20	30
20	27	15	25	15	30	20	40
25	34	15	25	20	30	25	40
32	42	15	25	20	30	25	50
40	48	15	30	20	30	25	50
50	60	15	30	20	40	25	50
65	76	20	30	25	40	30	50
80	89	20	30	25	40	30	50
100	114	20	30	25	40	30	50
150	168	20	40	30	50	35	60
200	219	20	40	30	50	40	60
250	273	25	40	30	50	40	65
300	324	25	40	35	60	40	65
Vessels and flat surfaces		30	50	40	65	50	80

Table 3 - Environmental thickness of insulation for non-domestic hot water services.

Steel pipe size	Water temperature of 60°C
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(mm)		Thickness of insulation (mm)	
NB	OD	Phenolic foam	Mineral wool
15	21	15	25
20	27	15	30
25	34	20	30
32	42	20	30
40	48	20	35
50	60	20	35
65	76	25	35
80	89	25	40
100	114	25	40
150	168	30	50
200	219	30	50
250	273	30	50
300	324	30	50
Vessels and flat		35	50

Table 4 - Environmental thickness of insulation for domestic central heating installations (+75°C) and hot water supply systems (60°C) to control heat loss in potentially unheated indoor areas with ambient air temperature of -1°C.

Outside diameter of copper pipe (mm)	Water temperature of 60°C/75°C	
	Thickness of insulation (mm)	
	Phenolic foam	Mineral wool
10	15	25
12	15	25
15	15	30
22	20	40
28	20	40
35	25	40
42	25	40
54	25	50
Cylinders	35	50

Table 5 - Environmental thickness of insulation for ductwork carrying warm air.

Temperature difference between air inside ductwork and ambient air (°C)					
10		25		50	
Environmental thickness of insulation (mm)					
Phenolic foam	Mineral wool	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool
20	40	25	50	35	65

Table 6 - Thickness of insulation for condensation control on ductwork carrying chilled air in ambient conditions 25°C, 80% RH for insulation having a low emissivity finish 0.05.

Minimum air temperature inside the ductwork (°C)							
15		10		5		0	
Thickness of insulation (mm)							
Phenolic foam	Mineral wool	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool	Phenolic foam	Mineral wool
20	30	25	50	40	75	50	100

4.12.10 Approved insulating materials

PF Phenolic Foam Insulating Materials (Suitable for temperatures up to 100°C)

PF1 Phenolic Foam Pipe Insulation

Rigid cfc-free "Class O" phenolic foam, pre-formed bore-coated pipe sections having a nominal density of 35 kg/m³ and thermal conductivity of 0.018 W/m·K at 10°C mean temperature. Supplied complete with factory applied "Bright Class O" reinforced aluminium foil facing.

PF2 Phenolic Foam Laminate Slabs

Rigid cfc-free "Class O" phenolic foam laminated slabs having a nominal density of 40 kg/m³ and thermal conductivity of 0.018 W/m·K at 10°C mean temperature. Supplied complete with factory applied "Bright Class O" reinforced aluminium foil facing.

PF3 Phenolic Foam Laminate Slotted Slabs

Rigid slabs as described under A2 and back-slotted to provide sufficient flexibility for application to cylindrical surfaces 350mm diameter and above.

PF4 Load Bearing Phenolic Foam Inserts for Pipe and Duct Support

Rigid cfc-free "Class O" high density phenolic foam purpose designed pre-formed pipe support inserts and duct support strips supplied with factory applied "Bright Class O" reinforced aluminium foil facing.

MW Mineral Wool Insulating Materials (Suitable for temperatures up to 230°C)

MW1 Mineral Wool Pipe Insulation

Rigid bonded "Class O" mineral wool, pre-formed pipe sections having a nominal density of 80 kg/m³ and thermal conductivity of 0.037 W/m·K at 50°C mean

temperature. Supplied complete with “ factory applied "Bright Class O" reinforced aluminium foil facing.

MW2 Mineral Wool Rigid Slabs

Rigid bonded "Class O" mineral wool slabs having a nominal density of 48 kg/m³ and thermal conductivity of 0.034 W/m·K at 10°C mean temperature. Supplied complete with “ factory applied "Bright Class O" reinforced aluminium foil facing.

MW3 Mineral Wool Flexible Blanket

Flexible bonded "Class O" mineral wool blanket having a nominal density of 28 kg/m³ and thermal conductivity of 0.034 W/m·K at 10°C mean temperature. Supplied complete with a factory applied "Bright Class O" reinforced aluminium foil facing.

MW4 Mineral Wool Mat

Bonded "Class O" mineral wool mat having a nominal density of 24 kg/m³ and thermal conductivity of 0.040 W/m·K at 10°C mean temperature. Supplied complete with “ factory applied "Bright Class O" reinforced aluminium foil facing.

4.13 Commissioning

The entire mechanical and public health services installation shall be balanced and commissioned by the Contractor in accordance with the general specification clause, CIBSE Commissioning Codes and BSRIA guidelines. The balancing and commissioning shall be carried out by a specialist company.

The Contractor shall prepare a detailed method statement associated with the balancing and commissioning works, which shall include the following specific details:

- During the balancing and commissioning of the LTHW system all control valves shall be fully open (except when by-pass double regulating valves are being set up)
- When the LTHW system is balanced and commissioned the pressure drop through the control valves, coils, boilers, etc. shall be measured and recorded wherever binder test points are fitted.
- All volume control dampers shall have their final position marked on site by red paint.
- As part of the balancing and commissioning procedure the regulation of main ductwork volume control dampers will not be acceptable. Where fans operate at above the design requirement belt and pulley changes on all belt driven fans shall be carried out rather than regulation of main duct dampers.
- During the balancing and commissioning of the LTHW system all thermostatic radiator valves shall be fully open.

A Specialist Commissioning Engineer will set to work, commissioning, documenting and demonstrating the mechanical services systems within the building, in addition to the chemical cleaning and chlorination of pipe networks. The Commissioning Engineer will be responsible for co-ordinating and programming the whole commissioning exercise including other Specialist Commissioning Engineers required on equipment. It is anticipated that the pre-commissioning will commence as soon as possible.

At the handover all the commissioning documents will be completed and handed over to the client.

The commissioning will be carried out in accordance with:

- The recommendation of the specific plant/equipment suppliers.
- The Controls Engineer will demonstrate the sequence of operation for all the systems, and the Commissioning Engineer will include for commissioning, recording and documenting the air/water flows on the systems at all stages of operation and covering all permutations.
- Relevant CIBSE commissioning codes.

4.14 Witnessing

The Contractor shall submit in writing the balancing and commissioning test results to the Clients Building Services Engineer before witnessing will take place. The PM will only witness test results if the test sheets demonstrate that the balancing and commissioning has been completed and carried out satisfactorily in accordance with the specification requirement. If during witnessing the test results are found to be inaccurate, then the Contractor shall re-balance and re-commission the systems again. This procedure shall continue until satisfactory results have been witnessed.

5 Electrical Services

5.1 Main Incoming Electrical Services

The Contractor shall provide an incoming electrical supply suitably sized to cater for the buildings anticipated maximum demand, including the agreed expansion capacity. The electrical supply shall be designed and selected to take due account of the building's electrical load characteristics.

The incoming supply shall be 230/400 V +10%/-6%, 50Hz TNS or TNC-S terminating in the Client owned main Low Voltage distribution switchboard.

The incoming supply capacity shall be assessed at an early stage of the project, taking into account all electrical loads and characteristics. The Contractor shall ensure that the anticipated maximum demand takes into account the building being occupied on a 24hr basis. The contractor shall ensure that the DNO's requirements are met in respect of location of metering, protective device types and incoming cable arrangements.

The incoming supply shall incorporate a minimum future load expansion capacity of 10%.

The Contractor shall liaise with the Client and ensure that disruption to the existing infrastructure and site operations is kept to a minimum practical level. The Contractor shall programme the works to suit all associated costs in carrying out the works outside normal working hours and in such sequence/sectional testing as may be required.

The Contractor shall carry out the installation with due regard to all other installation activities, to ensure that full co-ordination of services is achieved and that access for maintenance to any part or parts of the mechanical and electrical installations is achievable in accordance with best custom and practice.

The Contractor shall ensure that any proposed cable routes are satisfactorily co-ordinated with new or existing underground services prior to commencement of the works.

The Contractor shall provide all necessary trench work, ducts and builders' work necessary to install the new electrical supplies.

The Contractor shall ensure adequate space is provided within the electrical intake room for the electricity supply authorities' incoming cable, service fuse/circuit breaker and metering equipment.

The Contractor shall, prior to any isolation and installation work, notify the Client's nominated representative in advance of the proposed works.

The Contractor shall incorporate all necessary metering to suit the electrical supply authorities in conjunction with the Clients preferred electricity supplier. The precise method and location of the metering equipment shall be co-ordinated by the Contractor and where necessary, the contractor shall incorporate CT chambers within the main switch panel.

5.2 Primary Low Voltage Switchboard and Sub-Main Distribution

The Contractor shall design, supply, deliver, install, test and commission low voltage switchboards in accordance with the Tender Drawings and Specification.

The Main Switch Panel shall be of indoor type, free standing/wall mounted, cubicle pattern with an ingress protection rating of IP31 and a fault rating of 50kA for 1 second.

Switchboards shall be designed for front operation, front or rear access with top or bottom cable entry/exit and shall include for any secondary support steelwork that may be required to suit their location.

Switchboards shall be manufactured to Form 3 Type 2b, as defined by BS EN 61439 and the Electrical Installation Equipment Manufacturers' Association (EIEMA). Protection devices shall be of MCCB pattern to BS 60947-2. MCCBs shall have a breaking capacity (Icu) of not less than 25KA and a service breaking capacity (Is) of 100%Icu.

All ACB's / MCCB's, switches etc. shall be clearly labelled.

All main switchboards and sub-switchboards shall have a 3mm rubber mat in line with BS EN 61111:2009.

Pulse / Modbus metering shall be provided to the incoming electrical supply and all major outgoing supplies in accordance with the Building Regulations and CIBSE TM39. This shall include where necessary a central metering facility integrated with the Building Management System. The primary incoming supply meter shall be equipped with a digital multifunction meter, complete with Harmonic assessment facility, such as the Socomec Diris H or equal and approved.

Switchboards shall be designed and installed to fit the space available with due consideration for access, expansion and maintenance. Switchboards shall stand on a 100mm plinth.

It shall be possible to extend switchboards at one end by a minimum of one modular cubicle width without compromising access and maintenance requirements.

10% Spare capacity shall be provided in the form of both outgoing ways and load capacity. Spare ways will be populated with spare MCCBs of various ratings to suit the building load profile in agreement with the Client.

The switchboard shall incorporate a suitably sized MCCB to accommodate the future installation of a free-standing power factor correction cubicle sized to achieve a minimum power factor of 0.95 at all times.

The main switchboard, sub-switchboards and distribution boards shall incorporate a coordinated surge protection installation in accordance with BS EN 62305 and BS 7671+A2 18th Edition.

Each outgoing MCCB shall be provided with a key lock facility for use in both "on" and "off" positions.

The switchboard shall include the facility to accept a secondary incoming supply from a future standby generator and suitable means of changeover. The protective/switching device shall be sized to be capable of providing 125A TP&N for life safety systems to still operate in the event of a mains failure. The Contractor is to allow for all associated connections to allow this set-up. The switchboard shall be equipped with mains monitoring and status indication equipment suitable for interface with a future standby generator.

The generator circuit breaker shall be cabled to a suitable external position to allow the temporary generator to connect without disruption to the switchboard, housed in a suitable IP65 enclosure and located externally as agreed with the Client and Project Architect.

The Contractor shall ensure that all cable terminations are adequately sized to accommodate the cables selected for installation without modification to either cable or equipment.

Switchboards shall be designed to operate in a maximum ambient temperature of 35°C. All neutral bus bars shall be fully rated.

The Contractor shall obtain from the manufacturer final working drawings, which shall detail the general layout of the equipment, wiring details and protection device details. The drawings shall be obtained prior to commencement of manufacture and shall be submitted for comment to the client's nominated representative.

The Contractor shall provide a framed LV schematic diagram adjacent to the main LV switch panel detailing the entire LV distribution system.

The Contractor shall provide a complete secondary low voltage distribution system to serve the building. The distribution system shall be designed to serve areas and services in a strategic and logical fashion and be arranged so as to minimise inconvenience in the event of a fault.

Sub-distribution boards and final circuit distribution board's sizes shall be established using preliminary design information. The Contractor shall develop the design ensuring all boards finally selected provide 10% expansion in both spare outgoing ways and load capacity.

The precise rating of cables and associated cable support systems and their co-ordination with the building structure, other services and equipment shall be determined by the Contractor and indicated on the installation drawings.

Sub-main cabling shall be installed wherever practicable in a concealed manner within ceiling voids, floor voids and within riser shafts enclosures, the location of which shall be agreed with the Client so as not to compromise the aesthetics of the building.

Cables shall be supported on cable rack, cable tray or mono-point fixings as appropriate to the particular cables concerned.

Cable sizes, types and installation methods shall be determined by the Contractor. Prior to ordering or installing cables, the Electrical Contractor shall obtain the relevant final design criteria and carry out all necessary calculations to correctly size the cables.

Where cables and other electrical services pass through structural or fire-rated elements of the building, the apertures shall be effectively sealed to maintain the fire and smoke integrity rating. Fire seals shall allow easy access for the future installation of cables.

Cable calculations shall be based on the following general parameters:

- Ambient temperature of 30°C
- Cable grouped and touching
- Design current plus an additional 20% for future expansion
- Voltage drop shall comply with BS 7671, including 15% additional load capacity.

Cable support systems, including cable rack and cable tray, shall be sized to provide an additional 10% cabling space for future cabling installation.

Sub-main cables shall be XLPE/SWA/LSF in accordance BS 6724 and the General Specification.

Sub-distribution cables supplying life safety systems, emergency central battery units, fire detection and alarm panels and smoke evacuation systems shall be fire resistant LSOH armoured cables manufactured to BS 7629 and BS 8519 and BS 8491 as appropriate.

Cables shall be assigned a unique identity number corresponding to the source switchboard and outgoing way. Identity numbers shall correspond directly with general arrangement drawings, cable schedules and cable calculation sheets.

Cable identity markers shall be permanently marked black on yellow PVC sliding markers complete with black tags and cable ties. Identity markers shall be manufactured from low toxicity compounds with low flammability and smoke properties (LFHO).

Cable markers shall be fixed to cables at termination points, within 1m either side of wall/floor penetrations and at intermediate points at 15m intervals.

UPS System

The contractor shall design, supply, install and commission a UPS system that is in accordance with Approved Document B, London Plan, BS 9999 for Evacuation lifts, BS 9251 for Sprinkler Pumps and BS 9991 for Smoke Ventilation.

It shall be the contractor's responsibility to have the proposed system checked and reviewed with Building Control and the Fire Consultant.

The contractor shall engage a UPS specialist to provide a UPS system that allows back up supplies to operate for 1hour if power fails for the following:

- Sprinkler pump
- Evacuation lifts, if applicable
- Smoke ventilation, if applicable

The system shall consist of:

1. UPS
2. Battery Bank
3. Battery Isolator
4. DC cabling
5. Backfeed arresting unit – will be required if regen lifts are used.

The contractor shall provide automatic changeover switches of suitable rating for each system mentioned above. A separate distribution board shall be provided specifically for the UPS supplies. Each system shall have its own primary supply from the main panel board and a secondary supply another distribution board (DB/UPS) within the UPS room.

The secondary lift supplies need to be diverse from the primary, i.e., different fire compartments, to meet BS 9999.

5.3 Standby Generator Connection

The primary Low Voltage switchboard shall be provided with a manual changeover facility for the connection of a temporary standby lighting in the event of prolonged mains failure. The changeover device shall be arranged to prevent parallel connection with the mains utility supply. (See also 5.2)

The external generator connection point will be positioned in a discreet location to be agreed with the Client team to suit the landscape and indicative position of the temporary generator.

5.4 Final Circuit Distribution Boards

As a minimum the Contractor shall supply and install local area distribution boards to serve individual floor general lighting and small power services, kitchen power, laundry, external lighting and lift services. All HVAC plant services will be supplied by dedicated supplies.

Where not provided on the main switchboard, direct metering shall be provided to each distribution board in accordance with AD Part L2 of the Building regulations and CIBSE TM39, as a minimum.

Split boards may be provided where appropriate, c/w Pulse / Modbus metering for both lighting and small power elements.

Distribution boards shall be in accordance with BS EN60439-3, wall-mounted, metal-clad, IP3X (minimum) and equipped with incoming integral isolator and hinged lockable cover.

The Contractor shall ensure that all cable terminations are adequately sized to accommodate the cables selected for installation without modification to either cable or equipment.

All distribution boards shall be suitably sized to provide expansion of 10% spare load capacity and 10% outgoing ways.

Miniature circuit breakers shall be in accordance with BS EN 60898 and have a breaking capacity of M10 (10kA) subject to the full calculations and their results.

Arc fault detection devices (AFDD) conforming to BS EN 62606 shall be provided to every single-phase AC final circuits supplying socket outlets with a rated current not exceeding 32A as per the requirements of BS7671 18th edition amendment 2.

Circuit breaker characteristics shall be selected to suit the load characteristic being served.

Circuits supplying general-purpose socket outlets intended to be used for portable appliances, shall be protected using combined RCBO units in accordance with BS 7671 and BS EN 61009 and have a breaking capacity of M10 (10kA – subject to the final calculations being provided). It is preferred that RCBOs shall not occupy more than one conventional MCB way subject to space allowances.

Final circuits protected by RCBO units shall be designed such that the ZS value shall not exceed that required to ensure safe operation of the overcurrent element of the RCBO. The RCBO shall be used for additional protection only and earth fault loop impedance values shall not exceed the values denoted in Table 41.3 of BS 7671.

All unused ways shall be fitted with blank infill modules.

A typed A4 circuit schedule shall be provided, enclosed in a plastic wallet and fixed to the inside of the hinged door of each distribution board. Duplicate copies of the circuit schedule shall be provided in a separate section within the operation and maintenance manual (O&M).

Circuit charts shall incorporate information as required by BS 7671 and include the following information:

- Distribution board description
- Distribution board reference and number of ways
- Supply source reference
- Supply protective device type and rating
- Supply cable size
- Prospective maximum short circuit current (kA)
- Earth loop impedance value (Z_e)
- Final circuit reference
- MCB/Fuse type
- MCB/Fuse rating
- Cable size
- Cable type
- Circuit description

Circuit charts shall be produced and presented in a proprietary, computer-generated format, a disk copy of which shall be provided with the O&M manual.

Distribution boards shall be labelled to indicate distribution board function, distribution board identity number (DB Ref) and source of supply.

Labels shall be three-part laminate with black lettering on a white background.

Lettering shall have the following minimum dimensions:

Distribution board reference	10mm (min)
Distribution board function	6mm (min)
Distribution board source	6mm (min)

Labels shall be fixed to the distribution board with two self-tapping screws.

Details of all label inscriptions shall be submitted to the Client for approval prior to manufacture.

5.5 General Lighting Installation

The lighting installations throughout the building shall be designed and installed to conform to the requirements with respect of illuminance and limiting glare index, specified for the particular applications in the CIBSE Code of Interior Lighting. Lighting levels and colour temperatures shall be provided as specified on the Room Data Sheets.

Luminaires shall be LED-type throughout and as per the luminaire schedule unless agreed otherwise with the Employers Agent and Clients Building Services Engineer via samples and technical submittals.

The lighting design shall be undertaken in accordance with the performance specification, room data sheets and all applicable guides and standards where appropriate. The lighting installation throughout the building shall be in accordance with the following general principles:

- Within corridor and circulation areas the lighting shall be provided by ceiling mounted LED luminaires, with emergency lighting facilities where required. These luminaires shall be evenly spaced and provide the functional lighting to meet the illuminance as specified on the room data sheets.

Additional LED spots are required outside each bedroom door to supplement the larger functional luminaires along the centre of the corridor.

General lighting to corridor circulation areas shall be controlled via an automatic timer providing 2 levels of lighting, 100% and 50%, for night-time hours. The timer and manual override will be located at the nurse office on each floor. Additional switches shall control the memory box lighting, overdoor bedroom spots, occasional picture lighting and decorative lights, where provided. All switching regimes must provide lighting at an acceptable level of uniformity.

- The stair entry points and stair lobby areas will be controlled locally via PIR detectors.
- The lighting design to bedrooms and day spaces (i.e. lounges, activity rooms etc.) shall incorporate separate switching for the functional and decorative light fittings.
- Day spaces (including lounges, activity rooms and dining rooms) shall be manually switched from the point of entry into the room. Where there are 2 entries to the room, 2-way switching shall be incorporated. The decorative/feature lighting within these spaces shall be switched separately to the general/functional lighting. Absence control shall be incorporated within the general lighting installation and configured to provide manual on/off and auto off with a 45-minute overrun.

Where rooms of different lighting specification are combined to form a single space, the entire space shall be illuminated to the highest lux level specified (i.e. no change in lighting levels shall be permitted).

- The cinema shall have dimmable lighting control to vary the functional lighting level between off and 100%.
- The lighting in the spa bathrooms shall also be dimmable to allow for the adjustment of the functional lighting level between off and 100%.
- Coffered ceilings shall be provided with LED tape to the same colour temperature as the local functional luminaires, these should be independently switched for all other lighting.
- The lighting installation is of particular importance and appropriate consideration shall be given to the fact that visually impaired people will reside in the building. The design shall therefore ensure high uniformity levels are achieved throughout the building. Although lux levels shall be as defined in this specification and the RDS, attention is also drawn to the document 'Designing Lighting for People with Dementia' (published by the Dementia Services Development Centre of the University of Stirling in association with the Institution of Lighting Engineers) for all other aspects of dementia lighting design.
- Bedrooms shall be provided with downlighters to meet the specified lux levels around the operational area. Decorative luminaires may not be used to contribute to this lighting level. The operational area shall be provided with a lighting design with uniformity across the floor

of no less than 0.6. Light switches to all bedrooms shall be colour-contrasted by a minimum of 30 points in compliance with Approved Document M, utilising white switches on a grey background. The centre decorative pendant is to be switched from the door and the bed position, the recessed ceiling lights are also to be switched from the door and the bed position.

- Where no guidance to uniformity is provided in any of the CIBSE or other applicable guidelines, a design uniformity of no less than 0.6 shall be applied.
- All light switches shall be installed in metal boxes and in bedrooms they shall be of the large rocker type. Pull cord switches shall not be used for lighting control (these shall be used for nurse call systems only).
- In En-suites (excluding dementia) and shower areas lighting shall be controlled via a local switch outside the shower room.
- In en-suites and shower areas lighting shall be controlled by ceiling mounted PIR occupancy/movement detectors. These detectors shall have an overrun/time out range of minimum 2 to 15 minutes, which shall initially be set to 5 minutes.
- Drugs rooms, General Stores, Linen Stores, Cleaners Stores, Sluices and Hoist Stores shall be controlled by ceiling mounted PIR occupancy/movement detectors.
- Prior to any luminaires being ordered, the Contractor shall prepare a detailed data sheet / luminaire schedule for Client approval, indicating exact location for each type.
- Luminaires provided for Staircase lighting shall be positioned where they can be easily serviced.
- Lighting within offices shall comply fully with the recommendations of CIBSE Lighting Guide LG7, in particular maximum illuminance values (Cd/m^2), illuminance cut off angles, and relative ceiling/wall illuminance.
- Lighting to assisted toilets, assisted bathrooms, staircases and sluice rooms shall be controlled by ceiling mounted PIR occupancy/movement detectors. These detectors shall have an overrun/time out range of minimum 2 to 15 minutes, which shall initially be set to 2 minutes.
- All multi-gang switch plates shall have the rooms/areas served engraved for each switch.
- Allowance shall be made to provide lighting to the external maintenance shed (where provided).

A luminaire schedule has been produced as part of the contract documentation. This schedule is issued to demonstrate design intent in conjunction with the performance specification and room data sheets. These luminaires shall form the basis of the design, unless agreed otherwise with the Employers Agent and Clients Building Services Engineer. A detailed schedule to suit the actual building design shall be prepared by the scheme Designer detailing proposals at time of tender. All luminaires shall be submitted for approval, including samples where requested, and approved by the Employers Agent and Clients Building Services Engineer prior to procurement (note, this approval applies to intent and aesthetics only, and does not obviate the Designer/Contractor of any responsibility for the performance and suitability of the luminaires for the area and application intended).

Luminaires located in bath and shower rooms shall be suitably rated for the zone in which they are installed and have a fixed glass attachment.

Where decorative luminaires are utilised, they shall not be included in the lighting calculations to meet the performance levels specified. All decorative light fittings shall be separately switched from the general lighting. Location and style of all decorative luminaires shall be agreed with the Architect/Interior Designer. Decorative wall lighting shall also be switched separately to decorative ceiling lights.

Coordination of the decorative luminaires must be considered during the design process. The M&E Contractor shall propose suitable positions between the function lights considering all M&E services and the lighting uniformity in each room.

The Contractor's attention is drawn to the requirements of the Building Regulations Part L2A and any BREEAM pre-assessment relating to energy efficiency for lighting installations and associated lighting control. The requirements of this specification in relation to lighting switching shall be read in conjunction with the building Regulations and BREEAM requirements, and it shall be the Contractor's responsibility to ensure that the installation complies with the Building regulations, BREEAM pre-assessment and local Building Control Officer requirements. If this necessitates additional light switching/control, then this shall be provided as part of the contract.

The lighting installation shall be tested and commissioned in accordance with CIBSE Commissioning Code L.

The Contractor shall develop with the Architect solutions for any decorative/features within the reception area. These shall typically utilise LED luminaires but will be determined on a site-specific basis.

5.6 Emergency Lighting

A complete system of emergency lighting shall be provided to ensure all building escape routes, stairways, circulation spaces and routes away from the building to the agreed muster point, are illuminated in the event of a local lighting system failure.

Emergency lighting luminaires shall comprise of self-contained battery charging packs of 3-hour duration. Where practicable these shall be incorporated within the general service luminaires.

In instances where combined general service/escape luminaires cannot be used and self-contained units are proposed, these shall be a proven and attractive design with smooth lines and an absence of flanges or security bolts. The entire system shall conform to BS 5266, ICEL 1001 & 1006 (Emergency Lighting Design), CIBSE LG121 and local Authority requirements.

The Contractor shall be responsible for submitting the proposed scheme to the local statutory Authority for their written approval before commencement of the works.

Emergency lighting circuits shall be connected such that they operate on local sub circuit failure.

Testing facilities shall comprise locally positioned test switches in the form of a key operated switch units which shall be labelled. These shall be located adjacent to the serving distribution board, clearly marked / engraved.

The emergency lighting installation shall be fully tested, commissioned and certified in accordance with the recommendations of BS 5266. Emergency lighting shall specifically be

provided in sluice rooms, wheelchair stores and drug rooms, regardless of whether it is deemed required by BS 5266 or not.

NOTE. The Designer will need to agree the position of the first aid box, and all fire extinguishers to complete the design.

5.7 External Lighting

The building shall be provided with an external lighting installation incorporating the following items:

- Columns and bollard type luminaries shall illuminate all external paths, car parking areas, roadway and building exit points in accordance with the recommendations of CIBSE Lighting Guide LG6, BS 5489-1, BS EN 13201 and ILE Reduction of Obtrusive Light, and Local Planning Authority.
- Canopy mounted downlighters shall be provided at the main entrance where the construction allows.
- Bulkhead luminaries shall be mounted adjacent to all exit doors. These luminaries shall incorporate emergency facilities in accordance with the recommendations of BS 5266-1 & CIBSE LG12.
- External lighting complete with emergency facilities shall be provided to the fire alarm muster point and all designated escape routes thereto. Where these routes and or the muster points are remote from the building, the Contractor shall include for bollards to achieve the required illuminance in addition to the bulkheads referenced above.
- Allowance shall be made for the illumination of external signage to the front gate or drive entrance of the facility. A minimum provision of 2no power supplies should be provided by the Contractor.
- The Contractor shall also allocate suitable power supplies building mounted signage, specific details and the location(s) should be requested during the design stage.
- External lighting cabling shall be wired in XLPE/SWA or where within the building to be LSF. Cable ducts shall be provided when passing under roadway and car parking areas. Elsewhere, where the cabling is located in soft dig landscaping, a marker tape shall be installed covering the entire length of the buried cabling. All buried cabling shall be in accordance with the National Joint Utilities Guidance Notes (NJUG):2012 issue 6.
- The external lighting shall be controlled by a photocell/seven-day solar dial digital time switch with manual override positioned adjacent to the external lighting distribution board.
- The external lighting design shall comply with the appropriate standards for nursing homes, in particular CIBSE Lighting Guide LG9.

5.8 Small Power Installations

The small power installation shall be served from strategically located final circuit distribution boards, generally utilising 32A rated ring final circuits together with appropriately sized radial circuits where necessary.

The small power installation shall comply with the following items:

The quantity of general-purpose small power outlets shall be defined in the room data sheets.

The mounting heights for general purpose socket outlets shall be as follows, unless they are specifically shown on standard project drawings that shall take precedence:

- Above worktops (pantries, kitchens and laundries) 250mm.
- Corridors, staircases, common rooms, dining rooms – 450mm above finished floor level.
- The Contractor shall prepare a drawing illustrating mounting height of all electrical accessories for Client approval.
- All final locations to be co-ordinated with interior design and FF&E layouts.

The small power installation shall incorporate wheelchair charging facilities comprising 13A socket outlets, conforming to BS 1363, in locations to be agreed with the Client. These outlets shall be protected by RCBOs located in the local distribution board.

All small power socket outlets shall be protected by RCBOs conforming to BS EN 61009 located within the local distribution board.

Within kitchens, a flush switched fused neon indicator unit shall be installed in a position above the worktop controlling an un-switched socket outlet below the worktop for items of equipment such as refrigerators, dishwashers etc. Within the activity rooms or dementia kitchen / dining, isolation switches for cookers, dishwashers etc. will be located inside lockable cupboards not above the worktop.

Kitchens shall be installed in line with the IET “Electrician’s Guide to the Building Regulations” figure 5.2 indicating a minimum of 300mm from sinks and cookers, etc.

Laundry equipment power supplies shall be suitably rated to suit the particular appliances, each provided with a wall mounted local rotary isolator.

RCD / RCBO protection shall be provided in accordance with BS 7671.

Arc fault detection devices (AFDD) conforming to BS EN 62606 shall be provided to every single-phase AC final circuits supplying socket outlets with a rated current not exceeding 32A as per the requirements of BS7671 18th edition amendment 2.

For small power quantities refer to the room data sheets.

13A BS 1363 un-switched fused connection units shall be provided in every nurse office in a suitable position for the power supply to the fire alarm repeater panel(s).

Suitable power supplies shall be provided for all nurse call equipment as defined in section 5.14.

All rooms shall be provided with single and twin switched socket outlets in accordance with the room data sheets and the typical layout drawings.

2no. USB double sockets (with both type A & C) shall be provided to all bedrooms.

Appropriate power provision shall be provided within the communications room to suit the active equipment. A standalone UPS shall be provided to serve the communications and rack equipment, with provision for 2-hour backup in the event of power failure. The Contractor shall be responsible for liaison with the communications specialist to determine the exact project requirements.

Suitably protected and IP rated external sockets shall be provided in a minimum of 4No locations, affixed to the building façade. Reference shall be made to the external services layout

should this be available. Following no available drawing all positions should be agreed with the Client, patio areas being preferred.

Power supplies to door hold open and swing free devices as required. These shall be interfaced with the fire alarm (refer to section 5.10) and located above false ceilings or within store rooms, etc as agreed during the design development.

Cleaner's sockets (single) shall be provided along circulation / corridors and on stairs landing / half landing at a minimum of one socket per 10m.

Where fans are located in en-suites, local 3 pole isolation is required for maintenance purposes.

Socket positions and quantities shall be co-ordinated with the RDS, Architect's room layouts and Interior Designer's furniture layouts.

5.9 Electric Vehicle Charging

A minimum of 2no. twin outlet electric vehicle (EV) charging points shall be provided to allocated car parking bays, this quantity will be subject to the local planning authority and / or specific BREAAAM/ sustainable design requirements and the Electrical Contractor should seek clarification at the earliest opportunity. The EV charging points shall be robust, heavy duty, vandal resistant EV charging pedestal units specifically manufactured for exposed locations. The charging points shall be provided as 2no back-to-back charging points to cover 4no spaces/points. The EV charging points shall be managed by the home by means of fobs/RFID cards purchased at reception, this avoids use from the general public with no affiliation to the home. The management software shall be installed on the reception PC, if required. The Contractor will provide a technical submission for this equipment.

The contractor shall design and install the EV charge points as a minimum compliant to BS 61851 Parts 1, 21 and 22 in accordance with BS 7671 and all current amendments and associated guidance IET guidance documents. Should any inherent planning policies require additional chargers then the contractor shall design the installation to suit.

The EV point shall be an Autocharge EV as manufactured by Rolec, or equal and approved.

The charger shall be installed in a location agreed during the design stage with the client team and set back an adequate distance from the car parking spaces to mitigate risk of damage, ensuring there is no risk of cable strain or trip hazards.

Protection barriers shall be positioned in such a manner to allow full access and opening of any doors or covers that are part of the charging equipment for inspection, testing and maintenance.

The EV charger shall be fed locally from a distribution board within the home on a dedicated circuit via suitably sized underground duct(s).

The contractor shall ensure that selectivity of protective devices shall be coordinated to ensure discrimination between supply circuit over current protective device and protective devices within the EV charger is achieved.

The EV charger shall incorporate the following features:

- 2x IEC 62196 (Type 2) sockets
- 7.2kW rated output

- Input voltage of 230v AC/50Hz
- 2x Built in 30mA Type A RCBO & 6mA DC Sensitive device
- Built in class 1 MID compliant metering
- GPRS Communication
- Load management
- Protection barriers
- High gain GPRS signal antenna, if required to meet signal strength
- Fob/RFID control

The EV charger shall be installed and tested in accordance with the IET Code of Practice for Electric Vehicle Charging Equipment Installation, manufacturers recommendations and BS 7671 prior to handover, for the client then to take over the OCPP compliant management and set the installation to work.

5.10 Data and Telecommunications Facilities

A dedicated communications room shall be provided in the care home, suitably sized to accommodate a minimum of 1no 42U cabinet and UPS plus sufficient space for a 40U cabinet for the nurse call equipment – size to be confirmed with nurse call specialist. This room shall accommodate the rack mounted communications equipment and associated ancillaries which will be provided by others. Equipment shall be located such that appropriate clearance is provided for access (minimum 1m clear on 3 sides or each rack). The contractor shall liaise with the architect to determine an appropriate location for the room, which shall generally be located centrally within the facility. The contractor shall ensure that cable lengths do not exceed 90 metres.

The contractor shall employ GHM Communications Ltd. to design, supply, deliver, install, test and commission the voice and Wi-Fi active equipment.

The contractor shall provide data cabling systems in accordance with the Employer's Requirements and current legislation. The contractor shall ensure that all cables are tested and terminated in a way such that GHM can install the telephone system and any active equipment required to provide a fully functional system at handover.

A telephone and data system shall be incorporated into the scheme in accordance with the Client's requirements, tender drawings and room data sheets. The communications systems shall be the Ericsson LG iPECS telephone system, which shall be supplied, installed and commissioned by GHM Communications Ltd. The solution shall include:

Connectivity for SIP trunks (min. Nr 6) for incoming & outgoing voice calls (with PSTN back up)

- 100 x SIP DDI range (direct dial numbers for incoming calls to staff and resident phones)
- Free calls to UK landline and UK mobile telephone numbers
- IP phones for key staff offices (Reception, Manager, Admin, Nurse Station, Care Office, HAA)
- Basic analogue phones for kitchen, chef office, laundry, hair salon, staff room
- Smartphones (Nr 3 per nurse station plus Maintenance) to provide staff mobility, enabled for:

- Internal and external voice calls via the phone system (using the wireless network for connectivity)
- Notification of nurse call alerts via a smartphone app
- 12 months MDM (or Lock Down Software) included to manage/lock settings and ensure Client approved apps are only active on the smartphones.
- Provision for each resident bedroom to have an analogue phone socket, with a virtual SIP DDI providing a direct telephone number.
- GHM Care WiFi solution is designed around 5Ghz radio to provide internal coverage for both voice & data, via ceiling/wall mounted access points and online management. Primary coverage will be aimed to achieve a SNR -67dB, with secondary coverage aimed at -72dB.
- GHM will generate 'heatmaps' from DWG floor plans, to calculate the quantity and location for WiFi access points to meet the above criteria. As with any desktop survey the actual coverage will require a post installation 'validation' survey which may result in extra access points (at additional charge), therefore spare CAT6 cables should be pulled and left coiled above the ceiling (locations to be agreed).
- Data Switches are included to provide WiFi Access Points data & power.
- GHM's in house Nexus Messaging solution (Nr 1) included to present real time nurse call alert information to the smartphones (enabling staff acceptance visibility and alert history).
- Battery Back Up (Nr 1) rack mounted to provide 120 mins cover.
- Telephone Lines and SIP services to be supplied by GHM (via two contracts: install fees under the Main Contractor and recurring fees with the Client).
- PSTN telephone lines for Lifts (Nr 1 per lift), Fax, Alarm and SIP Broadband to be supplied by GHM.
- SIP Trunk and DDI service to be supplied by GHM.
- Data connectivity (FTTP were available) to be supplied by the Clients IT consultant (The IT Cloud).
- 1 Year maintenance contract for phone system, Wifi and Nexus starts from system installation date (Mon-Fri 9.00 to 17.30).

The system shall generally comprise of a fully integrated Cat6 installation throughout the building consisting of a main server cabinet and voice and data outlets throughout. The Specialist Installer shall liaise with the Architect at an early stage to ensure an adequately sized Comms room is incorporated centrally into the scheme to minimise cable runs in accordance with legislative guidance. The room shall be sized to accommodate all Openreach incoming services wiring and equipment, the wiring cabinet, I.T. infrastructure wiring and containment. Additionally, the room and/or cabinet shall house other monitoring equipment (i.e. CCTV/security). Advice should be sought at time of tender to ascertain the size and positioning of this equipment. The Specialist Installer shall be responsible for liaising directly with Openreach ensuring an adequately sized service is installed to each site inclusive of underground ducting and access chambers, carried out in accordance with the main contractor's programme of works.

The Specialist Installer shall include for the installation, cabling, outlets, hubs, switches, patch cabinet, patch panels, patch leads, terminations and final connections to form complete fully operational systems as follows:

- Cat 6 installation
- Telephone system (provided by GHM)

All Cat 6/Fibre cables intended for use as dedicated Openreach services shall be terminated in a manner acceptable for Openreach to adopt.

The contractor must make early enquiries with Openreach and agree the method required.

The contractor shall ensure all third-party requirements have been incorporated inclusive of provision of containment in accordance with the works and the associated tender documentation offering a continuous and complete infrastructure and fully functional system.

5.10.1 Cabling Specification

General

All necessary enabling cable outlet locations shall utilise RJ45 type outlets connected to category 6 cabling. The data outlets shall be located as required to ensure full access to the data access throughout the facility. The exact quantity shall be subject to a site survey to be conducted by the selected Sub-Contractor, generally in accordance with the room data sheets.

The installation shall be complete with all associated accessories, including faceplates, pattress boxes, all necessary containment, patch panels and communications cabinets. Accessories such as faceplates and socket modules are to be of the same design and specification throughout the installation to match the general electrical outlet accessories, in a finish to be agreed by the Client and Architect.

The Category 6 cabling and associated termination must conform to EIA/TIA 568B.2 category 6 and ISO 11801 Class B. The installation must be tested in accordance with the requirements of ISO 11801 and TSB40-A for class D links. Test results must be recorded, documented and included within the site documentation pack and Operation and Maintenance manuals.

All cabling shall be EuroClass Cca rated as a minimum as required by BS 6701.

Acceptance of the installation will be dependent on satisfactory test results: the Contractor will be entirely responsible for rectifying and aspects of the installation that do not meet the above standards.

All wall, floor and patch panel outlets are to be clearly labelled and marked on site plans also to be included within the site documentation pack. Acceptance of the installation will also be dependent on the supply of the site documentation pack.

Termination

All wall and floor outlets are to be terminated to present RJ-45 sockets as required.

All wall outlets are to be at skirting level unless otherwise indicated on the room data sheets or relevant room elevation drawings. Where outlets are within floor boxes, the Contractor shall ensure that the boxes supplied and fitted shall provide sufficient clearance to accommodate RJ45 converters within them. All RJ45 outlets must be co-located with at least one double, switched 13A electrical outlet.

Any outlets intended to feed ceiling mounted Wi-Fi points shall be left below the ceiling at high level, terminated with an RJ45 end. Backboxes/data points are not required to facilitate the Wi-Fi installation.

All Category 6 cabling is to be terminated on Category 6 patch panels located within appropriate cabinets.

Fibre Optic Cabling

Where the new build requires multiple cabinets to accommodate the Category 6 infrastructure due to its size, fibre optic cabling will also be required to be supplied, installed and terminated by the Contractor. This must be SC duplex, multi-mode, 4 core fibre optic cabling and must be terminated on suitable patch panels to be supplied and installed by the Contractor within each cabinet at each end of each link.

All fibre optic cabling is to be tested end to end to appropriate standards. Results should be documented and supplied.

In addition, the Contractor is to supply and install suitable fibre optic to UTP Cat6 media converters and fibre patch cords at both ends of each link. The media converters must run at 100Mbps and match existing where appropriate. The precise type (make/model) of media converters to be used will be specified by the Contractor in advance and issued for approval.

Dedicated Lines

Dedicated lines shall be provided to emergency systems such as the lifts and the fire alarm systems to provide a failsafe in the event of a power outage. These can be via GSM subject to specialist requirements.

Cabinets

The Contractor shall supply and install suitable cabinets to accommodate category 5e patch panels and associated equipment. The precise number, location and size of cabinets will vary from new build to new build, but where floor standing cabinets are required, they must be standard 42U (minimum), 19 inch units. These cabinets should be of a minimum size of 800mm x 1200mm and include:

- Lockable steel rear door
- Lockable glass front door
- Earth bond kit suitably connected
- Vertical cable management
- Horizontal cable management strips every 48 patch panel outlets, with additional strips at the top and base of the patch panel.
- 10-way vertical power rail providing spike and surge protection connected to a 13A electrical outlet via a standard 3 pin plug
- Adjustable pedestal feet
- Roof fans
- 20% spare capacity

Details of the internal layout within the cabinets shall be issued for approval.

Reference shall also be made to the nurse call section of this specification for typical cabinet requirements.

5.11 Fire Detection and Alarm System

The Contractor shall design supply install test and commission and set to work a multi loop analogue addressable Fire Detection and Alarm system in accordance with BS 5839- 1, BS EN 54–2 and in accordance with the local Building Control Authorities requirements.

The Fire Alarm Contractor shall be LS1013 and BAFE certified.

The system software shall be supplied on an “open protocol” basis to facilitate future independent reprogramming and system adjustment.

The Fire Detection and alarm system shall be designed and installed in strict accordance with BS 5839 to category L1/M standard unless directed otherwise by the Fire Engineer / Building Control.

The system shall comprise automatic smoke and heat detectors, resettable plate call points, electronic sounders and remote indicator units (remote indicator units shall be provided for all automatic detectors located in plant rooms, risers, lift shafts, storerooms, cleaners rooms etc.). The sounders may be incorporated within automatic detector bases. Loop powered sounders may be utilised.

Manual call points shall be provided with slim Perspex covers.

Sounders shall be avoided within the bedrooms and en-suite bathrooms. Sounders shall generally be located within the corridors to provide suitable coverage and adequate alarm levels to allow a managed evacuation by staff.

Anti-vandal/anti-tamper break glass units shall be utilised throughout.

Under BS 5839-1 for care homes there is a requirement to ensure that the detection equipment has a connection to a central monitoring point / Alarm Receiving Centre (ARC) included within the scheme – i.e. Continuously manned premises, remote from those in which the fire detection and fire alarm system is fitted, where the information concerning the state of the fire alarm system is displayed and/or recorded, so that the fire and rescue service can be summoned. The fire alarm Contractor shall ensure that there are suitable arrangements for summoning the fire and rescue service when the fire detection and fire alarm system operates. The arrangements should be such as to minimize the risk to any person responsible for summoning the fire and rescue service. Systems that automatically transmit a pre-recorded message direct to the fire and rescue service, via the public emergency call system, should not be used.

The main indicating and control panel shall be located in the ground floor entrance lobby or reception area in a location to be agreed with the Building Control Officer. Repeater panels shall be located at each nurse office. The battery back-up system will be provided in accordance with BS 5839 to maintain the system in standby mode for 24 hours, followed by a 30-minute full duty cycle. The charger unit incorporates fault sensing circuits, and full status indication.

EN 54 VAD's shall be provided in areas of high ambient noise level, i.e. plant rooms, laundries etc, the precise location of all flashing beacons shall be discussed and agreed with the Employers Agent and Clients Building Services Engineer prior to installation.

A system zone indication diagram or Zone Plan shall be provided for all floor levels of the building, mounted adjacent to the main fire alarm panel and adjacent repeater panels at each nurse station. This shall illustrate the zones in a colour coded format with alpha numeric descriptions matching those of the analogue addressable control panel and be mounted in a suitable frame with glass cover.

A fire alarm cause and effect schedule and escape strategy needs to be produced to ensure the correct protocols adopted during the managed evacuation.

The main indicating and control panel will be supplied using a suitable fire rated cable of 'standard' specification as detailed in BS 5839- 1, BS 7629 and BS 7846.

The fire detection and alarm system shall provide individual addressing of all fire detection devices together incorporating the sounders, each with full fault monitoring facilities. The system shall allow to incorporate additional beacons and sounders to be added at a future date without the need to increase the standby battery capacity.

Indication of fire and or fault zone alarms shall be by means of LED contained within the fascia of the control panel. The control panel shall also feature an LCD alphanumeric display which should give indication of the first and last devices operating under alarm or fault conditions.

The control panel shall incorporate an alphanumeric keypad which shall provide operation of the alarm system control facilities and allow interrogation of the system's status through coded access.

The Main Control and Indicating Equipment shall be provided with the following system facilities initiated via coded inputs via the function keypad:

- Alarm Accept.
- Alarm reset.
- Alarm sound/alert
- Alarm sound/evacuate
- Isolate remote transmission
- Lamp test

The control panel shall incorporate LED indication for the following system functions:

- Mains supply failure
- Mains supply healthy
- DC Supply failure
- Remote transmission isolated.

The control panel shall be capable of initiating shutdown of mechanical plant installations and provide separate interface signals to the lift installations and mechanical control panels (NOTE. This should be capable of being disabled during routine fire alarm testing).

The control panel shall have the capability of disabling the interface signals to the mechanical plant, lift etc. for use when carrying out routine fire alarm system testing. After initial commencement of tests, the panel shall be configured to allow the system to be muted but allow the completion of the weekly fire alarm tests.

Fire alarm panels shall be recessed in the main entrance lobby.

The fire alarm equipment shall be designed to provide facility for programming each addressable device with an identification code from the control panel and shall allow for the removal of any device ensuring that the remainder of the system is not compromised.

The fire alarm control panel shall be configured so that upon total power failure an automatic re-boot routine can be initiated in order to re-establish the system in its original operational configuration.

The control panel shall be provided with an integral paper printer for recording all events in hard copy format. Electronic memory event logging shall also be provided.

All cabling shall be either FP (zone wiring) or FP Plus (Supply & critical signal path wiring) Red LSF over sheath to BS 7629. Wiring systems shall be concealed with Cable runs confined to ceiling voids on cable tray or cable basket tray within main circulation routes where possible. Surface installations will be permitted in plant areas only or areas not generally accessible to the public.

Short circuit isolators shall be provided where loop detection circuits pass between defined fire compartments.

Cables shall be installed in accordance with the manufacturer's recommendations and multiple runs of cable shall utilize a dedicated cable basket or existing tray work for horizontal and vertical distribution.

All cable sheaths, shrouds, clips and saddles shall be manufactured from fire resistant low smoke zero halogen materials, coloured red.

New cables shall be routed using primary service corridors and plant service routes. Cable routes within ceiling voids shall be confined to areas within voids that are readily accessible.

Where possible, all circuit cabling shall be concealed within the building fabric or within accessible ceiling voids. Installations shall be flush, or surface as dictated by architectural finishes.

The Contractor shall provide magnetic door holding devices c/w relevant release switches to all non-secured corridor fire doors and day room entrance doors such that they are held open during normal operating conditions. Bedroom and day space doors shall be provided with free swing door hold devices as detailed in the room data sheets. The Contractor shall provide all necessary power supplies and door holding devices and fire alarm system interfaces. Upon activation of the fire alarm system all doors will close automatically.

The fire door magnetic contact circuit shall incorporate a seven-day digital time switch (generally located adjacent the local distribution board) which shall operate such that the fire doors will automatically close during night-time hours and then be reactivated each morning. The precise time settings shall be agreed with the Client.

The Contractor shall test and commission the system in complete compliance with BS 5839.

5.12 Lightning Protection System

A lightning protection system shall be designed and installed in accordance with BS EN 62305 and BS 7430.

The system shall generally comprise roof-mounted air termination networks, down conductors, test points and earth terminations.

The Contractor shall conduct a lightning protection risk assessment calculation for presentation to the Client in accordance with BS 62305 and survey the site to determine the precise extent of all necessary bonding.

The system shall be concealed wherever possible, with conductors located beneath roof finishes and dropping behind rainwater pipes wherever possible. Conductors above the roof finish shall not be utilized unless prior agreement is obtained from the Employers Agent and the Clients Building Services Engineer. The structural frame of the buildings shall be utilised to the fullest extent possible, subject to earth continuity tests. The Contractor shall provide a system that accords with the relevant standards and also remain in character with the style of the building.

Down tapes and conductors shall be colour matched to the surface to which they are attached. Aluminium down tapes may be used subject to agreement, however all installation works below ground level shall be copper.

Prior to commencing works, the Contractor shall carry out soil resistivity tests to establish the effectiveness of earth electrodes.

All extraneous fixed metalwork at roof level, such as handrails, flues, fans, soil stacks, guttering, down pipes, mechanical plant, pipe work, etc., shall be bonded in accordance with BS EN 62305

Electrical continuity of metal rainwater guttering, down pipes and drains shall be the responsibility of the main building Contractor. The Lightning protection Contractor shall direct and advise the main building Contractor on this aspect of the works.

Each down conductor shall terminate approximately 500mm above finished ground level from which a suitable length of 25 x 3 mm PVC-sheathed copper will run direct to a 2.4m long high-tensile steel copper clad earth electrode housed within a GRP inspection unit. Concrete inspection pits shall be used in vehicle roadways.

Prior to driving earth rods, inspection and testing shall be carried out in order to avoid damage to existing buried services. In instances where the risk to existing services cannot be safely established, earth mats shall be installed comprising 600mm x 600mm plain copper plates buried 600mm below finished ground with a partial backfill of bentonite. Original excavation, final backfill, and reinstatement shall be by the Main Building Contractor.

Upon completion of the works the total system shall be fully tested in accordance with BS 62305. All test results and certificates shall be issued at practical completion and provided within the maintenance manual. All testing shall be carried out by the Specialist Contractor.

5.13 Mechanical Services Electrical Provisions

The Electrical Contractor shall provide and install power supplies for all mechanical plant and equipment.

The Contractors shall liaise directly with the mechanical services and controls Contractor and develop the Tender design to determine final positions, loads, and termination arrangements and load characteristics for all associated power services.

All field wiring from control panels, including power and control wiring shall be the responsibility of the Mechanical Services Contractor.

Electrical services cable containment and support systems associated with the field wiring mentioned above shall be designed, supplied and installed by the Mechanical Services Contractor.

5.14 TV Aerial System

The building shall be provided with a TV aerial distribution system in accordance with BS 6259 and the following requirements:

- The TV Aerial system shall be installed by a Specialist Contractor, incorporating a central aerial, the location of which shall be agreed with the Client following site reception tests and where appropriate the Planning authorities.
- The system shall incorporate a central amplifier and splitter unit to ensure that the signal strength at all outlets is suitable for good TV picture and sound quality.
- The distribution cabling used within the TV aerial system shall be of an appropriate attenuation and impedance to suit the particular application.
- The TV aerial system shall provide Sky Q, terrestrial, free view and radio broadcasts throughout the facility.
- The head end equipment such as the aerial and multiplexers shall be compatible for Sky Q services.
- All day spaces shall capable of Sky Q services. The system shall be a digital integrated multiplex system complete with all hardware including dish required to provide a fully functioning system as required.
- As detailed in the RDS data points shall be provide behind all TV positions to allow for full Sky Q services, streaming, recording etc.
- All TV aerial outlets shall be of the flush mounted co-axial types, with combined radio outlets.
- Upon completion a testing and commissioning certificate shall be provided by the TV aerial specialist.
- Refer to the room data sheets for the TV allowances and quantities.

5.15 Nurse Call System

The contractor shall provide a CLB nurse call system to meet or exceed CQC requirements. There shall be a single system to provide resident call facilities, to monitor external doors (and drugs cabinets) and to provide night-bell indication. This is a non-speech, point-of-call reset system with progressive call levels and staff presence indication at multiple displays. The system is programmed for 'cause and effect' and should therefore be client operational input at the commissioning stage with regard to call levels, call direction, sounder volume, call grouping etc.

A nurse call system manufactured by CLB shall be installed to cover all areas of the property. The system includes acoustic monitoring and CCTV cameras to provide an added level of care.

The system shall be delivered through Adaptive IT Solutions with the first fix being supplied and installed by the electrical contractor, and second fix supply and installation of all hardware and accessories by Adaptive IT.

The nurse call system is IP based and utilises wired and wireless technology to deliver multi-level call and response with priority call handling via a software based solution.

The contractor shall allow for coordination between Adaptive IT solutions and GHM Communications for the networking of systems, installation of apps on devices etc where required.

Staff are able respond to calls from nurse call displays or via an app installed onto mobile handsets.

Residents can call for assistance from wall mounted call modules, ceiling or wall mounted pull cords, pear push buttons units connected to the bedhead, or via wireless resident pendants.

Call point modules are to be installed to communal areas and all resident accessible rooms, such as dining rooms, hairdressers and activity rooms.

Pull cords shall be installed to all ensuite bathrooms and assisted toilets, with two installed to each assisted bathroom.

Door monitoring is by means of door contacts linked to local call modules or bedhead call modules in the case of ground floor bedroom doors. Staff can disable the contacts by scanning the local call module.

Drug room monitoring is by similar means and links to an overdoor light to alert when the door is opened, staff can isolate the contact by scanning the call module.

The system typically comprises the following field devices:

Equipment	Image	Description	Location	Cable Link
Nurse Call Display Module ProDVX		- To be presented in 1 x Attema back box. Height and position to be agreed. Attema boxes free issued from Adaptive IT - Cat5e Data Cables should be terminated into patch panel at cabinet end and presented in Attema back box at each location - The Cables should be left sticking out of the box with approx. 200mm of cable and terminated onto a Cat5e Module to allow the cable to be tested. - Module can be removed after cable is tested as Adaptive IT fit a Phoenix Contacts connector on to the cable as part of their install.	Nurse Stations and Manager Office	Cat 5e to cabinet
Nurse Call Module C2610		- To be presented in 1 x Attema back box. Height and position to be agreed. Attema boxes free issued from Adaptive IT - Cat5e Data Cables should be terminated into patch panel at cabinet end and presented in Attema back box at each location - The Cables should be left sticking out of the box with approx. 200mm of cable and	Assisted toilets & bathrooms, communal areas, exits (coupled with door contacts)	Cat 5e to cabinet or daisy chain link depending upon location

		terminated onto a Cat5e Module to allow the cable to be tested. • Module can be removed after cable is tested as Adaptive IT fit a Phoenix Contacts connector on to the cable as part of their install.		
Nurse Call & Acoustic Module C1600		• Positioned at the resident bedside. Height and position to be agreed. • Cat5e Data Cables should be terminated into patch panel at cabinet end and presented in Attema back box at each location. • The Cables should be left sticking out of the box with approx. 200mm of cable and terminated onto a Cat5e Module to allow the cable to be tested. • Module can be removed after cable is tested as Adaptive IT fit a Phoenix Contacts connector on to the cable as part of their install. Nurse Call / Acoustic Monitoring Combined units requires 2 x Attema boxes to be fitted side by side.	Bedrooms	Cat 5e to cabinet
Pull Cord Module 2500		• Cat5e I/O link to peripherals such as pull cords or Door Contacts • These should be a 3rd colour, and should be clearly labelled at both ends, this is for easy identification. • Pull Cords Should be presented into Attema back boxes and to position of pull cord	Ensuite bathrooms, assisted toilets and bathrooms	Daisy chain link
Pear Push Call Button (Type per project)		The P2480/P2680 CLB Handset is a multifunctional device which features nurse call buttons, lights / blinds controls and a torch. These handsets connect to a C240x 4xRJ Module or a C1600 / C2600 Double AM / NC Module. The P2880 Handset allows care receivers to talk with care providers via a high-quality audio connection, e.g. after making a service call. Moreover, TV controls can be added to complete the set of features. The P2880 handset connects to a CLB C2800 Bed Head Module	Bedrooms	Link to bedhead module

Door Contact SC517		• Cat5e I/O link to peripherals such as pull cords or door contacts • These should be a 3rd colour, and should be clearly labelled at both ends, this is for easy identification. • Door contacts should be presented into Attema back boxes and sticking out of the door frame in the location that the contact is to be fitted.	Exit doors and drug cupboards	I/O link
Wireless Receiver Module C5100		• Daisy chain Cat5e link cables. These should be a different colour to the cables going back to the network for ease of identification. • Each cable should be labelled at both ends to allow easy identification. • The cables should be presented in the Attema back box. • The Cables should be left sticking out of the box with approx. 200mm of cable and terminated onto a Cat5e Module to allow the cable to be tested. • Module can be removed after cable is tested as Adaptive IT fit a Phoenix Contacts connector on to the cable as part of their install.	Corridors – number to suit layout.	Daisy chain link
Mini Dome Camera Avigilon H4		• Cat5e Data Cables should be terminated into patch panel at cabinet end and presented in the ceiling in a back box at each location. • The Cables should be left sticking out of the box with approx. 200mm of cable and terminated onto a Cat5e Module to allow the cable to be tested. • Module can be removed after cable is tested as Adaptive IT fit a Phoenix Contacts connector on to the cable as part of their install.	Bedrooms (Ceiling mounted opposite bed)	Cat 5e to cabinet
Attema Back Boxes		Nurse Call / Acoustic Monitoring Combined units requires 2 x Attema boxes to be fitted Side by Side. They need to be fitted into 76mm Holes, with 71mm centres for the two holes. Attema boxes free issued from Adaptive IT	All accessories	N/A

Other device options are wireless bed mat sensors and wireless wheelchair sensors that can alert if residents get out of bed or wheelchair when staff are not present.

First fix works are to include Cat 5e cabling to all IP connected accessories from the comms room data cabinet and termination of cabling into the required number of patch panels. At the

field end the cables are to be terminated into RJ45 modules to allow for testing. The contractor is to allow at least 200mm of cable from the back box to the module. All cabling is to be tested and results issued prior to hardware installation by Adaptive IT.

Back boxes shall be Attema hollow wall boxes supplied by Adaptive IT.

Within the comms room the hardware will require approximately 40U of space within an 800mm x 800mm data cabinet (or 800x1000 – the exact requirement is to be agreed with Adaptive IT). All Cat 5e cabling is to terminate into patch panels within this cabinet, with the cables to cameras terminating into separate patch panels to the call system cables. All cables shall be clearly identified as to their locations and whether they are call system or camera cables.

Typically the cabinet requirements will be the same as set out within the data section of this specification, as follows:

- Lockable steel rear door
- Lockable glass front door
- Earth bond kit suitably connected
- Vertical cable management
- Horizontal cable management strips every 48 patch panel outlets, with additional strips at the top and base of the patch panel.
- 10-way vertical power rail providing spike and surge protection connected to a 13A electrical outlet via a standard 3 pin plug
- Adjustable pedestal feet
- Roof fans
- 20% spare capacity

All cabling shall be Cat 5e with cabling between accessories and data cabinet of one colour, daisy chain links shall be of a second colour and I/O links to peripherals such as door contacts and pull cords shall be of a third colour. The layout of the comms cabinet shall be proposed and agreed with Adaptive IT.

All cabling shall be EuroClass Cca rated as a minimum as required by BS 6701.

The Cat 5e CAN BUS is not to exceed 90m in length, including daisy chained and I/O links, from the data cabinet.

The contractor shall determine the precise requirements of the system and provide proposal drawings for comment showing locations of all nurse call equipment and interlink cabling.

All hardware, software and licenses are supplied, installed and commissioned by Adaptive IT and typically includes the following items:

- Accessory items listed in the previous table
- Operator PC (including software)
- Comms Cabinet (800x800x 40U – exact requirement is to be agreed with Adaptive IT)
- Server UPS
- Server and CLB software
- PoE switches
- Handsets (including mobile app and management software)
- Wireless resident pendants
- Wireless overlay (to allow use of wireless peripheral devices)

- Wireless zoning license
- Room IP cameras (including PoE switches)
- Wireless sensors (for beds and wheelchairs)
- NFC sensor (improves audit trail of respondents to call alerts)

The nurse call system shall be fully tested and commissioned by Adaptive IT and certificates retained for inclusion into the O&M manual. Full training shall be provided to care staff by the specialist with records of attendees maintained for reference.

For information and to obtain a quotation contact:

Mr Jonathan White
Adaptive IT Solutions
Unit 8 Cirrus Park
Moulton Park Industrial Estate
Northampton
NN3 6UR

5.16 Access Control

The Contractor shall provide an access-controlled door entry system to BS EN 50133 and Secured By Design.

The access control system shall incorporate the following features:

- The door entrance system shall provide audio visual communication between the external call unit at the main entrance to the reception desk, admin office and the nurse offices on each level. The system shall enable visitors to make a call, however if the call goes unanswered it will be relayed progressively over the nurse call system to warn staff of a visitor at the primary entrance door. The primary entrance door shall be released via manual activation of an appropriate device positioned on the reception desk. The system shall also provide audio visual indication in each of the nursing offices and admin office but must not include the function to release the door from the nurses' station.
- The video intercom unit at the main entrance shall be linked to call staff on an escalating pattern as follows:
 - Reception desk (Video Intercom handset)
 - Admin Office (Video Intercom handset)
 - Managers Office (Video Intercom handset)
 - Nurse Offices (Video Intercom handset)
- The external staff/delivery door for the kitchen/laundry shall be provided with keypad access control
- A video Intercom unit shall be provided externally by the delivery entrance. The video intercom shall be linked to call staff on an escalating pattern as follows:
 - Kitchen (Video Intercom handset)
 - Reception desk (Video Intercom handset)

- Push to exit release buttons and green breakglass units shall be provided as necessary to suit the Building Regulations, general principles will be detailed on tender access control drawings.
- Internal doors entering or exiting the dementia wing will be secured via Keypads and maglocks . These controls shall be disabled in the event of fire alarm activation. Green break glass units shall also be provided at high level (1800mm AFFL) for emergency escape in a non-fire scenario. Maglocks shall be of the recessed type and rebated into the door frames.
- Digital keypad control shall be provided in lifts with access to the dementia wing, car park and staff areas.
- Where external vehicle gates are provided a video intercom as above, plus keypad entry/keypad exit shall be proposed. The video intercom will connect to the Reception and then escalate to the admin office and nurse's offices. It shall be possible to release the gates from the reception video intercom.
- A mechanical flush mounted push-button keypad lock shall be provided to sluice rooms, cleaners cupboards, hoist stores, housekeeping and clinical rooms thus covered within the building specification.

5.17 Closed Circuit Television (CCTV) System

The contractor is to provide and install a fully functioning CCTV system capable of monitoring each external facade, main entrance, delivery entrance and car park along with the entrance lobby internally. The system will consist of colour CCTV fixed dome cameras to the building, and internal areas where specified. The CCTV cameras shall be connected back to a multiplexer, time lapse digital video recorder (DVR) and controller located within the Comms room rack. The system shall be monitored on one wall mounted 24" colour monitor located in the Comms room with a secondary 24" monitor located in the admin office.

The following areas shall be covered as a minimum:-

- Building entrance (facing the exterior doors/lobby);
- Delivery entrance
- Reception;
- Complete building perimeter.

The CCTV system as a whole shall be able to provide images for use as evidence. CCTV cameras will be located such that they aid identification of individuals and the images and the way in which they are managed by the CCTV system shall be of "evidence quality"

The system shall be able to provide images at night in low levels of light (2 lux) in the event of failure of some or all of the external lighting.

The data of the CCTV system will comply with NSI-NACOSS

It is the responsibility of the contractor tendering to select the most appropriate equipment to fulfil the objectives and requirements of the system.

The CCTV system will be operated in a passive manner i.e. recording video images in the background. Actively controlling the CCTV cameras is not proposed: therefore telemetry controls are not required.

All cameras incorporated within the system are to be wired with 2 No (Cat5e) cables at each location and connected to a central switching matrix. The matrix shall be of modular design, and high ended functionality and offers high levels of flexibility and performance. Features shall include macro control, recorder control, a choice of keyboards, a complete offering of programmable functions.

The matrix system configuration software shall be user-friendly MS Windows application that permits the administrator to programme the matrix either on site or remotely via /IP Ethernet or RS-232. Use it to remotely check the system status of cameras, and monitors via the Ethernet connection or backup and restore both system data. The system is to be capable of an IP connection that can be configured on the admin office PC for remote connection and operation.

All cameras proposed shall have a minimum specification of the following:

- Colour/Mono high resolution dome camera 540 TVL colour/580 TVL mono
- 24" flat panel colour monitor (wall mounted) offering 1920x1080 resolutions
- All camera housings to be of the vandal resistant type fitted in discrete smoked domes
- All external CCTV cameras shall be provided with integral heaters and with the capability of recording good quality images at low lux levels
- All camera housing colours shall be sympathetic of the building façade finish, i.e. grey cladding = black camera etc.

The digital recording solution shall consist of digital video recorders (DVRs) Features to

Include:

- 30 day storage
- Real time recording
- Intuitive user interface
- Remote client monitoring
- Powerful search & export for ease of searching data by time, date etc
- Respond to events with alarm triggered dome positioning
- Record higher frame rates per second for certain cameras and assign the remainder to less critical cameras.
- Easily export video, audio and text to CD-RW or DVD+RW with one click of the mouse.
- Networked operation.

The electrical contractor will be responsible for supply and installation of any local power supply units.

5.18 Staff Clocking In System

To be confirmed by the client / operator during detailed design.

Allowance for 1no RJ45 outlet and 1No 13A single socket outlet shall be positioned in the staff entrance corridor mounted at 1800mm AFFL.

5.19 Induction Loop System

An audio frequency induction loop system is to be provided to a designated communal lounge on each resident floor, and to the cinema and bistro/welcoming area, for residents with hearing aids. This will provide a direct signal to such devices equipped with a 'T' induction loop setting.

The proposed equipment is a PDA200E unit manufactured by C-tec Ltd. This has inputs for both a TV/CD etc. and for a microphone. It includes indicator LEDs for external loop current and power on status.

The induction loop shall be a single continuous double-insulated conductor to the room perimeter. To avoid cross talk and interference the conductor is to be typically fixed 300mm below the finished ceiling line and be tested and certified in accordance with BS EN 60118-4,

The loop amplifier is housed in a wall mounted metal enclosure located behind the TV and connected directly to the induction loop. Input from a TV/audio device etc. is to be provided via a remote APL flush twin phono socket.

Commissioning and test certification as required by BS EN 60118-4 is to be provided to ensure compliance of the installation. Certificates and record drawings shall be included in the O&M Manuals.

5.20 Audio System

The contractor shall appoint Modal for the design and installation of the AV system within the home.

The contractor shall be responsible for first fix cabling, data and power requirements for the system to be functional at handover.

The contractor shall include cabling in Cat6 to lounges, bistro, hair salon, private dining, gym, assisted bathrooms and 1no external building mounted location.

Each cable will return to the controller as per the AV Systems drawings (if not provided assume administration office for purposes of tender).

A standalone system from Modal shall be installed within the cinema, which shall include a minimum of 8no speakers within the cinema room with Cat6 returning back to the AV equipment room / location. Power provision at the AV location will also be required in addition to the power provisions identified for the given room.

All music system hardware is by others.

5.21 Cabling and Containment Systems

The cabling installation shall be carried out in accordance with the following principles:

- All mains and sub-main cabling shall be XLPE/SWA/LSF cables having the appropriate number of cores to cover the phases, neutral, and earth requirements within the cable; i.e. 3c cable for single phase, neutral and earth. All cables to be installed on cable tray appropriate clipped before vertically and horizontally.

- All general-purpose lighting shall be installed in 6242B flat twin & earth cabling (minimum 1.5mm²) installed within the suspended ceiling and roof void spaces installed upon cable basket trays. The installation shall be concealed throughout except in locations such as the electrical switch room, plant rooms and lift shaft where surface mounted conduits shall be installed.
- All general-purpose small power circuits shall be installed in 6242B flat twin & earth cabling (minimum 2.5mm²) installed within the suspended ceiling and roof void spaces installed upon cable basket trays. The installation shall be concealed throughout except in locations such as the electrical switch room, plant room and lift shaft where surface mounted conduits shall be installed.
- The fire alarm installation cabling shall be FP Plus (Enhanced) to BS 7629 or BS 7846 Power Supply cables.
- The emergency lighting cabling shall be installed as detailed in item (b) above for general purpose lighting.
- The nurse call system cabling shall be routed through the building fabric clipped in place with multiple runs on medium duty cable tray.
- TV aerial system cabling shall be capable of offering full Sky capability.

5.22 Earthing and Bonding

The Contractor shall design, supply, deliver and install a complete Earthing system in accordance with BS 7671 and BS 7430 Code of Practice for Earthing.

System supply shall be TN-C-S (or TN-S as appropriate) and protection against indirect contact shall be by earthed equipotential bonding and automatic disconnection of supply.

A main earth bar of HDHC tinned copper mounted on insulated bobbins shall be installed in each switch room to which the following items shall be connected:

- Earthing conductors to electrodes (where necessary) utilising a ring connection system.
- Switchboard earth bars.
- Lightning protection system.
- Local HVAC ductwork system.
- Local piped services, including water, gas, steam, chilled water, etc.
- Structural steelwork.
- Local cable containment and support systems.

All equipotential bonding shall be carried out using 6491B single core copper cable coloured green/yellow.

Armoured cables shall be terminated by means of a proprietary cable gland c/w brass earth tag. Means of Earthing shall not be solely reliant on the gland: a separate earth cable shall be provided between gland and equipment earth terminal.

Where necessary, supplementary Earthing cables shall be provided, installed adjacent to the associated feeder cable. These conductors shall have a CSA of not less than 25% of the R1 CSA.

All primary cable containment (cable rack, tray, etc.) shall be mechanically connected to ensure electrical continuity. On primary services routes, at 20m intervals, primary cable containment

HVAC services, and structural steelwork shall be bonded together using green/yellow PVC/CU cable with a minimum CSA 16 mm².

Metallic trunking systems shall be mechanically and electrically continuous throughout their length. Brass continuity links shall be fitted to all trunking joints exterior to the trunking, utilizing brass bolts and shake-proof washers.

Static Earthing systems, where shown on the Tender drawings, shall be provided in accordance with BS 5958: Control of Undesirable Static Electricity.

Distribution boards shall be earth bonded to adjacent structural steelwork, HVAC services, process services and electrical containment systems.

Circuit Protective Earthing shall be achieved through the use of separate Earthing conductors, using 6491B insulated singles installed in conduit/trunking.

A single circuit protective conductor (CPC) shall be permitted for several circuits of the same type provided it is rated in accordance with BS 7671 to carry the highest expected fault level.

Circuit protective conductors shall be grouped according to type, e.g. lighting, socket outlet circuits, fixed equipment, etc.

5.23 Lift Supplies

The Contractor shall design and install suitably sized electrical supplies to the lift services within the building.

The electrical supply to lifts shall be derived from the main LV Switch panel and terminate in a suitably sized isolator or BS EN 60309 socket outlet (complete with plug).

The precise power supply requirements shall be agreed as stated within the addendum issued with this document.

All lift shaft lighting and general-purpose power sockets shall be provided by the lift specialist, including a 13A twin switched Metalclad socket outlet surface mounted within the bottom of each lift shaft.

5.24 Electrical Accessories

Accessories shall be MK or equal and approved. Accessories shall generally be flush MK Logic plus throughout with rocker switches on the outside of the plate. IP 44 MK Masterseal Plus will be utilised for external areas.

Light switches shall Match the finish of other accessories within that space, including chrome for all bedrooms

Multi gang switch plates to be engraved as necessary to indicate function of switches.

Care shall be taken to accurately co-ordinate mounting box positions with each other, furniture and dado rails. The sample room shall be taken as the standard for the project.

The outlets shall be installed to suit the final positioning of all workstations, equipment, etc.; allowance should be made for wiring into furniture or equipment supplied by others.

All outlets shall be from the same phase to the lighting and/or other circuits within that space.

The manufacturer and range of electrical accessories shall be consistent throughout the building subject to the approval of the Client.

Socket fascia's shall be chrome in all resident areas including corridors, each bedroom shall have a double socket with dual USB type A/C outlets located above bedside units. All other areas are to have white plastic accessories.

5.25 Roof Lights / AOV's

Where window/roof light locations do not allow for safe operation electronic remote winding gear is to be used. Roof lights requiring such operation shall be noted on the architectural drawings. The location of the control switch shall be agreed with the Architect and Client prior to installation.

Where automatic opening ventilators are identified on the architectural drawings for smoke clearance the Electrical Contractor shall include all associated electrical power supplies and fire alarm interfaces.

5.26 Labelling

Each item of electrical equipment including fused switch units, switch fuses, switches, bus-bar chambers, distribution boards and all other items of equipment shall be identified in accordance with Chapter 51 of the current edition of BS 7671 and shall have securely fitted, externally a white flexible type of 'Formica' or 'Traffolyte' label engraved with 10mm. black letters detailing the:

- Function of the equipment
- Reference number
- Fuse or breaker size type.

Examples: - Lift No 1 Fuse switch DBL1/1 fused at 60A TP&N

L1, L2, L3 'Formica' phase buttons shall be fixed inside all switchgear and distribution boards to indicate to which phase of the supply the various circuits are connected. The colouring shall comply with the current edition of BS 7671.

Flexible type Traffolyte identification labels shall be provided and tie wrapped at both ends of all sub main cables. The labels shall clearly state source of supply, purpose of sub main cable, size and number of conductors and type of cable.

Each distribution board shall be fitted internally with a TYPE WRITTEN list giving details of all MCB or fuse ratings, earth leakage rating (where applicable), supply phase(s), equipment serviced and size and type of all circuit conductors. A draft copy of the typed chart shall be made available to the Engineer for comment. The final version shall incorporate the Engineer's comments where necessary onto the chart.

Each schedule shall be mounted in an envelope formed from 0.5mm. Thick clear non-flammable material. The envelope shall be open at one end and fitted to the inside of the distribution board with 5mm. diameter rivets passing through eyelets in the envelope. An additional TYPED copy of each circuit card shall be incorporated in the maintenance manuals.

Each TP or TP&N item of switchgear shall have fitted on the cover a yellow 'Formica' or 'Traffolyte' label with 'Caution –400 VOLTS' engraved in 10mm. high black lettering.

5.27 Electrical Testing and Commissioning

All inspection, testing and commissioning shall be performed in accordance with BS 7671 and Regulations for Electrical Installations: Guidance Note 3.

The Contractor shall submit to the Clients Building Services Engineer a detailed method statement describing the tests to be performed. The Contractor shall advise the Client, in writing, two weeks prior to his intention to test, of a detailed method statement and programme. Testing may not commence without the Client's consent.

The Contractor shall develop a detailed programme to conduct all tests during periods that will avoid, or otherwise minimize, disruption to current site operations. The Contractor, in developing the programme, shall acknowledge the phased nature of the project and allow for repeat tests where necessary.

All testing equipment, materials and fuel etc. necessary to efficiently execute the tests shall be provided by the Contractor.

Two sets of all principal test records, Inspection Test Certificates and Instrument Calibration Certificates shall be supplied. One set shall be submitted for approval within 14 days of the tests/inspections being carried out; a second set shall be provided and incorporated into the Operation and Maintenance Manual.

During the electrical installation period, regular tests shall be performed by the Contractor to ensure that satisfactory results shall be eventually made. This is a particular requirement where works shall be concealed by the building fabric.

The Contractor shall satisfy himself of the full operational requirements of each and every system covered by the electrical services specification, and for each system shall prior to conducting testing and commissioning submit to the Client's nominated Engineer a fully detailed method statement indicating in detail the sequence of testing to be undertaken. For each task identified the method statement shall clearly indicate the required result or results, if more than one operation/output is applicable when the system is operating correctly.

Method statements shall clearly describe all tasks that are to be undertaken to satisfactorily demonstrate the whole system is operating correctly in accordance with the specification and shall include the proving of all interlocks, remote signalling and all input output conditions.

The Contractor shall provide all test certificates required by Building Control, e.g. Fire Detection/Alarm and Emergency Escape Lighting.

Following completion of the works and each discrete sub-section of the works, the Contractor shall issue a Completion Certificate. Completion Certificates shall be completed in NICEIC format.

The hand written test results shall be copied and issued to the Client two weeks before witnessing; and four weeks prior to practical completion to allow them to be checked, etc.

The Contractor shall allow within their programme of works sufficient time for the above.

Any deficiencies shall be reported to the Employer and / or their representative.

UPON COMPLETION OF THE WORKS, OR PRIOR TO PRACTICAL COMPLETION, THE CONTRACTOR AND THEIR SUB CONTRACTOR SHALL ARRANGE FOR THE WITNESSING OF ALL NECESSARY TESTS

AND COMMISSIONING BY THE CONTRACTOR, THE EMPLOYER (OR THEIR REPRESENTATIVES)
AND PROVIDE ALL NECESSARY CERTIFICATION IN ACCORDANCE WITH THE CURRENT EDITION
OF BS 7671 AT THE TIME OF DESIGN AND INSTALLATION.

6 Passenger Lift

The Contractor is to provide a minimum of 2No. 13 person “Stretcher” lifts from the ground floor to serve all floors in the Care Home. The lifts shall meet the requirements of EN81-2 and Part M2 of the Building Regulations for inclusive access. The Contractor should include for Otis Gen2 Life lifts at the tender stage.

Finishes to the landing and lift car doors together with all controls, handrails and fittings shall be stainless steel. Lift car internal walls shall be laminated finish with a half-height rear mirror, stainless steel handrail to the whole car and carpet finish to the lift car floor. The Contractor is to provide the lifts complete with the manufacturers’ supplied removable wall protectors, fitted for use during the Employer’s Fit Out. The internal finishes shall be in accordance with the Interior Designers requirements and agreed with the client prior to ordering.

Access control will be provided in the lifts where access is given to the dementia wing, staff areas and the car park. This shall be recessed into the lifts and be compact and aesthetically pleasing to the eye (ACT 5 keypad to be used).

A 5-year all-inclusive maintenance package to include all servicing, spares shall be provided. the costs of which shall be identified separately within the Contractors submission.

Training for site staff on how to lower the lifts and release doors in the event of an emergency/failure shall also be included.

The Contractor shall make all necessary applications for the phone lift lines and provide the dedicated internal phone system within the lift cars.

6.1 Extent of Works

A specialist Lift Contractor shall be employed to design, supply, deliver, install, test and set to work a lift installation to meet the project requirements. The Lift Contractor shall provide a lift with a minimum design life of 25 years based upon a commercial usage and rated for a minimum of 180 starts per hour.

The Lift Contractor shall be fully accredited to ISO 9001 Quality Assurance and will utilise and respond to the documentation systems set out within the preliminaries of the contract.

The extent of work covered by these documents includes the design, manufacture, delivery, installation, testing, commissioning and subsequent maintenance of the lift installation as detailed in this specification and on the project drawings.

Provide all manufactured items, materials, labour, cartage, hoisting, tools, plant, appliances and fixings necessary for the proper execution of the works, together with all minor and incidental works.

The following list identifies the work to be undertaken by the Contractor. The listed items are not intended to limit or exclude any items required by the contract documents or to complete the installation:

- the complete design of the lift installation
- selection of equipment, components and systems
- co-ordination with architectural and structural details

- co-ordination with other trades and Contractors
- compliance with Local Authority's requirements
- preparation and provision of design/shop drawings
- engineering calculations
- all works/costs associated with notified body approval if required

Where possible, all parts shall be of same manufacturer. Where not possible, components shall be selected such that they are fully compatible with the remainder of the installation.

6.2 Design Parameters

Work not covered by the requirements of Regulatory Authorities or this specification shall comply with the appropriate publication of the British Standards. Wherever a Standard or Code of Practice is referred to in this specification, it will imply the latest issue and/or revision applicable at the time of tender. If no British Standard exists, the Contractor shall comply with an equivalent standard published by a member of the European Community as recognised in the UK. The whole design shall comply with all relevant codes, standards and regulations, including but not limited to:

- The Lift Regulations
- All relevant British Standards and Codes of Practice,
- Health and Safety Regulations.
- DoH National Minimum Standards for Care Homes
- CIBSE Guide D
- The Provision and Use of Work Equipment Regulations (P.U.W.E.R)
- The Electromagnetic Compatibility Directive
- The Building Regulations Approved Documents in particular parts M and L
- The Construction (Design and Management) Regulations (CDM)
- The Health and Safety at Work act
- The Electricity at Work Regulations
- Local Authority requirements and By Laws
- The Contractors and employee's insurance requirements covering works on site
- Local Authority requirements and By-Laws
- The Contractors and employee's insurance requirements covering works on site
- The requirements of the Regional Electricity Company
- The Disabilities Discrimination Act (DDA)
- Any statutory instructions issued by The Health and Safety Executive or Commission
- BS 7671
- All relevant British Standards or Codes of Practice applicable to the specific equipment

Where requirements of any of the above cannot be met, state reason for non-compliance and provide details of measures to ensure equivalent level of safety and obtain Notified body design Examination Certificates. Details of any areas of non-compliance shall be provided to the Contract Administrator during Tender stage.

Full details shall be submitted as required for approval by the Local Authority Building Control Officer.

6.3 Particular Requirements

Include for the supply delivery, installation and commissioning of a minimum 2No. 13 person (suitable for transporting beds). Lifts shall be machine room-less traction type supplied and installed by a Specialist Contractor. Lifts shall serve all floors and comprise (or as required by the manufacturer):

- Shaft structure to suit manufactures standard sizes.
- Pit Depth to suit manufactures standard sizes.
- Travel as required to service all floors
- Speed 1.0 m/s
- Three Phase
- Headroom 3400 mm

Provide all necessary heating, cooling and ventilation to ensure the temperature within the, shaft and car remain within manufacturer's tolerances.

The lift car shall conform to the following requirements:

- Automatic 2 speed, side opening stainless steel doors.
- Doors to be electrically interlocked, so the lift will not move unless the door is closed.
- Push button panel to correspond with the floors served, plus 'door open/close' and 'alarm' functions. Panel to include tactile notation for visually impaired users.
- Voice announcement of floor designation and door open/close.
- Instantaneous type safety gear lift to bottom of car.
- LED lighting scheme with stainless steel bezels.
- Three hour maintained emergency lighting in car.
- Infra-Red safety beam curtain to prevent accidental door closure.
- Doors to be one-hour fire protection
- Floor indicators

Connection is required with the nurse call system so that in the event of an emergency button press the Nurse call is activated to make the care home fully aware.

An internal digital keypad with a 4-number code is required to activate the lift call buttons to prevent residents from exiting the building on their own accord from the dementia floor, restricting access to the car park and staff areas. This shall be recessed into the lift's architrave and form part of the lift package.

The following features shall be provided at each landing:

- Automatic, 2 speed, side opening stainless steel fire door complete with frame, stainless steel finish to external doors.
- Doors to be electrically and mechanically interlocked to prevent opening of the door unless the lift is at that level.
- Car call button [illuminated to show the call has been accepted], fitted at all landings.
- Door release key for all landings.
- Doors to be one-hour fire protection.
- Infra-Red safety curtain to prevent accidental door closure.
- Lifts to dementia wings, car parks and staff area to be only accessed via secure digital entry.
- Stainless steel finish to lift door surrounds at each level.

The following are to be installed (or similar to meet specific manufacturer's specification):

- Manual lowering instruction
- Over-speed governor with safety switch.
- Test report and test certificate.
- Minimum starts per hour = 180.
- Return to ground homing device.
- Car top control for use of Service Engineers.
- Full height electronic safety edge
- Electronic Keypad
- Telephone lines to lifts

6.4 Maintenance

The standard maintenance call-out must be available 24 hours a day all year around, with a response time of no greater than four hours.

The emergency button press call-out must get dialled to a 24 hour a day call centre, with a response time no greater than one hour. Emergency call out must be provided within the first year.

The auto dialler must be open protocol to allow the Client to switch the maintenance company after the contract period if desired.

6.5 General Requirements

The Lift Contractor shall liaise and co-ordinate with all other trades to ensure that all requirements are provided as required for the completeness and proper operation of the equipment or system.

The Contractor shall advise the Main Contractor of detailed Builderswork requirements.

The Contractor shall include for the following:

- Temporary lighting and power supply for construction purposes together with permanent power for testing and commissioning of the machinery.
- Identify datum levels for the alignment and positioning of equipment.
- Suitable dry storage area for equipment and tools.
- Acoustic treatment of lift well walls at all levels to minimise noise transmissions to these areas as and where required.

Prior to the order of any equipment, the Lift Contractor shall submit drawings for approval. As a minimum the drawings shall detail the following:

- Builders works
- Lift well section
- Lift well general arrangement
- Installation works
- Lift car finishes
- Lift car general arrangement
- Lift car section
- Lift car floor
- Lift car lighting
- Lift car operating panel

- Landing section (detailing architrave, lift control panel, call stations etc...)
- Landing elevation (detailing architrave, lift control panel, call stations etc...)
- Entrance details

The Lift Contractor shall include for the provision of as installed drawings for the installation and final shop drawings as provided during the progress of the works. Drawings prepared by the Engineer may be utilised for the as installed drawings provided that all details including notes on the drawings, are revised to depict the as installed condition.

1no. lift shall be supplied with protective drapes and all associated studs.

6.6 Installation

The Lift Contractor shall provide full height Protective barricades across each landing door opening into the lift shaft. Barricades shall comply with the requirements of the relevant Statutory Authority.

Provide all materials, fittings, accessories and apparatus of new manufacture complying with the relevant standard. Provide all materials, new, clean and free from corrosion unless otherwise specified.

Select and install material to prevent corrosion of the material or any other proximal material through galvanic action. Application of approved coatings suitable for the installation conditions may be used to prevent corrosion or galvanic interaction where material selection is not a practical means of achieving this objective.

Ensure that materials subject to exposure to the elements are suitable for long term, 25-year minimum exposure without degradation of performance.

All work shall be performed by experienced tradesmen.

6.7 Fire Alarm Mode

The passenger control system shall be so designed as to be able to receive a signal that a fire condition exists within the development. The signal will be hard wired and terminated within the machine room. The Contractor will be responsible for extending the wiring to the various unit controllers in order that the lift responds as follows:

- On receipt of a fire condition the lift shall stop, cancel all calls, then revert to ground floor level.
- Upon returning to the designated level, car and landing doors shall park open and remain open with the lift parked at the designated level whilst a fire condition exists.

6.8 Keys

Provide the following to the Client at practical completion of the Lifts:

- Labelled Emergency Lift Door Release Key (1 per lift)
- Labelled Control Panel Access Key (1 per lift)
- Labelled Service Control Key (1 per lift)
- Fire Curtains where applicable.

6.9 Operation and Maintenance Manual

Provide documentation for the purpose of enabling the Client to operate and maintain the plant and equipment.

Documentation shall include:

- As installed drawings
- Manufacturer's documentation of all equipment
- Instructions for operation of the system
- Maintenance procedures
- Listings of all entered programmable parameters
- Information relating to the expected operational life of all major system components.
- Warranty details in excess of the defect's liability period

Additional details to be contained within the documents are specified in the Scope and Quality Requirements sections of this specification.

The above documents shall be collated into a Manuals section containing printed texts and a Drawings section containing the drafted drawings.

Submit a draft copy of the document for approval prior to practical completion. An interim copy of the sections of the Operating and Maintenance Manual which refers to essential and emergency services shall be provided prior to practical completion for site use until the final versions of the manual are supplied.

7 Schedule of Manufacturers and Suppliers

7.1 General

Tenders shall be based upon the manufacturers stated in the schedules below. Any alternatives shall be offered as options to the base price.

Equal and approved alternatives shall be considered in all cases except where stated as 'Specified Outright'. Any alternatives shall be presented in a full technical submittal for approval by the Client and his team before any procurement or installation is undertaken.

Items in bold indicate preferred manufacturers, alternatives shall not be accepted without formal technical submissions and approval.

7.2 Mechanical Manufacturers

Equipment	Manufacturer
Boilers	Remeha
	Potterton
	MHS
	Ideal
Extract Fans	Nuaire
	Greenwood
	Vent Axia
Grilles, Diffusers & Louvres	GDL
	Advance
	Gilberts (Blackpool Ltd)
	Air diffusion
	Waterloo
LST Emitters	Jaga Tempo (LST's)
	Stelrad (non-LST)
Pipework Systems	See Pipework Materials & Manufacturers Selection Table under section 4.13.2
CHP	SAV
	Remeha
	Indop
Pressurisation Units	Grundfos
	Armstrong

	Mikrofill
	Wilo
Water Conditioners	Lifescience (Water King)
	Hydrotec
Duplex Water Softening Plant	Monarch Water
	Osmio Water
Pumps	Grundfos
	Wilo
	Armstrong
	DAB
Sanitary ware	Refer to sanitary ware schedule
TMV3 Valves	Peglar
	Reliance Controls Ltd
	BOSS
	INTA
Valves	Hattersley
	Crane
	Pegler Yorkshire
	BOSS (BSS)
	IMI TA
VRF/DX Cooling Equipment	Daikin
	Toshiba
	Mitsubishi
	Hitachi
Cold-water Tanks	Decca Plastics
	Dewey Waters
	AC Plastics
Heat Recovery Units	Nuaire
	Mitsubishi Lossnay
	Daikin
	Vortice
HWS Calorifiers	Hamworthy Powerstock
Fire & Smoke Dampers	Actionair

	BSB
	Advanced Air
Gas Interlock Systems/Proving Systems	Flamefast
	Gasguard
	Medem
Overdoor Heaters	Dimplex
	Diffusion
	JS Air Curtains

7.3 Electrical Manufacturers

Equipment	Manufacturer
Switchboards / Panel boards	Eaton (MEM) Ltd
	Dorman Smith
	ABB
	Square D
Power Factor Correction	As Switchboard manufacturer
Surge Suppression Devices	As Switchboard manufacturer
Distribution Boards	NOTE. DIST BOARDS TO BE OF THE SAME MANUFACTURER AS SWITCHBOARDS / PANELBOARDS
Lighting / Small Power Accessories	MK
	Crabtree (Electrium)
Luminaires	As per luminaire schedule
Cables	Prysmian Cables
	AEI Cables
	Draka
Containment – Cable Tray / Basket	Swift's or equal and approved
Containment – Trunking	Salamandre or equal and approved
CCTV Cameras (If dictated by planning / external policy)	HIKVISION
	Dahua
	Axis
EV Charger	Rolec Autocharge

8 Contract Sum Analysis

Contractors shall complete the following Contract Sum Analysis sheets and include within their tender submission.

Mechanical & Electrical Contract Sum Analysis

Project:

Contractor Name:

	£	£
1.00 Preliminaries		
1.01 Management		
1.02 Plant, Equipment & Accommodation		
1.03 O&M Manuals, Record Drawings & Asset Register		
Section 1.00 Total		
2.00 Design		
Detailed design calculations & drawings		
SBEM		
EPC		
Section 2.00 Total		
3.00 Mechanical		
3.01 Low Temperature Hot Water System		
3.02 Ventilation		
3.03 Comfort Cooling		
3.04 Hot & Cold-Water Services		
3.05 Natural Gas		
3.06 Above Ground Drainage		
3.07 Controls		
3.08 Sterilisation		
3.09 Chemical Cleaning & Water Treatment		
3.10 Testing & Commissioning		
3.11 Sprinkler System		
3.12 Spares		
Section 3.00 Total		
4.00 Electrical		
4.01 Main Incoming Electrical Services & Metering		
4.02 Low Voltage Switchboard & Sub-Main Distribution		
4.03 Standby Generator Connection		
4.04 Final Circuits & Distribution Boards		
4.05 General Lighting		
4.06 Emergency Lighting		

4.07	External Lighting		
4.08	Small Power Installation		
4.09	Electric Vehicle Charging		
4.10	Data & Telecommunications		
4.11	Fire Detection & Alarm System		
4.12	Lightning Protection		
4.13	Mechanical Services Electrical Provisions		
4.14	TV Aerial System		
4.15	Nurse Call System		
4.16	Access Control System		
4.17	CCTV System		
4.18	Induction Loop Systems		
4.19	Audio System		
4.20	Containment		
4.21	Earthing & Bonding		
4.22	Lift Supply		
4.23	Testing & Commissioning		
4.24	Spares		
	Section 4.00 Total		
5.00	Total Sections 1-4 Inclusive		
6.00	Option for 12 months maintenance		
7.00	Contractors uplift for variation works		%
Signed on behalf of Contractor:			
Print Name:			
Position:			
Date:			

Mechanical Only Contract Sum Analysis

Project:

Contractor Name:

1.00	Preliminaries	£	£
1.01	Management	_____	
1.02	Plant, Equipment & Accommodation	_____	
1.03	O&M Manuals, Record Drawings & Asset Register	_____	_____
	Section 1.00 Total		_____
2.00	Design		
	Detailed design calculations & drawings	_____	
	SBEM	_____	
	EPC	_____	_____
	Section 2.00 Total		_____
3.00	Mechanical		
3.01	Low Temperature Hot Water System	_____	
3.02	Ventilation	_____	
3.03	Comfort Cooling	_____	
3.04	Hot & Cold-water Services	_____	
3.05	Natural Gas	_____	
3.06	Above Ground Drainage	_____	
3.07	Controls	_____	
3.08	Sterilisation	_____	
3.09	Chemical Cleaning & Water Treatment	_____	
3.10	Testing & Commissioning	_____	
3.11	Sprinkler System	_____	
3.12	Spares	_____	
	Section 3.00 Total	_____	_____
3.00	Mechanical		_____

4.00	Total Sections 1-3 Inclusive		=====

5.00	Option for 12 months maintenance		_____
6.00	Contractors uplift for variation works		%

Signed on behalf of Contractor:

Print Name:

Position:

Date:

Electrical Only Contract Sum Analysis

Project:

Contractor Name:

1.00 Preliminaries	£	£
1.01 Management		
1.02 Plant, Equipment & Accommodation		
1.03 O&M Manuals, Record Drawings & Asset Register		
Section 1.00 Total		
2.00 Design		
Detailed design calculations & drawings		
Section 2.00 Total		
3.00 Electrical		
4.01 Main Incoming Electrical Services & Metering		
4.02 Low Voltage Switchboard & Sub-Main Distribution		
4.03 Standby Generator Connection		
4.04 Final Circuits & Distribution Boards		
4.05 General Lighting		
4.06 Emergency Lighting		
4.07 External Lighting		
4.08 Small Power Installation		
4.09 Electric Vehicle Charging		
4.10 Data & Telecommunications		
4.11 Fire Detection & Alarm System		
4.12 Lightning Protection		
4.13 Mechanical Services Electrical Provisions		
4.14 TV Aerial System		
4.15 Nurse Call System		
4.16 Access Control System		
4.17 CCTV System		
4.18 Induction Loop Systems		
4.19 Audio System		
4.20 Containment		
4.21 Earthing & Bonding		
4.22 Lift Supply		
4.23 Testing & Commissioning		
4.24 Spares		

Section 3.00 Total		_____

4.00 Total Sections 1-3 Inclusive		_____
		=====
5.00 Option for 12 months maintenance		_____

6.00 Contractors uplift for variation works		_____%

Signed on behalf of Contractor: _____

Print Name: _____

Position: _____

Date: _____