Delta Green
environmental design

SPECIFICATION

MARTELLO CAFÉ & PUBLIC TOILETS, ESPLANADE, SEAFORD

Building Services Engineering – Specification

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Contents

APPENDIX 1 – MECHANICAL SCHEDULES

APPENDIX 2 – ELECTRICAL SCHEDULES

APPENDIX 3 – NES SPECIFICATION

Rev	Originator	Approved	Date
P01	JaP / AC	JP	23/12/2021
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P03	JaP / AC	AC	24/02/2022

1.0 GENERAL CONDITIONS

1.1 GENERAL

This specification document is to be read in conjunction with the design drawings, the National Engineering Specification and all relevant design information. The purpose of this document is to provide support information relating to the mechanical, electrical and public health services installations associated with Martello Café & Public Toilets, Esplanade, Seaford.

1.2 THE BUILDING

The main function of the existing building is to provide a public toilet facility for beach goers and visitors to Seaford beach, there are also a few storage rooms for maintenance of the existing premises.

The existing building is to be demolished. The intention is to retain the existing slab and construct a new Café & public toilet facility on the existing site. The new building shall comprise; café, kitchen, plant space, accessible wc, wc's & a changing places facility.

These works will generally require the decommission and strip-out of redundant MEP services and provision of new MEP services to new building.

The building is to be highly energy efficient in its operation and materials are to be of low embodied energy in specification and of high recycled content.

1.3 OBJECTIVES OF THE PROJECT

The objectives of the project are summarised below:

- To provide new mechanical, public health and electrical services to the new building
- Provision of good quality, reliable plant and equipment to suit a building design life of 50 years
- Use energy efficient plant and equipment to minimise energy consumption
- Provision of flexibility with regard to comfort and control of plant
- Consideration of ease of maintenance
- Provision of suitable automatic controls for control and monitoring of plant and environmental conditions

1.4 INTRODUCTION TO THE SPECIFICATION

This section of the Specification shall be read in conjunction with section A64 of the National Engineering Specification (NES) Services Specification specific to this project and produced by Delta Green and issued as part of the complete Tender documentation.

The Contractor will be responsible for the development of the design from the RIBA Stage 4A information provided and for the design, supply, delivery and installation of plant and materials, including testing, setting to work and

commissioning, provision of handover documents and "as installed" drawings. The Subcontractor shall carry-out the final design and co-ordination of the mechanical and electrical services described in the NES specification and preparation of fully co-ordinated working drawings. These shall be submitted to the Contract Administrator/Services Engineer for comment and appraisal prior to commencing works on site.

The Subcontractor shall be responsible for the appointment of an independent Commissioning Specialist Subcontractor either a member of the HVCA Commissioning Group or a member of the Commissioning Specialists Association. This shall be carried out within 7 days of his own instruction to ensure that the specialist subcontractor's designs are developed with commissioning and maintenance good practice in mind. Shall the Subcontractor have any concerns regarding the commissioning, validation or functionality of the existing services, this shall be reported in writing to the Contract Administrator before the commencement of any work. The specialist subcontractor's responsibilities are to include:

- Design input: commissionability design reviews
- Commissioning management input to construction programming
- Commissioning management input during installation stages
- Management of commissioning, performance testing and handover/post-handover stages.

The Subcontractor shall assign an M&E services Technical Manager to the project to oversee fully the services installations throughout the entire duration of the project, from working drawing production, on-site co-ordination, pre-commissioning and final commissioning/testing and training.

1.5 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall refer to separate documentation for General Contract Conditions, target programme and other Specialist Sub-Contractor scope of works and requirements.

The tender documentation represents the sum total of the information available to the Contractor for their co-ordinated working drawings and equipment orders to be checked against and supplemented by their own survey works as necessary.

The engineering services shall form part of a Traditional Contract, as per the main contract preliminaries, which assume the following responsibilities for the Contractor:

The engineering services shall form part of a fixed price tender sum, which assumes (but is not limited to) the following responsibilities for the Contractor:

- Complete detailed design and co-ordination of mechanical, electrical and building health services to the Building.
- Technical submittals shall include a description of the equipment, with supporting drawings and manufacturer's data. No equipment shall be procured until the technical submissions have been approved.

- Detailing of the work and provision of complete production information and drawings based on the information provided, liaising with the employers' agent and others as necessary to ensure co-ordination of the work with the other related building elements.
- Design, Supply, installation and testing of all components, fixings and materials required to provide a complete working installation.
- Performance and load testing of all major plant items at manufacturers works prior to delivery to site.

The Client Team shall be invited to comment on testing/commissioning method statements and be present to witness and sign off prior to delivery.

- Schedule of suppliers/manufacturers of main/major items of plant or equipment or systems.
- Detailing of the work and provide complete production information and drawings based on the information provided, liaising with the Contract Administrator, Principle Contractor and other Specialist Contractors and others as necessary to ensure coordination of the work with related building elements.
- Supply, installation and testing of all components, fixings and materials required to provide a complete working installation.
- Provide schematic(s) of all major services indicating base building interfaces. Schematic(s) shall be fully detailed with flow rates, loads, circuit references etc.
- All manufacturers' drawings and technical details/information.
- Provision of all necessary builders work including production of builders work drawings.
- Provide specialist sub-trade drawings.
- Complete set of information to Project Manager for submissions to Building Control, Fire Officer and other statutory authorities and obtain approval of the works.
- Testing and commissioning of all systems in accordance with Building Regulations, CIBSE and BSRIA guidelines in order to provide an effective working installation to the satisfaction of the Project Manager.
- The main contractor accounts for the commissioning programme, responsibilities and criteria within the main programme of works.
- Seasonal Commissioning which must include:

  a. Testing of all building services under full load conditions, i.e. heating equipment in midwinter, cooling/ventilation equipment in mid-summer, and under part load conditions (spring/autumn)

  b. Where applicable, testing should also be carried out during periods of extreme (high or low) occupancy

  c. Interviews with building occupants (where they are affected by the complex services) to identify problems or concerns regarding the effectiveness of the systems

  d. Re-commissioning of systems (following any work needed to serve revised loads), and incorporating any revisions in operating procedures into the O&M manuals.

These must be undertaken under the control of a specialist commissioning manager.

The contractor shall also provide hand over documentation comprising of:

- As installed services drawings for all services.
- Operating and Maintenance manuals that include health and safety information in suitable electronic format (e.g. .pdf) for distribution and viewing.
- 3 no. USB copy of the Operating and Maintenance manuals that include health and safety information and the as installed drawings.
- Building Logbook
- Building Users' Guide

Provide demonstrations and training to the building occupiers in the correct operation of the services.

The Contractor shall refer to the Contract of Works for full details of their responsibilities.

1.6 INFORMATION TO BE PROVIDED AT TENDER STAGE

The Contractor shall submit at tender stage the following information for review:

- Schedule of suppliers/manufacturers of main/major items of plant or equipment or systems.
- List of Specialist Contractors to be utilised
- Programme of works and commissioning activities.
- List of Specialist Contractors to be utilised
- CV's for staff, including indication of responsibilities on similar projects.
- Technical submittal template to be utilised.
- Schedule of Day rates for personnel.

1.7 REGULATIONS AND STANDARDS

The building engineering services systems and installations shall comply fully with the latest editions of all relevant UK and local authority regulations, statutory requirements, design standards and codes of practice including but not limited with the following:

- British Standards Institution Codes of Practice
- British Standards
- Building Regulations, England & Wales
- WRC Regulations
- Construction Design & Management Regulations
- European Directives
- Harmonised European Standards
- Local Building Control Requirements
- Environmental Health Requirements
- District Fire Officer Requirements

- Factories Act
- CIBSE Guides and Publications
- HVCA Guides and publications including DW/144 and DW/172
- IET Guides and publications including BS 7671
- BSRIA Guides and Publications
- LPC Guides and Recommendations
- Relevant Health and Safety at Work Acts
- Local Water Authority Regulations
- Local Electricity Company Regulations
- Electricity at Work Regulations
- Health and Safety Executive's "Legionnaires' disease - The control of legionella bacteria in water systems". Approved Code of Practice and guidance, 2000
- Health Technical Memorandums (HTM's) and Health Technical Notes (HTN's)

The above list of Standards, Regulations and Guidelines is not exhaustive and as such does not relieve the Contractor of their responsibilities to comply with all necessary Regulations and Standards.

The Standards listed above should be considered as minimum requirement for the Contract Works.

1.8 DOCUMENTS TO BE PROVIDED BY THE CONTRACTOR

1.8.1 GENERAL

The Contractor shall be responsible for producing all design (equivalent to Stages 4b, 5, 6 & 7 as defined in BSRIA Publication BG 6/2014), installation, operating and maintenance manuals, user guides, as installed drawings etc as set out in this Specification. All such information shall be submitted to the Employer's Agent in a timely manner to suit the programme of Works and allow any comments to be made and incorporated into the information as appropriate and issued for construction etc.

This shall include, but not necessarily limited to, the following:

- Working drawings.
- Installation drawings.
- Manufacturers/Suppliers/Specialist Sub-Contractors fabrication, shop, certified drawing and diagrams.
- Final co-ordination of builder's works drawings.
- Equipment schedules and technical information
- Method statements.
- Operating and Maintenance Manuals.
- 'As installed' drawings.
- Building User Guide
- Building Log book in line with Part L2B 2016.
- Asset register.

- Commissioning schedules and data.
- Test Certificates

1.8.2 CO-ORDINATION OF ENGINEERING SERVICES

Final co-ordination of the Engineering Services Installations shall be carried out as part of the Contract works. The Contractor shall agree the principles of co-ordination with all parties concerned and incorporate details into the Co-ordination Drawings.

The Contractor shall provide all necessary details/drawings/schedules etc required to enable the final coordination drawings to be prepared.

The Contractor shall ensure the installation and co-ordination drawings make due allowance for all building elements, structure and services.

Prior to submission the Contractor shall check and approve all drawings, schedules and any other information provided by manufacturers, suppliers or Specialist Sub Contractors to ensure that all the requirements of the Contract documentation have been incorporated. Accompany all documents submitted with a certificate indicating that they have been checked by the Contractor.

1.8.3 PREPERATION OF DOCUMENTS

The Contractor shall prepare drawings to commonly recognised scales generally on A0/A1 sheets as appropriate and details and schedules on A3/A4 sheets.

Agree scales, drawing sheet size and format with the Employer's Agent before preparing any documents.

Prepare electrical drawings in accordance with BS EN 61082.

1.8.4 SYMBOLS

The Contractor shall use symbols and line conventions in accordance with BS EN ISO 3766, BS EN ISO 7518 and BS EN ISO 11091 Recommendations for symbols and other graphic conventions.

1.8.5 DOCUMENT NUMBERING/REGISTRATION SYSTEM

The Contractor shall agree with the Employer's Agent the document numbering/registration system to be used before preparing any documents.

1.8.6 BUILDERSWORK INFORMATION

The Contractor shall provide final Builderswork Information.

Provide fully dimensioned drawings showing both size and position of builderswork.

Holes may not be cut in steelwork, reinforced or pre-cast concrete without written permission from the Employer's Agent. Under no circumstances shall holes be cut in pre-stressed concrete. Permitted holes in steelwork must be drilled - burning by means of welding equipment is prohibited.

1.8.7 EXAMINATION OF DRAWINGS/INFORMATION

The Employer's Agent shall examine the propositions submitted for compliance, in principle, with the design intent. Such an examination shall not relieve the originator of such documents of his responsibilities and obligations under the Contract.

1.8.8 MAINTENANCE INSTRUCTIONS AND GUARANTEES

The Contractor shall retain copies delivered with components and equipment (failing which, obtain), register with manufacturer as necessary and hand over to Employer's Agent on or before Practical Completion.

Notify Employer's Agent of telephone numbers for emergency services at Practical Completion.

1.9 MANAGEMENT OF THE WORKS

1.9.1 PROGRAMME/PROGRESS

The Contractor shall provide detailed sub-programmes as necessary to support a Master Programme for the Contract Works.

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

- Ordering and installation periods.
- The completion of drawing, etc. including the minimum working days for comment.
- Work resulting from instructions issued in respect to the expenditure of provisional sums.
- Any temporary works necessary for the completion of the engineering services installations.
- Pre-commissioning, commissioning and performance testing of the engineering services installations, including the final acceptance testing to be demonstrated to the Employer's Agent.
- Preparation and provision of 'As Installed' Drawings and Operating and Maintenance Manuals.

The programme information shall be provided in the form of a simple bar chart type. Allowances shall be made to reissue information for approval following initial comment. Delays caused as a result of providing insufficient time to comment shall be at the contractors risk.

1.9.2 COVERING-UP

The Contractor shall ensure no section of the Works are covered, concealed or insulated until completion of a witnessed satisfactory test.

The Contractor shall give notice to the Employer's Agent when Works which are to be covered or concealed are ready for examination and/or measurement, not less than 10 working days prior.

1.10 QUALITY STANDARDS/CONTROL

1.10.1 PERSON IN CHARGE

The Contractor shall appoint foremen-in-charge and/or site agents to ensure constant management and supervision of the various elements of the Contract Works.

The Contractor shall give maximum possible notice to the Employer's Agent before changing the foremen-in-charge or site agents.

1.10.2 DIMENSIONS

Where installations are dependent upon site dimensions ensure that these are available before proceeding with the Works.

Do not take dimensions by scaling from the drawings.

Where dimensions are indicated on drawings check these on site, as appropriate, to ensure building construction and manufacturing tolerances can be accommodated.

Do not order or manufacture equipment using dimensions indicated on the Tender drawings, Specification or schedules.

1.10.3 SITE MODIFICATIONS

The Contractor shall ensure that where site modifications to assemblies are necessary, they shall be made in accordance with manufacturer's certified drawings and instructions.

Ensure that modifications made comply with any type test certificate obtained for arrangement of components.

1.10.4 STANDARDS AND REGULATIONS

The Contractor shall provide all materials and works in accordance with the appropriate British Standard or Code of Practice and where no BS or CP is applicable the Agreement Certificate for the particular item.

The Contractor shall comply with all statutory instruments and regulations and local byelaws relating to the area of the site. Comply with the requirements of the Approved Building Inspector.

Comply with all relevant requirements included in the Main Contract Preliminaries Section.

Notify all authorities in accordance with their regulations and obtain any required approvals for the installation.

Where no specific design, performance or installation standards are quoted the following shall apply.

- All Relevant Health Technical Memorandums
- CIBSE Guide Books A, B and C.
- CIBSE Codes of Practice.
- Chartered Institute of Plumbing and Heating Engineers Design Guide
- CIBSE Code for Interior Lighting & Relevant Lighting Guide(s).
- CIBSE Technical Reports.
- CIBSE Technical Memoranda.
- BSRIA Guides.
- Health and Safety Executive Legionnaires Disease Prevention Measures Document L8

The Contractor shall ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.

1.10.5TYPE TESTS

The Contractor shall provide certificates of verification of type tests. Ensure that drawings and other documents forming part of certificate are available prior to any order being placed.

1.10.6TEST CERTIFICATES

The Contractor shall ensure that where testing specific to the project is required, ensure test certificates include:

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

1.10.7INSPECTIONS AND TEST RECORDS

The Contractor shall ensure that where testing specific to the project is required, ensure test certificates include:

The Contractor shall prepare a set of drawings and/or report sheets to record accurately the test and inspection information including the following:

- Plant identification, section and installation under test.
- Manufacturer's reference number.
- Date, time, duration of test, weather conditions.
- Test results with itemised readings including records of all other checks and tests.

Maintain records of all specified inspections and tests performed including third party and works test certificates.

Include in records, as appropriate, details of the element, item, batch or lot, the nature, number and date of the inspections and tests, the number and type of deficiencies found, any corrective action taken and other relevant particulars.

Maintain all records on site for inspection. On completion of the Works, include copies in the operating and maintenance manuals.

1.11 TECHNICAL SUBMISSIONS

The Contractor shall be responsible for the production of technical submissions for all systems forming part of the mechanical, electrical and public health installation as detailed within this specification document.

The tender documentation represents the sum total of the information available to the Contractor to produce technical submissions for all systems. Technical submissions shall comprise fully coordinated working drawings, equipment schedules, description of system and any other pertinent information. It shall be made clear that without approval of a systems technical submission the Contractor will be proceeding at his own risk.

Technical submissions shall be produced in a format to be agreed, with the following information included:

- System name
- Product datasheets for all equipment forming part of the system
- Schedule of equipment
- Description of the proposed system
- Working drawings detailing all elements of the proposed system.
- Supporting calculations.
- Proposed specialist sub-contractor's details.

1.12 SOFTWARE

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

Ensure that the end user is properly registered with the software supplier for support and appropriate updating.

Ensure that application software is written in compliance with BS 7649.

1.13 SAMPLES

The Contractor shall supply the Employer's Agent samples of materials and / or workmanship for approval in so far as appearance and quality of construction. Any approval given does not relieve the Contractor of his responsibility for ensuring that the item is fit for its intended use.

Samples shall be provided for all plant/equipment/fittings that are visible to occupants and, as such, are of aesthetic significance. The below list provides an indicative, but not exhaustive, list of the type of items required:

- Trunking (for surface mounting)
- Heat emitters
- Wall mounted sensors/controllers
- Supply air diffusers, including wall mounted
- Extract air grilles
- Luminaires
- Wiring accessories
- Dado trunking
- Door control and Security system accessories and equipment

1.14 STANDARDS AND WORKMANSHIP

The standards and workmanship are to comply with the latest Codes of Practice and Regulations.

The new electrical installations shall conform to the IET Wiring Regulations BS 7671:2008, 17th Edition, incorporating Amendment 3:2015.

The standards of materials and workmanship shall be as defined by the National Engineering Specification document that forms part of this tender document.

1.15 DESIGN CRITERIA

All systems have been designed to the scheduled criteria, and the Contractor is to advise of any areas where the systems deviate from this performance level. The following design criteria represent standard good practice for such facilities, as agreed with the Client and outlined in CIBSE guidelines.

Outdoor conditions;

Winter design	-4°C saturated
Summer design	30°C db / 20°C wb
Heat Rejection Plant	Summer Design 35°C db

Internal Conditions

The client should note the temperatures in the following table and review. The temperatures are based on industry standard data / benchmarks;

Inside Conditions	Summer Maximum	Winter Minimum	Comment
Kitchen	24	21	No humidity control

Cafe	24	21	No humidity control
Toilets areas	Not cooled	19	
Changing Room	Not cooled	19	

Table 1. Heating design criteria

Population Density/Fresh air provision

General spaces: Occupancies to match the architect's FF&E layouts. A fresh air rate is via natural means via openable windows and trickle vents.

Internal cooling loads (Electrical)

	Lighting	Small Power
General Accommodation	12 W/m^2	15 W/m^2 on floor distribution
Circulation areas	8 W/m^2	Nil

No dedicated IT Room

Internal cooling loads (Occupancy)

Sensible Gain 90 W/person

Latent Gain 60 W/person

Air change rates

Area	**Supply**	**Extract**	**Notes**
Kitchen	60 AC/hr	60 AC/hr	Subject to final kitchen layouts – TBC. Ventilation by tenant.
Café	-	-	Naturally Ventilated via window openings. Please refer to Indoor Environmental Report for window

			openings requirements.
Toilets areas	6 AC/hr	6 AC/hr	(-ve) Pressurisation. Air transfer to be via 10mm undercut door, trickle vents, or air transfer grilles, as required from adjacent spaces.
Changing Room	6 AC/hr	6 AC/hr	

Lighting

Area	Average Lux Level (lx)	Glare Rating (UGRL)	Uniformity (U0)	Colour Rendering Index (Ra)
Circulation Areas & Corridors	100	25	0.40	80
WC Areas	200	25	0.40	80
Plant Rooms	200	25	0.40	80
Kitchens	500	22	0.60	80
Store Rooms	100	25	0.40	80

1.16 SPARES

The Contractor shall compile and submit to the Employer's Representative one month before Practical Completion of the works, a complete list of special tools, test equipment and spare parts to cover twelve months' operation of the installations. The Contractor shall also submit an additional list of special tools and test equipment likely to be needed during the useful life of the installation, i.e. over and above the 12 months' period. If the Contractor fails to give this information in good time and the Employer is thereby prevented from carrying out proper maintenance of the installation, the Contractor will be responsible for carrying out the maintenance at its own cost. This requirement is in addition to the provision of the spares and tools required for routine maintenance

and access. It shall be the Contractors responsibility to provide a fully itemised schedule of spares for each and every system and item of equipment installed within their works.

The Contractor shall provide the following spares as part of the contract:

- Filters – one complete replacement of each filter on each HRU and Fan Coil Unit.
- Keys
    - 3 x Fishtail (emergency lighting)
    - 2 x Distribution Board locks (per DB)

2.0 UTILITIES

2.1 ELECTRICITY

An existing electricity supply is provided to the development. The Contractor shall allow to contact the local network operator and arrange for the safe decommissioning and disconnection of this supply.

A new 100A TPN (69kVA) electricity supply shall be provided to the development. The service shall be presented within a dedicated electrical cupboard on the northern façade of the building.

Delta Green have made an initial application to the network operator UK Power Networks. From appointment the Contractor shall take over dialogue with the network operator and progress payment and programming of the works.

It should be noted that PV is proposed to the development. The network operator, UK Power Networks, shall be made aware of on-site generation and include for all necessary export capacities.

A separate UKPN supply is provided in close proximity to the building. This electricity supply powers esplanade lighting and a concessions stand. Due to the close proximity of this supply to the existing toilet block, to be demolished, the Contractor shall allow to liaise with UKPN to disconnect this existing supply. The Contractor shall liaise with UKPN to provide a temporary builderswork supply (TBS) that will maintain power to lighting and the concessions stand for the duration of the works. It is proposed that the TBS will be located adjacent to the existing kiosk concesisons immediately adjacent to the existing toilet block. Once the building works are complete a new sub-main cable shall be provided from the new building to power existing lighting and concessions stand. The Contractor shall allow for a torpedo joint or similar to joint existing below ground cabling with new.

2.2 GAS

No gas supply required to the development.

2.3 WATER

The Contractor shall arrange for South East Water Utilities to undertake procurement and installation of 2 no new metered domestic incoming cold water mains from their networks. The existing mains water connection is insufficient for the requirements of the new development so will need to be upgraded.

The 1no existing mains shall be decommissioned as part of the strip-out works.

The new incoming cold water mains shall be extended into the building terminating with an isolating valve, double check valve, and water meter.

The supply shall be provided as scheduled in the following table, to be checked as part of the design process:

Location	Incoming Mains Cold Water
Cafe	35mm Ø Cu / 32 mm Ø MDPE
WC Area	28mm Ø Cu / 32 mm Ø MDPE

Initial applications have been made to South East Water.

2.4 TELECOMMUNICATIONS

A new BT Openreach service shall be provided to the development.

Delta Green have registered the scheme on the Developer Portal with BT Openreach. The Contractor shall be responsible for progressing works with BT upon being appointed.

3.0 MECHANICAL SERVICES

3.1 MECHANICAL INSTALLATION – GENERAL

The requirements of the mechanical services for the project are as outlined below and are identified in greater detail on the accompanying Delta Green drawings and NES document.

This Specification details the works associated with the provision of new mechanical services to serve the new development. The Contractor is to supply, install, commission, set to work and provide client demonstrations for all systems detailed within this Specification.

Access panels shall be provided to all mechanical equipment and valves in line with manufacturers recommendations.

The Contractor is to produce installation drawings for approval by the design team for all services described within this Specification.

The Specification may be summarised as follows:

- Plant and Distribution Philosophy
- Incoming Mains Cold Water Supply
- Cold Water Services
- Domestic Hot Water Services
- Electrical Heating Installation to Changing Places
- VRF Heating to Café Area
- Automatic Controls Installation
- Above Ground Drainage
- Mechanical Ventilation Installation
- Training
- Builder's Work
- Inspection and Testing
- Working Drawings, Record Drawings, Operation & Maintenance Manuals, Building Log Book, Building User Guide
- 12 Month defects period
- Seasonal Commissioning

The mechanical installation shall fully comply with all current British Standards and Regulations, Local Authority requirements.

3.2 STRIP-OUT WORKS

The Contractor shall decommission and strip out existing redundant services within the existing Building. It is the Contractor responsibility undertakes a full building survey to ascertain the works required. Should there be any doubt as to whether equipment is redundant the Contractor shall notify the Contracts Administrator (CA) for further clarification.

The strip-out works shall include, but not necessarily limited to;

- Existing heating emitters, pipework and associated equipment.
- Existing ventilation plant, ductwork, diffusers and associated equipment.
- Existing domestic water services pipework and associated equipment.
- Existing above ground drainage and associated equipment.

3.3 RAINWATER PIPEWORK

The method of removing the rainwater from the roof and transporting it to the underground drainage system shall be as designed and specified by the Architect. Rainwater pipework installed from roof outlets or gutters to connection to below ground drainage shall be installed by the Contractor. The installation shall comply with the pipework manufacturer's requirements as well as relevant current British standards and Building Regulations. The Contractor shall be responsible for coordinating the pipework installation on site with other installed services. The contractor shall ensure that the design, installation, commissioning and maintenance of the system comply with the manufacturer's instructions and recommendations. For specific performance requirements and outlet locations for the rainwater system refer to the project Architect.

Any internal rainwater pipe is to be airtight and all joints should be watertight, to compensate for thermal movement only pipes and fittings with flexible jointing must be used within the building. Internal rainwater pipes should be tested to withstand a constant air pressure of 38mm water gauge for three minutes. For specific performance requirements, materials and outlet locations for the rainwater system refer to the project architects' drawings.

3.4 FOUL DRAINAGE

The contractor shall provide all new above ground foul water drainage serving WC's, WHB, sinks together with condensate drainage from mechanical equipment, and shall connect into the underground foul drainage system, as indicated on the drawings. The materials to be used shall be PVC(U) for both vertical soil pipe and for the small diameter waste pipes and horizontal runs.

Within the WC area all pipework shall be concealed within the walls, as far as practically possible – to prevent damage by vandalism.

Where there are high temperature discharges from appliances (Water Heater Pressure Relief) metallic laterals shall be utilised, which are to be formed in copper. These shall be of a length / configuration to allow for the temperature to degrade to the operating temperature of the PVC-U system before being discharged into it.

Where temperature has not degraded sufficiently prior to connection with the stack this shall also be metallic to the below ground connection. Metallic Stacks shall be formed in Cast Iron, being of Ensign by Messrs Saint Gobain or equal and approved or if preferred the stack can be formed in Copper.

Where pipework passes through fire compartments firebreak sleeves shall be fitted.

All new soil and waste systems shall comply with the requirements of BS EN 12056, Building Regulations and the Local Authority requirements for all above and below ground drainage work. All new waste pipework shall be of a suitable size and fall, for the appliances connected and appliance use, and shall be installed in accordance with the requirements of the Scope of Works and British Standards.

All pipework shall be provided in the manufacturer's standard lengths. Pipework and fittings shall be properly stored and protected on site, in accordance with the manufacturer's recommendations. Plastic pipe and fittings shall be fully protected from the sun.

Jointing rings, couplings and adaptors, shall be of types recommended by the manufacturer of the pipes being jointed. Rubber joint rings shall be stored in their delivery bags and not exposed to sunlight.

Where un-plasticised PVC (uPVC) pipework and fittings are used in above ground drainage systems, these shall comply with the requirements of BS 4514 and BS EN 1329. They shall be joined by solvent welding as described in BS 4514, with due allowance for thermal expansion being made.

Joints between uPVC pipes and cast iron pipes to BS 416 shall be made using cast iron adaptors incorporating a synthetic rubbing ring seal.

uPVC pipework joints shall be thoroughly cleaned using an approved cleaning solution prior to solvent welding. Only solvent weld cement provided by the pipework and fitting manufacturer shall be used when forming a joint.

All exposed pipework and traps shall be chrome plated.

All pipes shall have the internal burr removed after cutting. Pipework joints shall be thoroughly cleaned prior to solvent welding. Only solvent weld cement provided by the pipework and fitting manufacturer shall be used when forming a joint.

All uPVC pipework in excess of 40mm passing through a fire rated wall or floor shall be provided with an intumescent collar to BS 476. All pipework and collars need to be adequately installed and supported as per manufacturer's instructions. Please refer to Architect's compartmentation drawings to ensure all pipework is suitably protected.

Plastic pipework shall be supported by holderbats of metal or plastic-coated metal screwed to the structure, as required and at the centres recommended in BS EN 12056, except where the pipe is anchored by an expansion fitting.

Access caps shall be fitted at ends of all horizontal pipework, at junctions and changes of direction. Access plates shall be fitted at each floor level immediately above the highest connection, at the foot of each vertical stack and at junctions to horizontal connections to enable the complete disposal system to be internally cleaned and rodded. The Contractor shall liaise with the Contract Administrator to ensure the provision of access panels and hatches where required and that these offer adequate access for future maintenance and repairs.

The following connection details shall be provided to the appliances:-

Appliance	Connections
Water Closet	100m dia. plastic push fit pan connector of an approved type connecting to 100mm dia. UPVC soil pipe.
Wash Basin	32mm dia. 75mm deep seal polypropylene bottle trap, MUPVC waste pipe and anti-syphon pipe (where required)
Sink	40mm dia. 75mm deep seal polypropylene tubular trap MUPVC waste pipe and 32mm dia. MUPVC anti-syphon pipe (where required).
Shower	50mm dia, 75mm deep seal top access trap with grating, 50mm MUPVC waste pipe.

The Contractor shall carry out all tests requested by Local and Statutory Authorities and as outlined in the NES specification on the entire installation and shall supply all necessary clean water, appliances and equipment for this purpose.

The Contractor shall be prepared to carry out any test and make available for inspection, any section of the Works at any time during the progress of the Works or after substantial completion of the Works.

Test Certificates shall be submitted by the Contractor to the person witnessing the test for their signature of approval to the effect that the system satisfied the requirements of the Scope of Works, British Standards and Best Practice.

The Test Certificates shall be provided by the Contractor and shall be required to be completed for all sections of the installation.

Water flow tests shall also be carried out to ensure the system is clear of debris and building material.

For details of the below ground drainage system, refer to details and drawings provided by the project Structural Engineer.

3.5 COLD WATER

The Contractor shall allow for supply, install and commissioning of all new domestic cold water services serving outlets throughout both the café and the WC areas, as indicated on the drawings.

3.5.1 Café Area

The Contractor shall allow to supply, install and commission new domestic cold water services serving the café area of the building. The works include;

- Provisions of new domestic cold water services to all outlets throughout the café area of the building. The intention is to serve outlets with MWS throughout and therefore no storage is proposed. Please note this system will be extended by the tenant as part of their fit out.
- Chlorinate new installation to ensure the system is ready for use. Chemical injections points should be provided as required.

New cold water services shall be extended and brought into the building via long radius easy bend rigid duct, entering the building in MDPE (blue) and transform to copper at low level within the plantroom.

The new cold water main shall be provided with new stop cock, double check valve, pressure reducing valve, drain cock, water meter and inline water conditioner.

All water meters shall be line sized and shall be manufactured by Messrs Elster. The meter shall be complete with pulsed output functionality. The meter shall be certified in accordance to the 'Measuring Implements Directive' to a suitable accuracy.

Elster Metering Limited
130 Camford Way
Sundon Park
Luton
Bedfordshire LU3 3AN
Tel. + 44 1582 846400
E-Mail water.metering@gb.elster.com

The adjustable PRV shall be of the Commercial 315I Series by Messrs Reliance

Reliance Worldwide Corporation (UK) Ltd.
Worcester Road
Evesham
Worcestershire
WR11 4RA
Tel. 0800 389 5931
w: www.rwc.co.uk

For chlorination purposes the Contractor shall install injection points at the building entry to enable chemicals to be injected and sanitise the installation.

To control limescale to the development, the Contractor shall supply and install an electromagnetic water conditioning unit on the system side of the incoming mains water services to the new building.

The system shall be WRAS approved and installed in accordance with all manufacturer's installation instructions. The unit shall comprise of an 110v DC electrical coil for generating the magnetic field, a designed flow path that enables all the water to cross the magnetic field line at an angle of 90 degrees, with PTFE plated body.

The power supply/control box shall have a polarity reversal mechanism to eliminate routine maintenance of the unit, and shall be connected to an isolated 230 volt, single phase, 50Hz electrical supply, provided by the Electrical Services Contractor, with final connection by the Contractor.

The unit shall be as Hydromag or similar approved product.

Hydrotec (UK) Ltd
Hydrotec House
5 Manor Courtyard
Hughenden Avenue
High Wycombe
Bucks HP13 5RE
Tel: (0494) 796040
Fax: (0494) 796049

3.5.2 WC Area

The Contractor shall allow to supply, install and commission new domestic cold water services serving the WC area of the building. The works include;

- Provisions of new domestic cold water services to all outlets throughout the WC area of the building. The intention is to serve outlets with MWS throughout and therefore no storage is proposed.

- Chlorinate new installation to ensure the system is ready for use. Chemical injections points should be provided as required.

New cold water services shall be extended and brought into the building via long radius easy bend rigid duct, entering the building in MDPE (blue) and transform to copper at low level within the plantroom.

The new cold water main shall be provided with new stop cock, double check valve, pressure reducing valve, drain cock, water meter and inline water conditioner.

All water meters shall be line sized and shall be manufactured by Messrs Elster. The meter shall be complete with pulsed output functionality. The meter shall be certified in accordance to the 'Measuring Implements Directive' to a suitable accuracy.

Elster Metering Limited
130 Camford Way
Sundon Park
Luton
Bedfordshire LU3 3AN
Tel. + 44 1582 846400
E-Mail water.metering@gb.elster.com

The adjustable PRV shall be of the Commercial 315l Series by Messrs Reliance

Reliance Worldwide Corporation (UK) Ltd.
Worcester Road
Evesham
Worcestershire
WR11 4RA
Tel. 0800 389 5931
w: www.rwc.co.uk

For chlorination purpose the Contractor shall install injection points at the building entry to enable chemicals to be injected and sanitise the installation.

To control limescale to the development, the Contractor shall supply and install an electromagnetic water conditioning unit on the system side of the incoming mains water services to the new building.

The system shall be WRAS approved and installed in accordance with all manufacturer's installation instructions. The unit shall comprise of an 110v DC electrical coil for generating the magnetic field, a designed flow path that enables all the water to cross the magnetic field line at an angle of 90 degrees, with PTFE plated body.

The power supply/control box shall have a polarity reversal mechanism to eliminate routine maintenance of the unit, and shall be connected to an isolated 230 volt, single phase, 50Hz electrical supply, provided by the Electrical Services Contractor, with final connection by the Contractor.

The unit shall be as Hydromag or similar approved product.

Hydrotec (UK) Ltd
Hydrotec House
5 Manor Courtyard
Hughenden Avenue
High Wycombe
Bucks HP13 5RE
Tel: (0494) 796040
Fax: (0494) 796049

Within the WC area of the building, which is generally unheated, all cold water pipework will be trace heated for frost protection. Self-regulating trace heating tape shall provide 10 W/m. The tape shall be by Messrs Raychem or equal and approved, being of their Winterguard System.

Raychem / KSM Limited
Unit 2 Eldon Road Industrial Estate,
Attenborough,
Nottinghamshire,
NG9 6DZ

Tel: 0115 968 3544
Fax: 0115 922 9500
Email: sales@traceheating-cables.co.uk

Where used it shall be installed below the insulation. The presence of trace heating, below the insulation shall be clearly identified.

Within the WC area all pipework shall be concealed within the walls, as far as practically possible – to prevent damage by vandalism.

3.5.3 General

All pipework and fittings shall be supplied, installed and commissioned in accordance with the NES specification.

All pipework and fittings shall be supplied, installed and commissioned in accordance with the NES specification. Domestic water services shall be, generally, installed in copper tube BS EN 1057 Type R250 with end feed capillary fittings to BS EN 1254. The system must be WRAS approved.

All pipework where exposed in view shall be installed in chrome plated copper tube pipework. Exposed unfinished copper tube pipework shall not be accepted in any instance.

All pipework shall be supported adequately and thermally insulated where concealed within ceiling voids and pipe casings in accordance with the requirements of the NES specification. Surface run visible pipework shall be painted with primer/undercoat and at least two finishing coats in a colour to be agreed prior to installation.

The use of dissimilar material where they are liable to cause corrosion shall be avoided.

Where pipework passes through walls, floors or ceilings, tubular pipe sleeves of a non-combustible material compatible with the pipework shall be fitted. The internal diameter of the sleeve shall, except where necessary to allow for expansion and contraction or where otherwise specified, not exceed the outside diameter of the pipework by more than one pipe size and shall project 3mm beyond the finished surfaces.

Automatic Flow Limiting Servicing Valves will be provided to sink and WHB connections. These will be of the Type AFL by Messrs Arrow Valves or equal and approved. The AFL cartridges shall be selected in accordance with the BREEAM requirements under water efficiency.

All new installed pipework should be insulated in accordance with the requirements of BS 6700 and BS 5422 all joints shall be taped and all services identified in accordance with BS 1710. Cold water pipework insulation shall be vapour sealed. All joints shall be taped and all services identified in accordance with BS 1710. The insulation shall preferably be foil-faced Phenolic Foam – complete with internal coating suitable for installation on copper pipework. The insulation shall be installed by an insulation specialist unless the mechanical contractor can prove his competence to the satisfaction of the contract administrator / services engineer. The specialist contractor shall present a proposal for agreement prior to confirmation of order, including insulation material and finish.

On completion, the Contractor shall clean all completed pipework, fittings, support steelwork and brackets and make good thermal insulation in accordance with the NES specification.

All exposed and insulated pipework shall be finished in Stucco Embossed Aluminium Sheet to provide mechanical protection.

The Contractor shall use a water treatment Specialist Contractor for the analysis, design, supply, installation and operation of any system cleaning and chemical treatment process as Goodwater Limited (T: 01189 735003) or equal and approved.

The Contractor shall ensure the water treatment and pipe cleaning processes comply with statutory authority, COSHH Regulations and health and safety requirements.

Before any newly installed cold water mains, rising mains, storage tanks, cold water down services and hot water services pipework systems are brought into use for domestic purposes, they shall be disinfected by chlorination executed by the Water Treatment Specialist, in accordance with BS 6700. This shall be undertaken immediately prior to handover (within 5 days).

The Contractor shall also test the quality of the mains water system for the following;

- Clostridia
- E.coli
- Enterococci
- Legionella
- Pseudomonas
- Total Coliforms
- Colony Counts

This shall be undertaken prior to handover and test results provided as part of the handover documentation. Should anything any test fail, the system shall be re-disinfected and re-tested until negative samples are achieved. No additional claims shall be accepted to this regard.

On completion, the Contractor shall clean all completed pipework, fittings, support steelwork and brackets and make good thermal insulation in accordance with the NES specification.

3.6 HOT WATER

The Contractor shall allow to supply, install and commission new domestic hot water services serving the refurbished areas and extension, all as indicated on the drawings.

3.6.1 Café Area

The Contractor shall allow to supply, install and commission new domestic hot water services serving the café area of the building. The works include;

- Provisions of new domestic hot water services to all outlets throughout the cafe area of the building. Please note this system will be extended by the tenant as part of their fit out.
- Provisions of new electric point use instantaneous water heaters to provide hot water to the building, in the location indicated on the drawings
- Chlorinate new installation to ensure the system is ready for use. Chemical injections points should be provided as required.

The MWS shall be extended to serve unvented electric 'point of use' instantaneous water heater. The water heater is located in the store as indicated on the drawings.

The unvented hot water heaters and all pipework must to be insulated against heat loss and heat gain; the insulation must be installed as per the manufacturer's instructions. These shall be supplied and installed completed with the necessary means of expansion and safety valves.

The electric point of use water heaters shall be of the Multipoint Instantaneous Range by Messrs Heatrae Sadia, or equal and approved.

Heatrae Sadia Heating
Hurricane Way
Norwich
Norfolk
NR6 6EA
Tele: (0)1603 420100
Fax: 0844 871 1543
E-mail : sales@heatraesadia.com

www.heatraesadia.com

The MWS fill connection to water heater shall be provided with a pressure relief valve

Where unvented water heaters 'blow down' into a tundish the pipework top the stack must be formed of copper, or a material suitable for the temperature of the discharge.

3.6.2 WC Area

The Contractor shall allow to supply, install and commission new domestic hot water services serving the WC Area The works include;

- Provisions of new domestic hot water services to all outlets throughout the WC area of the building.
- Provisions of new electric point use water heaters to provide hot water to the building, in the location indicated on the drawings.
- Chlorinate new installation to ensure the system is ready for use. Chemical injections points should be provided as required.

The MWS shall be extended to serve unvented electric 'point of use' instantaneous water heater. The water heater is located in the WC panelling indicated on the drawings.

The unvented hot water heaters and all pipework must to be insulated against heat loss and heat gain; the insulation must be installed as per the manufacturer's instructions. These shall be supplied and installed completed with the necessary means of expansion and safety valves.

The electric point of use water heaters shall be of the Multipoint Range by Messrs Heatrae Sadia, or equal and approved.

Heatrae Sadia Heating
Hurricane Way
Norwich
Norfolk
NR6 6EA

Tele: (0)1603 420100
Fax: 0844 871 1543
E-mail : sales@heatraesadia.com

www.heatraesadia.com

The MWS fill connection to water heater shall be provided with pressure relief valve.

Where unvented water heaters 'blow down' into a tundish the pipework top the stack must be formed of copper, or a material suitable for the temperature of the discharge.

Within the WC area of the building all water pipework will be trace heated for frost protection. Self-regulating trace heating tape shall provide 10 W/m. The tape shall be by Messrs Raychem or equal and approved, being of their Winterguard System.

Raychem / KSM Limited
Unit 2 Eldon Road Industrial Estate,
Attenborough,
Nottinghamshire,
NG9 6DZ

Tel: 0115 968 3544
Fax: 0115 922 9500
Email: sales@traceheating-cables.co.uk

Where used it shall be installed below the insulation. The presence of trace heating, below the insulation shall be clearly identified.

Within the WC area all pipework shall be concealed within the walls, as far as practically possible – to prevent damage by vandalism.

3.6.3 General

All pipework and fittings shall be supplied, installed and commissioned in accordance with the NES specification.

All pipework and fittings shall be supplied, installed and commissioned in accordance with the NES specification. Domestic water services shall be, generally, installed in copper tube BS EN 1057 Type R250 with end feed capillary fittings to BS EN 1254. The system must be WRAS approved.

All pipework shall be supported adequately and thermally insulated where concealed within ceiling voids and pipe casings in accordance with the requirements of the NES specification. Surface run visible pipework shall be painted with primer/undercoat and at least two finishing coats in a colour to be agreed prior to installation.

The insulation shall preferably be foil-faced Phenolic Foam – complete with internal coating suitable for installation on copper pipework. The insulation shall be installed by an insulation specialist unless the mechanical contractor can prove his competence to the satisfaction of the contract administrator / services engineer. The specialist contractor shall present a proposal for agreement prior to confirmation of order, including insulation material and finish.

The use of dissimilar material where they are liable to cause corrosion shall be avoided.

Thermostatic mixing valves shall be installed on the hot water supply to all wash hand basin outlets. These shall be as Horne Engineering Limited type H15-11B or equal and approved, manufactured with a body of DZR brass, suitable for a maximum operating pressure of 10 bar, and factory pre-set to 41°C.

Horne Engineering Ltd
PO Box 7
Rankine Street
Johnstone
PA5 8BD
T: 01505 321455
E: sales@horne.co.uk

Thermostatic mixing valves shall be complete with check valves, flow regulator, strainers, swivel inlet connections and compression fittings for 15mm diameter copper pipework.

All thermostatic mixing valves shall be installed in accordance with the manufacturers' recommendation and commissioned in accordance with Water Regulations.

Within the Accessible WC areas pipework (hot and cold) shall be insulated and shall be contained within a proprietary pipework boxing system. Exposed pipework within this instance will not be accepted. These shall be as MX range by Messrs Pendock or equal and approved;

Pendock Ltd
Alumasc Interior Building Products
Halesfield
19 Telford Shropshire
TF7 4QT
Tel: +441952580590

Email: sales@pendock.co.uk

Automatic Flow Limiting Servicing Valves will be provided to sink and WHB connections. These will be of the Type AFL by Messrs Arrow Valves or equal and approved. The AFL cartridges shall be selected in accordance with the BREEAM requirements under water efficiency.

Where pipework passes through walls, floors or ceilings, tubular pipe sleeves of a non-combustible material compatible with the pipework shall be fitted. The internal diameter of the sleeve shall, except where necessary to allow for expansion and contraction or where otherwise specified, not exceed the outside diameter of the pipework by more than one pipe size and shall project 3mm beyond the finished surfaces.

On completion, the Contractor shall clean all completed pipework, fittings, support steelwork and brackets and make good thermal insulation in accordance with the NES specification.

All new installed pipework should be insulated in accordance with the requirements of BS 6700 and the NES specification all joints shall be taped and all services identified in accordance with BS 1710.

In all other situations proprietary axial expansion compensators shall be provided, selected and installed strictly in accordance with the Manufacturer's recommendations.

All expansion compensators and rubber bellows shall be manufactured by Engineering Appliances Ltd.

The Contractor shall allow within the tender for all provision including suitable anchors and all pipework guiding and expansion movement facilities.

The Contractor shall use a water treatment Specialist Contractor for the analysis, design, supply, installation and operation of any system cleaning and chemical treatment process as Goodwater Limited (T: 01189 735003) or equal and approved.

The Contractor shall ensure the water treatment and pipe cleaning processes comply with statutory authority, COSHH Regulations and health and safety requirements.

Before any newly installed cold water mains, rising mains, storage tanks, cold water down services and hot water services pipework systems are brought into use for domestic purposes, they shall be disinfected by chlorination executed by the Water Treatment Specialist, in accordance with BS 6700. This shall be undertaken immediately prior to handover (within 5 days).

The Contractor shall also test the quality of the hot water system for the following;

- Clostridia
- E.coli
- Enterococci
- Legionella
- Pseudomonas
- Total Coliforms
- Colony Counts

This shall be undertaken prior to handover.

3.7 ELECTRIC HEATING

The Contractor shall allow to supply, install and commission new heating system serving the WC area, all as indicated on the drawings.

The works include;

- Provisions of new electric radiant panels to changing places area.

The electric radiant panels shall be finished in RAL 9016 (White) in epoxy polyester powder coating (to be verified and confirmed with the Architect prior to placing the order).

The electric radiant heaters shall be as the EnergoCassette range by Messrs Frenger Systems or equal and approved.

Frenger Systems Ltd
Riverside Road
Pride Park
Derby
DE24 8HY
Telephone: +44 0 1332 295 678 / Email: sales@frenger.co.uk

The Contractor shall be responsible for ensuring that all mounting supports and brackets are fixed securely to the walls.

The electric radiant panels shall be supplied complete with the manufacturer's controllers to provide timeclock and thermostatic controls.

The Contractor shall be responsible for coordinating the electric radiant panels with the other mechanical and electrical equipment, as required.

An electrical supply shall be derived from a local isolated power supply, by the Electrical Services Contractor.

3.8 AIR CONDITIONING

The Contractor shall allow for the design, supply, installation, testing and commissioning of all new air conditioning system to serve the café area of the building.

The air conditioning system shall comply with the design criteria section and relevant guidance and requirements within British Standards, Building Regulations, CIBSE publications and Institute of Plumbing publications. All new air conditioning system shall be installed in accordance with the requirements of the NES specifications that shall supplement this document.

Generally, the proposed works can be summarised as follows;

- Provisions of new VRF air conditioning system to serve the cafe and kitchen area.

As a cost saving the constractor may identify the use of a Multi-split type system.

The VRF system is based on a 3-pipe technology with heat recovery, with refrigerant circuits from the external condenser to indoor solenoid valve box and water circuits from the solenoid valve box to indoor fan coils units. Fan coil units shall be served by solenoid valve boxes (BS) boxes for refrigerant changeover to enable simultaneous heating and cooling where required. These BS boxes shall be located in the ceiling voids within the core areas so as not to create noise within quieter areas. 2 No. additional ports shall be provided on the solenoid boxes to allow for future tenant fit out.

All pipework shall be insulated in accordance with the specification. The contractor shall carry out the installation of the new refrigerant pipework, power and controls, interconnecting electrical installation and commissioning.

The VRF system shall be provided with a master controller which will be located within the kitchen area. The BEMS shall be linked to the air conditioning system to monitor for faults.

The VRF system shall be interfaced with a local room controller(s). The VRF supplier shall provide the controller which will including time clock controls and system controllers. The controller will require 7 points to control each indoor unit:

- On / off
- Fan speed
- Mode
- Louvre
- Temperature
- Return air sensor
- Fault code

The equipment manufacturer shall be responsible for the manufacture of the compressor, refrigerant oil and refrigerant used within the system to maintain integrity of design and optimise efficiency and reliability of equipment.

The outdoor condenser units shall be located on roof of the building, subject to acoustic requirements.

Systems of this type generally operate with, ideally Refrigerant HFC R32, but should this not be available at the point of the installation then HFC R410a shall be accepted. The refrigerant shall be a zeotropic blend constituted

of a maximum of two different refrigerants providing a maximum temperature glide of less than 0.17K to avoid fractionation problems.

Refrigerant leak detection systems will be provided as required.

The equipment manufacturer shall be fully certified and registered to comply in the areas of CE, Eurovent, ISO9001 and ISO14001. A Certificate of Conformity shall be supplied with each machine.

All equipment will be manufactured by Daikin UK (or equal and approved):

Daikin UK
The Heights
Brooklands
Weybridge
Surrey
KT13 0NY

All equipment shall be run tested in accordance with the following procedures prior to leaving place of manufacture.

- A choke test carried out on the refrigerant piping to detect obstacles
- The pipework shall be tested to 38bar.
- Electronic leak testing shall be carried out to ensure maximum system refrigerant containment.
- System vacuum test to 2 Torr.
- Refrigerant test to within 0.3%.
- Electrical tests shall include flash testing at 1440V AC to ensure that current leaks above 5mA are detected, megger test at 500V DC to ensure resistance levels are above 10 mega Ohm and earth continuity tests.

Outdoor units

The outdoor units shall be air-cooled type incorporating heat exchanger coils manufactured from copper tubes and aluminium fins, factory treated to reduce the effect of atmospheric corrosion due to the saline environment. The unit casing shall be manufactured from (70µ) polyester powder coated baked enamel finish sheet steel in order to have a high corrosion resistance and to protect against salt laden environment close to where the units may be installed. The colour shall be manufacturer's standard 'Ivory White'. The air outlet shall have plastic coated wire guards.

The units shall be complete with electronic expansion valve(s), oil separator(s), high pressure switches, inverter driven fan motors, safety thermostat, over current relay, inverter overload protection, fuses, necessary solenoid

valves, liquid shutoff valves, gas line shut off valves, short re-cycling guard timer and all necessary sensors for optimized, safe and trouble free operation.

The access to the internal components for maintenance purposes shall be by removable panels.

All refrigerant connections both internal within the unit and the external connections to the indoor units shall be brazed. Flared or mechanical connections will not be acceptable on the outdoor unit.

The external condensers shall be positioned at ground floor level within a plant enclosures – to suit the acoustic conditions. The units shall be mounted via suitable support system appropriate for the floor construction. The supported system anticipated for each enclosure are as follows;

- Plant enclosure equipment should be supported via proprietary uni-strut support system with large weight spreading pads by Messrs Big Foot Systems to lift the units off the ground. The units are to be supported on this type of system via anti-vibration mounts.

Indoor units

Within the Offices ceiling mounted (semi) recessed units shall be provided and installed.

The ceiling mounted unit casing shall be manufactured from heat resistant plastic. The casing colour shall be Ivory White. The back plate and the support frames shall be manufactured from galvanised steel plate.

The fan shall be multi blade cross flow type, statically and dynamically balanced to ensure low noise and vibration free operation.

The heat exchanger coils will be manufactured from copper tubes and aluminium fins. It shall have electronic expansion valve to control refrigerant flow rate in response to the load variation in the conditioned space. The expansion valve shall be controlled by an integral computerised PID control system to maintain correct room temperature.

The air filters shall be incorporated within the unit and shall be washable resin net type. A spare set of filters shall be provided and left on site.

Electrical supply shall be derived from a local isolated power supply, by the Electrical Services Contractor, with final power connection by the Contractor.

Controls

The Contractor shall design, supply and install central control system to each floor (Ground to Second) to control the air conditioning.

The controls shall be provided with necessary link/interface to allow the BEMS to monitor the system for faults and flag alarms, as required.

The system shall be web-addressable such that the tenant may integrate and alter parameters remotely.

Within each space hardwired wall mounted controllers shall be provided to control the indoor units.

Refrigerant pipework

The pipe work shall be of refrigerant quality copper to BS2871 Part 2, ASTM 280, DIN1754/8905 half hard tempered. Soft tempered pipe work may be used where the pipe diameter is 1/4" or 3/8". Long radius bends shall be formed using pipe bender. The use of short radius pre formed bends and elbows should be avoided to minimise pressure drop and possibility of leaks.

Oxygen free nitrogen shall be passed through the pipework during all brazing of joints to prevent the formation of oxidation scale on the inside surface of the pipework.

All pipe work shall be clean, de-hydrated and sealed. Pipe work shall be stored under dry conditions. Any pipe work found to be stored without the end caps should be rejected. Where sections are cut from a new coil any remaining lengths must be re-sealed. During the installation if the system has to be left unattended for any purpose whatsoever, the openings in the systems must be securely sealed.

Pipe work fittings for branching off to indoor units must utilise headers or joints as supplied by the manufacturer. No other fittings are acceptable. The positioning of these joints shall be strictly in accordance to the manufacturer's specification.

All pipe work shall be insulated with Armaflex Class-0 type insulation, 13 mm thick as manufactured by the Armstrong Industries. The joints or headers shall be insulated with the pre formed insulation supplied with these fittings. Insulation exposed to atmospheric conditions shall be protected with two coats of special Armstrong NH insulation paint. All insulation joints shall be made using Armaflex adhesive and care should be taken that the every part of insulation is sealed to maintain a vapour barrier. The external pipework shall also be mechanically protected by inverted galvanised cable tray (with small apertures) to prevent seagull damage.

The pipe work must be supported through its entire length according to good refrigeration practice. The intention is that all pipework will be routed and supported on cable trays. However the brackets must not be positioned directly on any joints or headers. On horizontal pipe work the bracketing should be over the insulation to allow pipe movement due to contraction and expansions. The vertical pipe work shall be bracketed at no more than 1000 mm centres. The horizontal pipe work shall be bracketed at no more than 1500 mm centres.

The pipe work layout and the pipe sizing shall be according to the Installation guides supplied by Daikin with the units.

All pipework where exposed to view in occupied spaces shall be boxed in or concealed within an appropriate pipework boxing system. These shall be by Messrs Pendock or equal and approved;

Pendock Ltd

Alumasc Interior Building Products
Halesfield
19 Telford Shropshire
TF7 4QT
Tel: +441952580590
Email: sales@pendock.co.uk

Thermal insulation

All Refrigerant pipework shall be insulated with slip-on close cell elastomeric pipe insulation, with a fire performance rating class "O" of the Building Regulations, having a wall thickness of not less than 13mm. After commissioning, all joints to be properly sealed to provide an adequate seal and clearly marked for ease of identification.

Where required, external insulation shall be protected within a suitable enclosure to encase the piping to reduce the effects of bird, vermin UV and environmental attack. Where clipped externally, outside of casings the armaflex insulation shall be completed with two coats of armafinish paint to minimise UV degradation. The external pipework (and insulation) shall also be mechanically protected by inverted galvanised cable tray (with small apertures) to prevent UV degradation and bird damage.

Condensate pipework

Condensate pipework shall be run in copper tube to BS EN 1057, thermally insulated for the first 2 metres adjacent to each fan coil unit. It shall be regularly and adequately supported in accordance with the requirements of the NES specification and laid to a continuous fall at a minimum gradient of 1 in 100. Condensate pipework shall generally run above the false ceilings supported from new tray containment. Were it connect directly to foul drainage the new pipework shall be complete with a self sealing waste valve as Hepworth type HepVo and all necessary fittings to form a transformation.

Fittings shall be end feed capillary or compression fittings where necessary, with tees provided in place of bends to allow access for cleaning. Traps shall be provided at each indoor unit with a minimum water depth of 1.5 times negative pressure on inlet and 0.5 time's negative pressure at discharge.

In instances where it shall be not possible to run the condensate via gravity means due to site restrictions or extended distances to local soil pipes, a peristaltic condensate pump shall be provided to pump the condensate discharge to the local soil pipe. The condensate pump shall be by Messrs Aspen Pumps and shall be selected from their peristaltic condensate pump range compatible with the selected AC units.

All condensate pumps will be manufactured by Aspen Pumps Ltd (or equal and approved) and be supplied by:

Aspen Pumps Ltd,
Apex Way
Hailsham

East Sussex
BN27 3WA
Tel No: 01323 848842

Commissioning and testing

Commissioning shall be carried out by a Daikin trained engineer.

The entire refrigeration system shall be pressurised with Nitrogen to 38 bar for a period of 24hours.

Leak testing shall be carried out with a calibrated electronic leak detector, or similar if the system fails to hold pressure within testing period.

Upon completion of pressure test the pressure shall be released and vacuum pump installed on the system to remove air and moisture from the system. The system shall be evacuated to –101.1kPa (-758mmHg, 2 torr) and held for a period of 2 hours with the vacuum pump switched off.

Refrigerant should be charged to the liquid pipe in its liquid state to ensure that the refrigerant composition is assured. The refrigerant charge shall be calculated to the system requirements and in accordance with Daikins Design and Installation Instruction booklet.

Maintenance log book

For systems with an installed refrigerant charge in excess of 3 kilograms, the Contractor shall prepare a maintenance log book relating to the new DX installation and shall record actual installed refrigerant type and charges in accordance with the requirements of the F Gas Regulations. This shall be maintained on site and kept up to date by the owner and shall be kept ready for inspection by a competent inspector at any time.

3.9 GENERAL VENTILATION

The Contractor shall allow to supply, install and commission new ventilation system serving the building, all as indicated on the drawings.

Mechanical ventilation shall be provided to both buildings, all as indicated on the drawings.

3.9.1 Café Area

Ventilation to the café area will be provide via openable windows to satisfy overheating and building regulations. The tenant will provide kitchen ventilation as part of their fit out based on the requirement of their business. A space for the ventilation plant is allocated at roof level (above the kitchen).

3.9.2 Kitchen Extract Ventilation

The kitchen extract system shall utilise a high temperature extract fan located on the roof, directly above the kitchen area. The kitchen area shall be provided with variable speed extract.

The kitchen extract system shall discharge air above roof level.

The kitchen extract air handling plant shall be of the Squif Inline Fan range manufactured by Messrs Nuaire or equal and approved.

Nuaire Limited
Western Industrial Estate
Caerphilly
CF83 1NA
Tel: 029 2085 8200
e: info@nuaire.co.uk

The fan shall be installed with inverter control for accurate commissioning of the system and adjustment of fan speed. The fan shall be brought on by a manual switch on a panel provided for the 'chef'. The panel will also control the fan speed.

Although the final design will be developed, based on the final selection of equipment, an assumed air change rate of 60ACH has been utilised to size the ductwork. The final duties shall be based on details provided by the Catering Specialist using the methods described in HVCA DW/172 once the tenant has agreed theor layout.

Generally, the kitchen air shall be extracted through a canopy hood and baffle filters and exhausted via galvanised steel ductwork to the extract fan and onwards to the discharge point located on the roof. The canopy will be installed as part of the tenants fit out.

The discharge of the extracted air from the kitchen is 1000mm above the roof ridge of any building within 20 m of the building housing the commercial kitchen.

Extract ductwork shall be shall be complete with all necessary access hatches for cleaning. Exhaust air shall pass through filters provided within the canopy (by the tenant) before discharging vertically, complete with atmosphere side sound attenuators and conical exhaust terminals in accordance with DW/172.

All internal surfaces of the extract ductwork shall be accessible for cleaning.

The kitchen shall be provided with make-up supply air via the openable doors and windows – subject to the tenant final details.

Room side sound attenuators shall be fitted to the ventilation ductwork to meet the requirements of the Acoustic Consultant's recommendations.

Ductwork

Kitchen extract ductwork shall be installed in full compliance to HVCA Specifications DW/144 and DW/172. The ductwork shall be rectangular with access cleaning doors provided in horizontal runs of ductwork at no less than 3 metre intervals and at changes of direction.

All cleaning doors on horizontal ductwork shall be mounted on the side of the ductwork. Cleaning doors shall be co-ordinated with corresponding builderswork access doors in stud work around the extract duct.

The kitchen exhaust ductwork shall be fire rated to avoid the need to install fire dampers.

The unit shall be provided with the manufacturers highest level of coastal protection to ensure the longevity of plant equipment in the highly saline environment.

Kitchen Extract Filters

To be incorporated as part of the tenants fit out.

3.9.3 WC Area

The Contractor shall allow to supply, install and commission new ventilation system serving the WC area of the building, all as indicated on the drawings.

A heat recovery unit will operates under the dictates on the manufacturer's Ecosmart controller unit with touch screen capabilities (with the control unit being located in the store) to the changing places area. This shall allow the system to operate under timeclock controls together with functions for trickle mode, boost and purge modes. This will provide the client with flexibility to house the space are utilised. Final settings shall be verified and confirmed with the client.

The heat exchanger units shall be either the OPUS XBOX Heat Recovery Units by Messrs Nuaire or equal and approved.

Nuaire Limited
Western Industrial Estate
Caerphilly
CF83 1NA
Tel: 029 2085 8200
e: info@nuaire.co.uk

Fresh air shall be drawn in through a fresh air intake louvres, to the ceiling void mounted units and shall be filtered and pre-heated by means of the crossflow plate heat exchanger before being ducted via a system of rigid galvanised ductwork into the spaces served by the ventilation system. Supply air temperature will be maintained by means of off temperature sensors from the heat exchanger to a maximum of 21°C [adjustable] and a minimum

of 18° [adjustable] with final temperature treatment to each space being carried out by the local air conditioning units – heating or cooling.

The horizontal format unit shall be manufactured from Aluzinc corrosion resistant steel, with 25mm double skinned infill panels and extruded aluminium frame, giving extremely low noise levels. The unit shall be mounted in accordance with the acoustic engineers details.

The unit shall include the following items:-

- A cross flow exchanger block with automatic summer bypass
- Condensate drip tray and 22mm drain connection
- Supply and extract filters (G4 grade pleated filters)
- Integral infinitely variable speed controls with maximum adjustment for accurate commissioning, run on timer and fascia mounted failure indication
- Interface connection for Ecosmart sensors/enablers, dampers and BEMS

The unit shall be constructed with removable panels allowing full maintenance access from the side or as required.

The acoustically lined low noise unit shall be fitted with an integral control, to facilitate the following energy saving and operational functions integrally installed within the fan unit, all components shall be pre-wired and fitted by the manufacturer:

- Background, boost and purge speed adjustment / setting
- Integral fan failure indication
- S/L terminals for remote switching
- Integral heat exchange frost protection

The units shall be provided with an interface from the fire alarm system to automatically shut down the ventilation system in event of an alarm.

The complete fan unit shall be provided with manufacturers warranties of at least 5 years.

The unit shall have low energy, high efficiency EFF2 motor assemblies with sealed for life bearings. The impellers shall be directly driven and of high efficiency backward curved design. The heat exchanger block will be of high efficiency.

Atmosphere side, room side and cross talk sound attenuators shall be fitted to the ventilation ductwork to meet the sound attenuation requirements of the Acoustic Consultant's recommendations. These shall be provided as a package for the heat recovery units.

Fresh air intake, supply air, return air ductwork (from the space) and exhaust discharge shall all be thermally insulated in accordance with the BS 6700.

To WC areas and cleaner's cupboards will be of an extract only configuration.

Mechanical extract ventilation capable of providing air changes per hour to each space served, as identified earlier in the scope of works.

All fan units shall be manufactured by Nuaire or equal and approved;

Air will be draw from the respective space via a egg crate grilles or ceiling mounted air valve. Galvanised spiral ductwork will convey air to the extract fan which will discharge to outside.

All fans shall draw via a balanced extraction points. It is the intension that no VCD's are therefore required but the fan is commissioned via an integral speed controller. However, where this is no possible VCD's shall be provided for balancing purposes.

All unheated WCs located within the development shall be provided with mechanical extract ventilation. These spaces shall operate in 'trickle' mode (continuous) and provide 'boost' ventilation under the dictates of a room occupancy sensor and remain on 'boost' for 15 minutes [adjustable] after the occupancy. The fan unit shall be switched by integral PIR or via the lighting PIR sensor.

A local power supply will be provided to each of the fan which will be switched by their integral PIR or the lighting PIR sensor.

The fans units shall be provided with manufacturer's speed controller for ease of commissioning.

All fan units shall come with 5 years parts and labour warranty.

The unit shall be acoustically lined and manufactured from heavy gauge, corrosion resistant aluzinc and tested to leakage class 'L2'. The unit will be manufactured to provide a low height solution to enable it to be located in low depth ceiling and floor voids. For ease of installation the unit shall be supplied complete with 4 mounting brackets for inclusion into a drop rod mounting system.

Impellers shall be of high efficiency, performance and sound optimised backward curved design.

The unit shall be fitted with ErP 2015 rated, low energy, high efficiency IP54 EC motorised fans providing low specific fan powers and stepless speed control without tonal noise generation. Fan/motor assemblies have sealed for life bearings with an anticipated working life of 70,000 hours (L10) and shall be suitable for single phase supply.

The fans shall be provided with the manufacturer's 'Ecosmart' controller and this shall incorporated the following energy saving and operational functions:-

- Integral infinitely variable speed control
- Integral background ventilation commissioning facility
- Integral boost ventilation commissioning facility
- Integral adjustable run on timer
- Integral S/L terminal for boost trigger from remote switch e.g. light switch etc,.

- 4 No. low voltage sockets for interconnection of remote failure indicator

3.9.4 General

The Contractor shall allow for all new ductwork sections required to form a complete installation to be supplied, delivered and erected, complete with all hangers and supports, control and fire dampers, plant, grilles, access doors etc., all in accordance with the NES specification for Sheet Metal Ductwork, DW/144 as published by the HVCA.

Flexible connections shall be provided at all connections onto fans and shall be flame resistant, non-organic flexible sheet secured with flat galvanised steel band to the duct and fixed so that a smooth internal surface is presented to the air flow. No flexible connection shall be more than 300mm long.

Where cross talk sound attenuation is provided, manufacturers shall specify the losses expected under operating conditions. Data shall be derived in accordance with BS EN ISO 7235. The manufacturer's quoted losses shall be derived in accordance with BS EN ISO 7235.

On completion of the installation, the Contractor shall be responsible for commissioning and balancing air flow rates through the systems and proving the performance of the system matches the design. The Contractor shall employ the services of a Specialist Contractor to carry out the testing and commissioning. The specialist shall carry out a proportional balance using the new volume control dampers installed to each main duct and terminal. The final air flow rate and pressure at each fan shall be recorded and submitted to the Contract Administrator for comment.

The Contractor shall detail requirements for access panels to all system components requiring access.

The Contractor shall supply and install smoke dampers to suit the fire strategy, general where ductwork passes main corridor that are main fire escape routes.

The Contractor shall supply and install fire dampers to suit the fire compartments. Fire dampers in ductwork shall generally be mechanical, steel dampers of the folding curtain type. Where intumescent fire dampers are specified, they shall be fixed using galvanised steel guide plate or angles. All gaps around the periphery shall be sealed using intumescent paste or mastic or fire-resistant mortar.

Fire dampers shall be installed in accordance with Building Regulations Approved Document Part B volume 2. Fire dampers shall be tested to BS EN 1366 and shall be classified to BS EN 13501. They shall have an E classification equivalent to, or greater than, 60 minutes to match the fire compartment rating. Fire and smoke dampers shall also be tested to BS EN 1366 and shall be classified to BS EN 13501. They shall have an ES classification equal to, or greater than, 60 minutes to match the fire compartment rating. Fire dampers activated only by fusible links shall not be used for protecting escape routes, which shall be by means of ES classified fire and smoke dampers.

The Contractor shall note the requirement to fix dampers either within the thickness of walls/floors or surface-fixed to walls/floors as shown on the design drawings. The Contractor shall ensure that in a fire, expansion of the ductwork would not push the fire damper through the structure.

The Contractor shall supply and install volume control dampers where indicated on the drawings and where required to balance the systems.

The Contractor shall supply and install all grilles, diffusers and louvres as shown on the drawings and as detailed on the schedules contained within the NES specification. Where the grilles and diffusers are to be located within bulkheads, the Contractor shall ensure that all requirements for the bulkhead are conveyed to the Building Contractor including access requirements. Where installed within a false ceiling, all plenum boxes for grilles and diffusers shall be supported independent of the false ceiling grid and shall be supported from the concrete soffit with suitable drop rod and associated ancillaries.

Fire dampers shall be provided at all compartment walls and the ductwork arrangements shall comply with BS 5588 Pt 9. All Ductwork shall be pressure tested. Ductwork within the building shall not be insulated. Ductwork within the roof plant room shall be insulated and clad in accordance with the NES specification.

All fresh air intake, supply and return air ductwork shall be thermally insulated in accordance with the requirements of the NES specification. Any ductwork exposed at roof level shall be finished in VentureClad 1577CW in grey finish (to be confirmed by Architect prior to installation) as supplied by:

Venture Tape Europe Corp
Units 5-6 Faraday Close
Drayton Fields
Daventry
NN11 5RD

Tel: 01327 876555

Before applying the final finish to the thermal insulation, the Contractor shall ensure that all insulation surfaces are clean and dry and free of dust, grease or silicone. All insulation should be sealed securely, giving an even surface for the finish application by using foil tape to ensure a good vapour seal prior to the finish being applied.

The Contractor shall progressively remove the liner whilst using an applicator to achieve a smooth air bubble free surface to the finish until the entire sheet has been applied. The Contractor shall plan the application so that the edges of the sealing flaps face down and joints have at least a 75mm overlap.

Louvres

Louvres mounted in the external walls, shall be of the type ALA-SO as manufactured by Messrs Schako or equal and approved. These shall be metallic and sized as per the equipment schedules. They shall incorporate fixed rain-repellent blades and vermin screen.

Frame and blades made of anodised natural colour aluminium profiles. Wire mesh grid made of galvanised sheet steel. All fixings shall be concealed.

The louvres shall be painted to non-standard RAL colour. Final colour and finish to be in accordance with architects' specification.

Air Valves

Internally diffusers served by the extract fan units, shall utilise air valves, for both supply and extraction of air. These shall be as SVZ (Supply) / SVA (Return) by Messrs Schako or equal and approved.

Schako
Index House
St Georges Lane
Ascot
Berkshire
SL5 7EU
Tel.: 0 13 44 63 63 89
Fax: 0 13 44 87 46 58
e-mail: richardtyson@schako.uk.com

They shall be of metallic construction comprising a round front frame made of galvanised sheet steel painted to a non-standard RAL colour (colour to be confirmed and verified by the architect) and circumferential cellular seal. With cover on the adjustable valve disc made of galvanised sheet steel, painted to non-standard RAL colour (colour to be confirmed and verified by the architect) for air volume regulation. Counter nut to fix air volume setting and adjustment spindle made of galvanised steel.

Extract air ductwork shall all be thermally insulated in accordance with the requirements of the NES specification.

Plenum

Each diffuser will be provided with a purpose made plenum box. This plenum shall be acoustically and thermally insulated and shall be spherically shaped with a spigot connection, sized to suit ductwork as detailed on the drawings and in accordance with the manufacturer's recommendations. The external finish of the plenum box shall match the ductwork.

All grilles will be fitted with volume control dampers.

Attenuators

Duct mounted attenuator shall be installed to fan units as located on the drawings. The attenuators shall generally match the width and height of the connecting ductwork unless otherwise indicated. Attenuators shall be sized

and selected in accordance with the recommendation of the acoustic consultant recommendations and to suit the associated air handling plant and fan units.

Attenuators will be provided by Messrs Caice or equal or approved;

Caice Acoustics
3 Winnersh Fields
Gazelle Close
Winnersh
Wokingham
RG41 5QS

Tel.: 0118 918 6470

Attenuators shall be of the splitter type with the acoustic fill retained within perforated metal with a melinex or similar lining to prevent the mitigation of fibres.

4.0 ELECTRICAL SERVICES

4.1 ELECTRICAL INSTALLATION – GENERAL

The requirements of the electrical services for the project are as outlined below and are identified in greater detail on the accompanying Delta Green drawings and NES document.

This Scope of Work details the works associated with the provision of new electrical services to serve the new development. The Contractor is to design, supply, install, commission, set to work and provide client demonstrations for all systems detailed within this Scope of Works.

The Contractor is to produce co-ordinated installation drawings for approval by the design team for all services described within this Scope of Works.

The Scope of Works may be summarised as follows:

- Provision of incoming electrical supply
- Provision of switchgear and distribution boards
- Provision of electrical containment
- Provision of small power
- Provision of general lighting
- Provision of lighting controls
- Provision of emergency lighting
- Provision of external lighting
- Provision of mechanical services power
- Provision of fire alarm services
- Provision of CCTV system
- Provision of WC alarm system
- Provision of data outlets structured cabling & ICT infrastructure
- Provision of PV system
- Provision of earthing and bonding
- Provision of lightning protection system

The electrical installation shall fully comply with all current British Standards and Regulations, Local Authority requirements and pertinent European standards in their entirety; this includes the IET Wiring Regulations BS 7671:2018, 18th Edition, incorporating Amendment 1:2020 in addition to all Health Technical Memorandums.

4.2 MAIN POWER SUPPLY

A new electricity supply shall be provided to the development as detailed elsewhere within this document.

Ducting for this new supply shall be installed in accordance with UKPN guidance and specification.

The Contractor shall allow for all on site excavation and reinstatement required to complete the new electricity supply installation.

The Contractor shall liaise with the Client and manage the following agreements, which need to be completed prior to energisation of supply:

- Supply Agreement with a Supplier
- Meter Operator Services Agreement with a Meter Operator
- Connection Agreement with DNO

It shall be the Contractors responsibility to manage the Client and ensure that the aforementioned agreements are in place in co-ordination with the programme.

The Contractor shall ensure that suitable earthing is provided to the development. The Contractor shall ensure that suitable earth leakage protection is provided.

All ducting for DNO cabling shall be twin walled black polyethylene ducting such as Ridgiduct, complying with the current edition of the ENATS specification 12-24.

All trenching works shall be carried out in compliance with DNO specification and best practice guidance.

Underground services shall be installed in compliance with the latest edition of NJUG recommendations.

The Contractor shall undertake all ongoing negotiations with the DNO for the delivery of the electricity supply.

The new electrical supply will comply with the requirements of the Electrical Safety, Quality and Continuity Regulations.

A PV system is to be provided to the development. The network operator shall be made aware of this, with an export capacity agreed to enable on site generation to be exported to the grid.

4.3 LV DISTRIBUTION

The contractor shall be responsible for the supply, and installation and commissioning of a new LV distribution system to serve the building. This shall include the provision of all new switchgear and sub-main cabling.

A new high load distribution board, DB1, shall be provided to the development. This board shall be rated at 250A and have facility for two high load outgoing ways. This board shall be as manufactured by Hager, the 250A Hybrid Distribution Board – Supplied with 250A Incomer pre-fitted inclusive of surge suppression.

All new distribution boards shall be as manufactured by Hager, from the Invicta 3 Type B product range.

A new 100A TPN (400V) switch disconnector shall be provided at the electrical intake as the main point of isolation to the development. Sub-main cabling shall be routed from this main point of isolation to the new distribution board.

MID approved metering shall be provided as indicated on the drawings to enable billing of supplies.

Separate metering shall be provided to the café / kitchen demise to enable sub-letting of this space from the incoming building supply.

All secondary power supplies shall be co-ordinated with the DNO to ensure compliance with the Energy Networks Association's Engineering Recommendations ENA EREC G99.

The main electrical switchroom shall be provided the following notices and equipment:

- Safety posters as identified by Health Technical Memorandum 06-02, including first aid/electric shock treatment;
- Single line diagrams as identified by Health Technical Memorandum 06-02;
- Rubber mats;
- A mimic board (including, where appropriate, key locks, keys and site logbook);
- A sign positively identifying that the LV earthing is a TN-S system;
- A battery charger (for the instruments and power-driven switches including trip circuits);
- Storage space for maintenance tools.

All final distribution boards, motor control centres and similar locations shall be provided signage identifying the LV earthing system.

All new prefabricated switchgear shall be as manufactured by Hager and from the Invicta 3 product range or equal and approved.

All final distribution boards and consumer units shall comply with BS EN 60439-3.

All metering shall include Modbus communications and pulsed output for connection to the BMS system. The Contractor shall ensure that all metering equipment is commissioned and set to work. Readings available shall be, but not limited to; Voltage, Current, Frequency, Power, Energy, Demand Values and Harmonic Distortion.

Submain cabling shall be carried out in Multi-Core Armoured Zero Halogen, Low Smoke (OHLS) as Draka Saffire BS 6724, or equal and approved. Sub-main cabling shall incorporate XLPE insulation, with bedding comprising zero halogen, low smoke (OHLS). Armour shall be galvanised steel wire armour (aluminium wire armour for single core). Sub-main conductors shall be stranded plain annealed copper wire (class 2) to BS EN 60228.

Multi-core LV distribution cables shall have a black outer sheath to denote their voltage rating.

New distribution boards shall be wall mounted and incorporate circuit protective devices in the form of MCB's and RCBO's, as required to comply with BS 7671.

The system shall be designed such that protective devices clear overload currents and short-circuit faults within the prescribed disconnection times of BS 7671.

The LV distribution system shall be designed to achieve full electrical discrimination / selectivity.

All sub-main and final circuit cabling shall be provided labelling at both cable ends.

Sub-main labelling shall be of the traffolyte type or equal and approved. Labelling shall include cable size and load serving.

Final circuit labelling shall include circuit reference labelling. This shall be fixed direct to cabling.

All switchgear shall incorporate 25% spare capacity for future expansion.

All distribution boards shall be provided traffolyte labelling indicating the panel/distribution board reference.

Printed typed schedules shall be provided to all switchboards, panelboards & distribution boards. Schedules shall indicate:

- Switchgear Reference
- Rating of Switchgear
- Location of Switchgear
- Supplied From
- Circuit Reference
- Conductor Size & Cable Specification
- CPC Size & Cable Specification
- Circuit Protective Device Rating & Type
- RCD Protection Installed?
- Installation Method
- Circuit Description
- Circuit Type
- Any Other Details

Proposed Manufacturers:

Hager Ltd
Hortonwood 50
Telford
TF1 7FT

F.A.O. Jason Pritchard
Tel: 07979541193
Email: Jason.pritchard@hager.com

Or equal and approved

4.4 CONTAINMENT

The Contractor shall design, supply, install and commission a fully functioning containment system to the development.

Electrical services of any type and/or voltage band installed on or in any containment type should have a current-carrying capacity for the grouping of cables and local environment of the containment system. The Contractor shall ensure that all electrical services are suitably sized in compliance with BS 7671.

Where cable containments pass through a fire compartment, a fire stopping material will be used to make good the opening. A fire barrier shall be installed within the containment (close to the fire compartment wall), where the containment has an internal air space (for example trunking systems).

Where cables of any type and/or voltage band are installed in a trench, service tunnel or duct, they should be installed on other containment types such as ladder rack or tray work. The arrangement of the secondary containment should keep the cables out of any accumulated water and not impede access along the trench/tunnel/duct. Trenches, service tunnels and ducts should be self-draining.

Where the containment system is used for other services, the space should have natural ventilation. The effect that other services, such as heating pipes, in the same trench or duct may have on the local environment should be taken into account.

When sizing a trench/tunnel/duct, consideration for maintenance access should be assessed. The recommended minimum clearances are given in Defence Works Functional Standard DMG 08: 'Space requirements for plant access operation and maintenance'. Manholes or access holes should be provided for entry into cable tunnels and ducts. SELV lighting and a power supply at entrances to trenches and service tunnels should be provided. The provision for portable forced ventilation systems for use of maintenance staff may be required under the Health and Safety at Work etc. Regulations.

On main cable routes where additional cables may subsequently be required, spare cable ducts, trenches or service tunnel space shall be provided.

Steel cable trays and aluminium or steel ladder rack can simplify installation where several cables are to be installed in close proximity. In damp areas and in order to reduce the risk of corrosion by electrolytic or water action, the containment should have a galvanised finish.

Such containments should only carry cables of one voltage band. Basketry can be considered for a mixture of cables at low voltage and voltage bands below, provided all such cables are insulated to LV grades.

Where these types of containment are installed in a common service route, each containment system should preserve the segregation of the various voltage bands. The highest voltage band should be installed on the lowest containment rail. The containments should not be used to support any other services.

Manufacturers' data shall be used to assess the maximum mechanical loading and fixing arrangements of each containment system.

Such fixings shall not be connected to any demountable building element (for example ceiling tiles, wall partitions) or other engineering services.

Metallic ladder-rack, tray or basketry shall be electrically continuous and may be used as a supplementary earth return path. Each length of the containment should be mechanically joined with overlapping fillets on all three sides, and it is recommended that these are supplemented with copper links to ensure earth continuity. Where the installation topology prohibits the mechanical jointing of the containment system, an earth cable (of 6 mm² minimum size) should be used to provide the earth continuity.

In order to limit the effect of electromagnetic radiation and reduce high fault currents, the containment system should not form the only earth return path of any circuit on the containment.

In installations with segregated essential and nonessential circuits, complete segregation of nonessential and essential subcircuit wiring is desirable, but may not be possible in all instances. Where either the essential or the non-essential wiring is less than, say, 30% of the total wiring, separate containment systems may not be practical or justified.

Extra-LV circuits can be installed with LV circuits operating at the mains potential providing that the insulation is equally rated to the maximum circuit voltage present. Wires of mixed service should be suitably screened to reduce inter-circuit electromagnetic interference.

Small TP & N cables installed in trunking should be tied or clipped together in small convenient bunches. Groups of four single-core larger cables, comprising a three-phase supply and neutral, should be laid in trefoil, interleaved at suitable intervals and labelled to assist identification of circuits. The number and size of any cable bunch in any trunking should not exceed that allowed in the IET Wiring Regulations Guidance Note 1 Selection, Appendix A.

All metal trunking shall be galvanised to provide an anti-rust treatment.

All equipotential contact surfaces shall be free of rust or corrosion or have an anodised finish to ensure electrical continuity to earth and between trunking sections. Tinned copper bonding links shall be used across all trunking section joints to complete the equipotential bond and earth connection. The metallic trunking or metal conduits shall not be used as the sole earth return path of the circuits within the containment.

All conduits and trunking systems should be solidly fixed. Such fixings should exclude the use of demountable building elements (for example ceiling tiles, wall partitions) or other engineering services. All fixing systems should be suitable for the mass of the containment and wiring systems.

Approved non-flammable fire barriers and penetration seals should be inserted in cable trunking where it penetrates floors and partitions which are intended to form fire barriers (that is, fire compartment walls). The outside of the trunking should also be locally fire-insulated on both sides for 500 mm to prevent heat transfer by conduction along the metal trunking and the passage of smoke. Unenclosed cables entering/ leaving barriers or seals should also be fire protected with ready-mixed inert material or fire-resistant paint.

Fire barriers and penetration seals should be provided for all cable installations entering/leaving switchrooms and plant cubicles where gland plate sealing is not provided. Underfloor trunkings or flush lay-in trunkings are a useful containment system for services to "island" (mid-floor area) equipment such as radiography units and theatre tables, computer hub rooms and laboratory benches. In such locations, it is essential that the manufacturer, structural engineer and architect all be consulted.

Cables bunched in steel conduit of 20 mm, 25 mm or 32 mm diameter are economical. Conduits less than 20 mm in diameter shall not be used.

The number and sizes of cables pulled into any trunking and/or conduit should not exceed the circuit-loading guidance in the IET Wiring Regulations Guidance 1 Selection Appendix A and BS 7671 Chapter 52. The conduit system for each distribution board shall be kept separate, and cables from different distribution boards shall not be enclosed in the same conduit.

Conduit shall be heavy-gauge quality to BS 31. Enamel finish is satisfactory for indoor dry locations. A passivated, galvanised, Class 4 finish shall be provided where damp conditions are likely. The use of only passivated, galvanised, Class 4 finishes may be more cost-effective, as it will negate the need of any retrospective touch-up painting of installed metallic conduits and trunking.

Sub-main cabling shall be routed within ceiling voids contained on metal cable ladder and metal heavy duty cable tray.

Power cabling shall be routed within ceiling voids contained on metal cable basket.

LV cabling such as fire alarm, data, security etc. shall be installed within ceiling voids on metal cable basket.

The Contractor shall ensure that sufficient segregation is provided between 230V and low voltage cabling.

Within Plant Rooms containment shall be installed surface mounted within metal containment.

All containment runs shall be installed parallel and perpendicular to walls and ceilings.

Final circuits shall be served by metal conduit, recessed flush into the building fabric.

Where cabling is routed within underground ducts the Contractor shall ensure 2 x No. draw cords are provided to each duct.

Containment systems for data cabling shall be suitable for CAT 6 data cabling.

Horizontal containment used for IT should be at least 300mm to 600mm from other building services containment, subject to the voltage band of any distributed power cabling system. The IT distribution strategy and separation distance are exclusive of any maintenance access requirements that should also be considered.

Proposed Manufacturers:

Legrand Electric Ltd
Great King Street North
Birmingham
BN19 2LF

F.A.O. David Stokes
Tel: 07717737854
Email: david.stokes@legrand.co.uk

Or equal and approved

4.5 SMALL POWER

The Contractor shall supply, install and commission a new small power installation to the development.

All current-carrying conductors (cables, busbars etc.) shall be suitably sized to carry their design load after the application of any de-rating factors generated by their installation environment and in accordance with manufacturers' data. All cables shall be of an approved type tested by an external body such as the British Approvals Services for Electrical Cables (BASEC) or CBS ENELEC. The conductor size shall limit the volt drop between the network origin and point of use to the values given in BS 7671 IET Wiring Regulations.

Cross-linked polyethylene (XLPE) cables shall be used throughout the development.

In general, socket-outlets (as defined by BS 7671) will conform to BS 1363 or IEC harmonised standards and be connected to a ring or radial circuit. The protective device for a single-phase socket circuit should be rated no higher than 32 A for a ring circuit and 20 A for a radial circuit.

All sockets should be suitable for the local environment. While this may appear obvious, it ensures that suitable precautions (IP ratings) are made for sockets in kitchens, laboratories, plantrooms and general circulation spaces.

External power supplies shall be provided where indicated on the drawings. External supplies shall be controlled via switched fused connection units, with neon, installed internally.

The small power installation shall generally be carried out in lsf twin and earth as detailed on the accompanying distribution board schedules.

All cabling installed shall employ cable sheaths of the low smoke and fume (lsf) thermosetting type.

Final circuit wiring to twin 13A switched socket sockets and other outlets shall be taken from the local distribution board. Sockets shall be double gang unless otherwise stated.

Unless otherwise stated all switched & un-switched fused connection units shall incorporate status neon.

A variety of socket outlets shall be used within the building, as detailed herein:

- Internal Areas - Logic Plus by Messrs MK
- Plant Rooms - Metalclad Plus by Messrs MK
- External Areas - Masterseal by Messrs MK

High integrity earth wiring shall be provided for all circuits with high earth leakage currents. This shall be generally any circuits powering ICT equipment.

The Electrical Contractor shall provide electrical power to all mechanical equipment, as required by the Mechanical Contractor, as shown on the accompanying drawings.

All electrical accessories, with the exception of light switches, shall be provided labelling indicating circuit references. Labelling shall be of the printed type and detail the full circuit reference, with the exception of plant room areas which shall be provided traffolyte labelling.

The Contractor shall be responsible for identifying and designing any contactor controlled circuits – such as external lighting / water heaters / radiant panels, etc. This shall be cabled such that a dedicated digital timeclock operates a contactor to switch the circuit on or off at pre-defined times. The digital timeclock shall incorporate a 24 hour / 7day display, pre-programmed with UK time and automatic summer/winter adjustment. The timeclock and contactor shall be housed within a dedicated metal enclosure positioned locally adjacent to the serving distribution board.

The Contractor shall allow to joint and re-supply existing esplanade lighting and concessions kiosk from the new development.

4.6 GENERAL LIGHTING

The Contractor shall, supply, install and commission a new general lighting installation.

The lighting installation shall be provided in accordance with design criteria detailed elsewhere in this document. In addition, the lighting installation shall be provided in compliance with:

- SLL Code for Lighting (2012)

- SLL Lighting Handbook (2018)
- CIBSE Guide F – Energy efficiency in buildings

The lighting installation shall be designed to:

- Maximise use of natural daylight;
- Avoid unnecessary high levels of illumination;
- Incorporate efficient luminaires, control gear and lamps;
- Incorporate effective controls.

General lighting will not be provided to the café or kitchen. This general lighting installation shall be provided by the incoming tenant. Emergency lighting only shall be provided to these areas.

Low energy LED lighting shall be provided as the main source of lighting throughout the development.

Lighting circuit wiring shall be taken from the local distribution board.

Lighting circuits shall be wired as a radial circuit with a maximum protective device rating of 10A.

Lighting circuits shall be cabled in such a way that the energy associated with the lighting installation can be easily metered. It is proposed to provide split load distribution boards. All lighting circuits shall be cabled from the lighting section of these distribution boards.

Lighting circuits shall be suitably designed to ensure that protective devices are not activated upon energisation of lighting circuits. Generally LED light sources are proposed throughout the development, LED light sources can introduce high inrush currents which should be taken into account in the design of lighting circuits.

Lighting shall be provided in accordance with the accompanying luminaire schedule.

4.7 EMERGENCY LIGHTING

The Contractor shall design, supply, install and commission a new emergency lighting system to the development.

Any external emergency lighting shall be achieved via luminaires with integral battery packs to achieve compliance with BS 5266.

The emergency lighting system shall comply with BS 5266-1:2016, and all other pertinent standards, codes of practice and best practice guidance.

All external emergency lighting circuits will be provided with a key switch test facility. These will be mounted in an array adjacent to the local distribution board serving the area. The wiring of emergency lighting luminaires will be such that the emergency circuit can be tested without isolation of the general lighting circuit.

Each luminaire will receive both a switched and un-switched live connection from the same circuit. A neon charging indicator will be clearly visible.

The emergency lighting shall be capable of 3 hours operation.

All emergency luminaires will be connected via plug-in ceiling rose (Red) complete with 1.5mm2 minimum HR flexible cable.

Upon completion of the works the Electrical Services Sub-Contractor will allow for a complete test of the emergency lighting system and produce a testing/commissioning certificate, which will be bound into the Operating Maintenance manual. This test will be completed outside of normal working hours, and during the hours of darkness. As part of the emergency lighting test, the Electrical Services Sub-Contractor will allow for marking-up an AutoCAD drawing highlighting each test position and results of each point.

Log books shall be provided in accordance with BS 5266 forming part of the Operation and Maintenance Manual.

4.8 EXTERNAL LIGHTING

The Contractor shall supply, install and commission a new external lighting system.

New lighting and emergency lighting installations shall be provided as shown on the accompanying drawings, the luminaire schedule and NES document. Emergency lighting shall be installed in compliance with BS5266: Part 1 2016 'Emergency Lighting. Code of practice for the emergency escape lighting of premises.'

Lighting will consist of building mounted luminaires.

All external lighting shall be controlled as a single zone.

Control zones shall be provided for external lighting. Each zone shall be provided a timeclock to automatically switch lighting on / off, zones shall be provided photocell hold off during daylight hours. The timeclock, contactors and all associated ancillaries shall be provided within a dedicated enclosure adjacent to the serving distribution board.

External lighting shall be provided in accordance with:

- CIBSE / SLL Lighting Guide 6: The Exterior Environment (2016)

Where necessary to comply with BS 5266 external lighting shall be used to provide emergency lighting in accordance with BS 5266. It will not be acceptable for separate emergency bulkhead type fittings to be installed adjacent to external lighting.

External emergency lighting will be provided key-switch testing from the unit the external light serves.

4.9 LIGHTING CONTROLS

The Contractor shall design, supply, install and commission a lighting controls system to the building.

A simple easy to maintain lighting controls system shall be provided to the development.

It is proposed that within WC areas, presence detection shall be provided. Presence detection shall be integral to light fittings to provide a robust installation, and as noted on the accompanying luminaire schedule.

Manual switching shall be provided to plant rooms.

Where mains presence detection is to be provided this shall be as manufactured by CP Electronics, or equal and approved.

4.10 FACILITIES FOR THE DISABLED

The Contractor shall supply, install and commission a new WC alarm system to all new accessible WC's constructed as part of the works.

A new WC assistance alarm shall be provided in the following areas:

- Disabled WC
- Changing Places WC

The assistance alarm system shall comprise; pull cords, reset buttons, audible and visual alarms as necessary to provide a fully functioning system.

A WC alarm panel shall be provided in the kitchen / café space. All new WC alarm systems shall be cabled back to this manned area, so that assistance can be provided should an alarm be raised.

The alarm panel shall be provided printed labelling identifying the source of alarm at the alarm panel.

The WC assistance alarm system shall be installed in accordance with Approve Document M, in relation to setting out of equipment within the room.

The WC assistance alarm system shall be provided in full compliance with the latest edition of BS 8300.

The WC assistance alarm system shall be as manufactured by C-Tec.

Proposed Manufacturer:

C-TEC (Computionics Limited)
Challenge Way
Martland Park
Wigan

WN5 0LD

Jeff Pankhurst
Tel: 07826946192
Email: jeff.pankhurst@c-tec.co.uk

4.11 FACILITIES FOR THE HARD OF HEARING

None required as part of the works. This system shall be provided by the incoming tenant, if required.

4.12 DATA INSTALLATION

The Contractor shall develop Delta Green Tender drawings to design, supply, install, set to work and commission a new Cat 6 data installation to the building.

The incoming telecoms line shall enter the building within the electrical intake cupboard. The Contractor shall select a suitable connection, be this fibre / cat 6, etc. as necessary to link the incoming telecoms point to the new data cabinet.

A new wall mounted patch cabinet shall be provided within the building. All data cabling shall be routed from this central location throughout the building.

This section of the document is the performance specification for the data installation for the development. This document specifies those systems that are to be supplied and installed by the main contractor. These are the:

- Passive ICT equipment comprising; data cabling, server cabinets and patch frames etc.

Main building contractor to be responsible for the supply and installation of the following:

- Server room fit-out and M&E services
- Data cabling including all patch and server cabinets
- Containment and ducts for the above cabling
- Intruder Detection System IDS
- CCTV system

Client in-house IT team will be responsible for procurement of the following:

- All external telecoms links & liaison with BT
- Alarm lines and Redcare
- Main building data network including routers and firewalls
- Wireless network access points

- UPSs in the server room and hub rooms
- Any new telephone handsets

The data cabling for the network will be CAT-6 UTP system with RJ-45 terminations and patching. The data cabling sub-contractor shall be an approved installer of the proposed cabling system.

The data cabling package includes the supply and installation of server cabinets, patch frames, patch panels, cable management panels, fibre and copper patch cables, OM3 fibre cables, CAT-6 UTP copper cables with RJ 45 terminations and BT block wiring.

The data outlet locations for wall outlets, trunking outlets and Wi-Fi ceiling outlets are shown on the small power and data drawings by Delta Green.

The standard for the design of the structured cabling systems is:

- BS EN 50173-1 latest edition. Information technology. Generic cabling systems. General requirements
- BS EN 50173-2: latest edition. Information technology. Generic cabling systems. Office premises

The BS EN 50174 series of standards apply to the installation of the structured cabling. There are three parts:

- BS EN 50174-1: latest edition Information Technology - Cabling Installation - Part 1: Specification and Quality Assurance
- BS EN 50174-2: latest edition Information Technology - Cabling Installation - Part 2: Installation planning and practices inside buildings
- BS EN 50174-3: latest edition Information Technology - Cabling Installation - Part 3: Installation planning and practices outside buildings

The standards that apply to the testing of the structured and IRS cabling are:

- BS EN 50346: latest edition - Information technology. Cabling installation. Testing of installed cabling.

All of the components of the data cabling system shall be sourced from a single manufacturer and provided with a 25-year performance warranty.

The following components shall be used:

Item	Description	Manufacturer
1	Server cabinets	Brand Rex or Excel
2	Patch Frames	Brand Rex or Excel

3	Cabinet / patch frame PDUs	Brand Rex or Excel
4	CAT-6 UTP cable	Brand Rex or Excel
5	24 port CAT-6 patch panels	Brand Rex or Excel
6	CAT-6 data outlets	Brand Rex or Excel
7	CAT-6 patch cords	Brand Rex or Excel
8	OM3 fibre cable	Brand Rex or Excel
9	OM3 Duplex LC fibre termination panels	Brand Rex or Excel
10	OM3 Duplex LC fibre patch cords	Brand Rex or Excel

Server cabinets shall be:

- Excel Environ part SR800 544-42812 WDBR or equal
- 42 U high x 800 wide x 1200 deep
- Omit front door
- Metal mesh split rear door
- Top cable entry power and data
- Black
- Omit one side of paired cabinets
- Horizontal cable management (10 per cabinet)
- Machine screws and captive nuts (50 per cabinet)
- Levelling feet (not castors)
- All panels earthed to earth stud

Patch Frames:

- Excel 2 post 42U 75mm, Excel part no: OR 541 -742 or equal
- 42U high x 800 wide x 400 deep
- Top cable entry power and data
- Black
- Vertical cable management both sides 42U x 150 mm x 300 mm, Excel part no: OR 541-007 or equal

- Horizontal cable management (15 per frame)
- Machine screws and washers (50 per frame)
- All panels earthed to earth stud

Cabinet / patch frame PDUs:

- Cabinet (4 per cabinet) C14 plug 12 C13 sockets vertical, Excel part no: 555-240 or equal
- Patch frame (1 per frame) C14 plug 6 UK sockets horizontal, Excel part no: 555-250 or equal

CAT-6 UTP cable:

- CAT-6 U/UTP 500 m reel white LSOH, Excel part No: 100-103 or equal

24 port CAT-6 patch panels:

- CAT-6 unscreened 24 port 1U, Excel part No: 100-302 or equal

CAT-6 data outlets:

- CAT-6 unscreened low profile white, Excel part no: 100-366 or equal

CAT-6 patch cords:

- CAT-6 unscreened 1.5 m Red (400 Nr), Excel part no: 100-551 or equal
- CAT-6 unscreened 3 m Grey (400 Nr), Excel part no: 100-312 or equal

OM3 fibre cable:

- OM3 12 core LSOH, Excel part no: 200-157 or equal

OM3 Duplex LC fibre termination panels:

- 24-way multi-mode 12xLC, Excel part no: 200-464 or equal

OM3 Duplex LC fibre patch cords:

- OM3 LC-LC duplex 2m, Excel part no: 200-044 or equal

The CAT-6 cables shall be terminated to the TIA/EIA T568B colour scheme:

Fig 1 Wire colour code for termination

The data cabling sub-contractor shall provide a 12-month warranty covering both parts and labour. The warranty will allow for the repair or replacement of any component or circuit that is shown to be faulty within 12 months of the date of the site acceptance by the consultant.

The system shall be installed in full compliance with the manufacturer's standards and provided with a certificate of compliance to that effect.

- The manufacturer shall provide a guarantee that the installed CAT-6 will meet the ISO/IEC 11801 Channel E performance standard for a minimum period of 25 years from the date of the site acceptance by the consultant.
- The manufacturer shall provide a guarantee that the installed OM3 Fibre will meet the ISO 11801: 2002 performance measurement +/- 1dB for a minimum period of 25 years from the date of the site acceptance by the consultant.

The manufacturer's guarantee shall indemnify the customer from the full cost of replacing all or part of the system that is found to be non-compliant, including the cost of removing and replacing furniture, carpet tiles and floor panels, weekend working, site security and consultant's fees for re-test witness and re-acceptance.

The data cabling sub-contractor shall submit two copies of the following detailed installation drawings for approval at least four weeks before commencing work on site:

- Single line schematic of the backbone showing all cables and cable numbers
- Face plan of each cabinet showing the location and designation of each patch panel
- Floor plan at a scale of 1 to 50 @ A1 showing the main cable routes and location of each wall, dado and floor-box outlet of CAT-6 outlets. Floor plan to be co-ordinated with the furniture layout showing the positioning of all desks wall-outlet positions by way of single solid triangle with relevant number of CAT-6 cables and individual numbers adjacent.

The data cabling sub-contractor must amend the drawings as indicated by the IT consultant and resubmit them for approval at least one week before commencing work on site.

The data cabling sub-contractor must provide two hard copies and a CDROM of the following drawings revised to show 'as-built' information:

- Single line schematic of the backbone showing all cables and cable numbers
- Face plan of each rack showing the location and designation of each termination panel
- Floor plan of each floor at a scale of 1 to 50 @ A1 showing the main cable routes and location of each wall, dado, grommet and floor-box outlet.
- Excel spreadsheet listing each cable or loom installed and the cable length.

Two copies of the test results indicating the date on which each cable was tested must be provided within two weeks of the completion of the tests.

The Contractor shall ensure that labelling is provided to both cabling and terminals at each end. Cabling shall be of the printed self-adhesive type. A labelling topology shall be agreed with the Hospice ICT consultant and deployed throughout the building.

4.13 FIRE DETECTION & ALARM SYSTEM INSTALLATION

The Contractor shall design, supply, install and commission a new fire alarm system to the development.

The fire alarm system shall be provided in full compliance with BS 5839-1:2017.

The fire alarm system shall be provided in full compliance with the fire strategy and building control requirements.

Fire alarm interfacing shall be provided to a number of systems these can be summarised as follows:

- Air handling plant

Cables used for any part of a fire alarm system should be an enhanced grade cable as defined by BS 5839.

All fire alarm cables should also satisfy the CWZ rating of BS 6387; that is, the cable should be able to withstand water and impact and be subjected to a temperature of 950°C for three hours.

Cable systems may be derogated from their respective mechanical cable impact requirements of BS 6387 by installing enhanced-grade fire alarm cable in a continuous containment, which then satisfies the impact requirement of BS 6387.

The fire alarm installation shall comprise but not be limited to: manual call points, automatic detection, visual alarm devices, sounders, fire alarm interfaces etc. as indicated on the drawings and as required to comply with BS 5839.

GENERAL REQUIREMENTS

The Contractor shall supply, install and commission a fire detection and alarm system in accordance with the following standards, rules, recommendations and requirements:

- BS 5839
- BS 7671
- FOC Rules
- Local Building Control Authority
- Local Authority Fire Office
- LPS 1014 and BS9004

The Delta Green drawings shall be used as base design and enhanced upon to ensure full compliance with BS 5839 and that the aforementioned category of fire alarm system is achieved. The Contractor shall identify any areas which need to be enhanced, at Tender stage, and allow for all associated costs within their Tender return.

The system shall be cabled in FP 200 red cabling. The Contractor shall make all due allowances to facilitate this method of installation.

The system shall be zoned to meet the requirements of fire zoned compartments.

Careful consideration shall be given to the selection of fire detection sensors to be installed on the system.

Ceiling-mounted sensors shall be located in accordance with BS 5839, and shall be co-ordinated with other services and the ceiling grid system to provide a symmetrical co-ordinated layout.

All sensors shall have a visible 'fire' LED and shall be provided with a lockable and tamper-proof base. Sensors in need of maintenance shall generate a pre-alarm condition that shall be recorded at the main control panel for integration by the maintenance Engineer.

The system shall be automatically and continuously monitored for fault conditions, audible and visual alarms being given at the main fire alarm panel and future graphics terminal in the event of a fire or fault.

Fire detection and control panels shall operate independently, but shall be interfaced to provide full information and control functions at each location.

Provision shall be made for a minimum standby battery capacity of 72 hours, allowing a 1.5-hour sounding of all alarms at the end of this period.

All break glass units and devices shall be connected to detector circuits.

All audible and visual alarms shall be connected to sounder circuits.

The system shall be suitable for 24V DC operation and shall be installed so as not to cause radio interference in excess of the limits stated in BS 800.

Allowance shall be made for all control panels, cabling, devices, connections, interfaces, design, testing and commissioning so as to provide a complete system.

An updated colour zone chart shall be provided at the fire alarm panel upon completion of the fire alarm installation.

FIRE ALARM INSTALLATION

The fire detection and alarm system shall be designed and installed in full accordance with BS 7671 IET Regulations for Electrical Installations, and BS 5839.

All 230 volt cabling systems supplying life safety systems shall comply with BS 6387.

All cables shall be fire resistant FP200 type cable installed on dedicated cable containment systems or clipped directly to building fabric. Cables shall be run horizontally or vertically: diagonal runs will not be acceptable.

Cables shall be installed in accordance with the manufacturer's recommendations and multiple runs of cable shall utilize a dedicated cable basket for horizontal and vertical distribution.

All cable sheaths, shrouds, clips and saddles shall be manufactured from low smoke zero halogen materials coloured red.

Cables shall be securely fixed near bends, termination points and on straight runs at intervals no greater than recommended by the cable manufacturer or the 17th Edition Wiring Regulations.

At detector and sounder locations, cables shall terminate in galvanized BESA or MI clamp junction boxes.

Where possible, all circuit cabling shall be concealed within the building fabric or within voids. Installations shall be flush or surface as dictated by architectural finishes.

Wiring to flush accessories, i.e. call points, shall be installed in conduits flushed into the wall and secured. Conduits shall be `set' clear of the wall within the ceiling void and terminated in brass ring bushes. A flush steel box shall be coupled to these conduits at the accessory position using couplers and brass bushes. Recessing of plastic boxes shall not be permitted.

Within ceiling voids, cables shall be fully supported by means of drop rods, cable tray or unistrut to within 500mm of the accessory to be supplied. Support systems shall be rigid and fixed at least two separate positions along its length. Attachments to ceiling tile or ceiling grid systems will not be acceptable.

FIRE ALARM MANUAL CALL POINT

The Contractor shall supply and install red flush or surface-mounted addressable call points conforming to the requirements of BS 5839: Parts 1 & 2.

Call points shall be labelled "Fire - Break Glass" and shall be mounted 1200mm AFFL, to underside of box. The lid retaining fixing screw shall be a slotted standard design.

A label shall be fixed to the call point indicating the address and loop number. The label shall be white/red/white Traffolyte fixed with epoxy adhesive.

Manual call points shall be provided on the following basis:

i) On all exit routes (travel distance not to exceed 30m)
ii) Final exits to open air
iii) Exits from all plantrooms
iv) Floor landings of stairways

Call points shall incorporate plastic coated glass key operated test facility and red LED to provide visual indication that the call point has been operated.

FIRE ALARM AUTOMATIC DETECTORS GENERAL

All detector heads shall incorporate visual indicators and plug-in universal bases for interchangeable plug/socket arrangements with other detector types.

Detectors installed in an obscured position shall be provided with remote visual indicators. Each detector base and/or remote indicator shall be fitted with an engraved label identifying zone and address. Remote indicator labels shall identify the location of the remote device.

FIRE ALARM HEAT DETECTORS

The Contractor shall supply and install heat detectors that are either fixed temperature type or rate of rise temperature type, complying with BS 5445.

FIRE ALARM SMOKE DETECTORS

The Contractor shall supply and install optical type smoke detectors complying with BS 5447.

- Detectors shall be installed in the following areas:
- All defined escape routes
- Room leading on to escape routes
- Plant rooms and store rooms
- Voids in excess of 800mm

For rooms adjoining escape routes, detectors shall be mounted on the ceiling adjacent to each door. Should a single detector provide coverage to the room in accordance with BS 5839, the detector shall be positioned centrally to provide total room coverage.

Detectors shall be finished in white.

FIRE ALARM SOUNDERS/BEACONS

The Contractor shall supply and install red alarm sounders of the solid state type or combined sounder beacons suitable for operation on 24V.

Sufficient sounders shall be provided to achieve an alarm sound level of 65dBA, or 5dBA above background noise level.

Sounders shall be mounted 300mm below ceiling levels. Sounders shall not be mounted in ceiling voids.

VISUAL ALARM DEVICES

The contractor shall supply and install visual alarm devices in accordance with BS 5839.

EN54-23 compliant visual alarm devices (VADs) shall be provided within the following areas:

1. Plant Rooms
2. Communal WCs
3. Roof Terraces

FIRE ALARM SHORT CIRCUIT ISOLATORS

The Contractor shall allow for the supply and installation of short circuit isolators to suit the loop and zones. All isolators shall be installed in an easily accessible location.

FIRE ALARM TESTING & COMMISSIONING

The Contractor shall make all necessary site inspections, adjustments and tests during installation to suit the demands of the programme and partial possession where applicable to the project and to allow for a full inspection and commissioning test prior to handover to the client.

The installation, testing and commissioning shall be modelled on those presented in BS 5839.

During the installation, arrangements shall be made for inspections and tests to be carried out in the presence of the Engineer and upon completion the final commissioning tests shall be carried out in the presence of the Engineer.

Audibility tests throughout the building shall be fully demonstrated to the Engineer and in the presence of the Fire Officer/Building Control.

Two copies of all test data shall be submitted for acceptance on completion.

The agreement shall commence upon completion and official handover of the building.

A logbook shall be provided to record all activities before and after handover.

FIRE ALARM LOGBOOKS

The logbook provided by the Contractor shall be handed to the Employer. It shall be in 3 parts to record events, maintenance and replacement parts.

FIRE ALARM INTERFACES RELAYS

Input / Output Relay devices shall be connected onto the addressable loop circuits and shall be addressable. Each device shall be located within 1m of the equipment with which they are to interface.

FIRE ALARM ZONE CHARTS

The Contractor shall allow for 3 No. new A3 zone charts to be positioned at the main panel and two repeater panels. Zone charts shall be laminated / framed and suitable for the area to be positioned.

FIRE ALARM EQUIPMENT SUPPLIES

A dedicated protective device shall serve the fire alarm control panel and associated equipment shall be coloured red and labelled "Fire Alarm Supply: Do Not Switch Off".

4.14 SECURITY DETECTION AND ALARM

The Contractor shall employ a specialist Intruder Alarm company to design, supply, install, test and commission a complete intruder alarm system that meets the requirements as described below, in order to suit the design and layout of the building.

The basic principle of coverage required for the building is that all rooms that can be accessed externally by any means are protected with confirmed coverage, all external doors must be fitted with door contacts.

Cabling for the security system is to be contained on metallic cable basket.

The specialist intruder alarm company shall be a member of NACOSS and/or SSAIB and be accredited by ACPO.

The intruder alarm system shall be the property of the Client i.e. not of the 'hired/rented type', and shall not be of the remote programming type.

The entire system shall be of an open protocol type. In this specific regard, the requirement is that the manufacturer's UK agents will offer free technical support to any specialist security maintenance contractor appointed by the Client to deal with any maintenance or modifications to the system. This technical support will not be reliant on the specialist security maintenance contractor having attended a course in order to qualify for technical support.

The intruder alarm system shall comprise of the following equipment:-

- Control panel with standby batteries, charger etc. to give a minimum of 8 hours operation under mains electricity failure and having a BT Redcare Interface (or similar; to be agreed with BFC).
- Remote keypad with English text readout flush mounted with stainless steel facia.
- Magnetic door contacts on all external doors.
- Final setting button sited at the main entrance door
- Dual technology / sequential detectors
- Self-actuating external sounder/strobe units.

The intruder alarm system shall be connected to a dual path signalling system (meeting the requirements of PD 6669:2017) to the intruder alarm suppliers' remote monitoring station to provide 24 hour, 365 days per year monitoring of the system. With the advent of the UK's PSTN lines being discontinued in 2025, it is recommended that the specialist looks towards IP and radio solutions to aid future proofing. The Contractor shall ensure necessary arrangements for the provision of a suitable network line and all equipment for connection of the chosen system. All signalling equipment, including aerials, and SIM cards shall be supplied and installed.

The intruder alarm system shall be wired utilising LSZH cables with stranded copper conductors, to BS 4737/BSEN5013, installed on galvanised steel tray work above ceilings and enclosed in galvanised steel conduit concealed in the building fabric. The Contractor shall be responsible for installing the necessary containment and shall ensure that the extent of tray work/conduit installed is fully co-ordinated with their specialist to ensure that no cabling is surface clipped.

Allowance shall be included for the comprehensive maintenance of the system for a minimum duration of 12 months following formal Handover (allow for at least 2 service visits during a 12 month period as defined within BS4737/BSEN5013 and for attendance for breakdowns). Proposed dates for 'maintenance' visits during this period shall be handed to BFC at handover and copies included within the O & M manuals (inclusive of As Fitted Drawings). It is expected that these dates will make use of the School holiday periods wherever possible.

Full details of the proposed installation including details of specialist proposed shall be submitted to the CA for approval a minimum of 6 weeks prior to commencement of the works.

Allowance shall be included for the specialist to demonstrate the intruder alarm system to the Client (allow one half day).

The intruder alarm system shall be linked to the CCTV system to enable any motorised CCTV camera/s to automatically turn and focus on a door/window where an alarm device has been activated.

4.15 CCTV

The Contractor shall design, install, set to work and commission a new CCTV system as outlined within the specification and as detailed on the Delta Green drawings.

This section of the document is the performance specification for the CCTV system for the building.

The purpose of the CCTV system is to:

- Deter entry to the site by unauthorised persons
- Deter theft from or damage to the buildings
- Deter theft from or damage to cars in the carpark
- Provide reassurance to staff leaving the building at night
- Enable night staff to monitor visitors approaching / leaving the night (ward) entrance
- Record evidence of theft, malicious damage in a format suitable for police evidence

The CCTV system shall conform to:

- National Security Inspectorate Code of Practice for the Design, Installation and Maintenance of CCTV Systems NCP 104 Issue 2 January 2010 or later edition
- Home Office CCTV Operational Requirements Manual Publication No. 28/09 April 2009 or later edition
- BS EN 50132-7: 1996 or later edition

The definitions of image size and quality for Detect, Observe, Recognize and Identify shall be as set out in Home Office CCTV Operational Requirements Manual Publication No. 28/09 April 2009 or later edition.

Where appropriate, locations will be described as being front or rear and left or right as seen by an observer standing outside and facing the front of the premises.

CCTV Monitors

Server Room	
Purpose:	Management of CCTV system; reviewing recorded images; view all cameras and control the PTZ cameras during the working day using 5 x 4 display
Size	18-inch rack mount LCD/LED tilt slide flat panel by the CCTV supplier
Resolution	1080p
Type	PC by PGH, client software by the CCTV supplier
DVD	DVD recorder

Network Video recorder

Capacity	Record and monitor up to 32 channels at up to 1080p @ up to 25 fps
Network i/f	Includes dual 1 GB NICs optimized to separate record and viewing data to ensure 100% recording and smooth playback even with multiple client connections.
Power supplies	Redundant power supplies and separate RAID 1 Operating System 2.5" solid state drives (SSDs) from storage drives.8 x RAID 5/6 removable storage drives
Storage	SAS hard drive options (1 TB, 2 TB, 3 TB, 4 TB) providing raw storage capacities of up to 32 TB.
Motion sensing	The system shall be configured so that all cameras can be viewed simultaneously at a frame rate of 25 FPs but recorded at a lower / variable frame rate. The contractor shall recommend the recording frame rate and the threshold for detecting movement for recording at a higher frame rate. The system shall discriminate between movement caused by the wind blowing trees etc. and the movement of cars and people
Storage capacity	31 days based on: 2 x 1080p external camera @ average 10 fps 24 x 7 12 x 702p external camera @ average 5 fps 24 x 7 4 x 1080p internal camera @ average 10 fps 24 x 7 4 x 702p internal camera @ average 5 fps 24 x 7
Local display	18in LCD rack mount with tile & slide mechanism
Form factor	2U rack mount form factor with optional locking front bezel. Rack rails included for use with four post racking systems.

DVD recorder

The DVD recorder shall be located in the server room as part of the network video recorder (or if separate, rack mounted).

The DVD recorder shall be able to make a copy of and play back recorded images from selected cameras at selected times for selected durations in a format acceptable to the Police.

The DVD recording shall include an onscreen camera ID and the date and time stamp.

CCTV camera cabling

The data cabling for the CCTV cameras shall CAT-6 UTP system with RJ-45 terminations and patching installed by the data cabling contractor.

All camera data cables and terminations shall be located indoors in accessible locations (e.g. floor void, ceiling void or riser closet). Any necessary external cable cables shall be run in conduit with exterior grade CAT-6 cable from the camera to the indoor CAT-6 data socket.

CCTV Network Switches

The CCTV supplier shall provide and install the following network switches for the CCTV cameras. Each switch shall be a 24 port x 100Mbps PoE switch with a 1Gbps uplink over a CAT-6 copper cable, Netgear FS728Pv2 or equal.

The following network switches are to be provided:

Switch ID	Location	Ports available	Ports used
CCTV 01	Server Room	24 PoE	As drawing

Lifetime licence and warranty shall be included in the scope of supply.

Network Interface

Closed Circuit TV interface

The Closed Circuit TV (CCTV) system will be an IP-based system with a number of cameras linked to PC based monitoring stations and a video recorder. Typically, the video recorder will record up to 32 camera channels.

The CCTV system will have its own data cabling installed by the data cabling sub-contractor. The cameras will be located inside and outside the building as necessary to provide security for patients and staff.

During commissioning the CCTV system will operate as a stand-alone sub-network. Once the system is commissioned the CCTV networked video recorder will be patched into the main PGH data network so that one or more PCs can monitor the CCTV cameras. Typically, the CCTV system will be monitored from the reception desk during the day and from the ward reception desk at night. The network video recorder in the sever room will enable CCTV recordings to be transferred to a DVD should the police require evidence.

Closed Circuit TV network configuration

The CCTV shall be configured with fixed IP addresses for each camera. The Hospice will allocate a block of private IP addresses for the CCTV system.

The network video recorder shall have two 1 GB network cards:

One network card will be allocated an IP address on the CCTV network for recording camera data

One network card on the will be allocated an IP address on the PGH main network for displaying camera images

The Hospice will provide PCs and display screens for the Main Reception desk and the Ward Reception desk. The CCTV sub-contractor shall supply the rack-mounted display screen for the server room.

The objective of the CCTV system is to provide coverage of all entry and exit points of the development to record any criminal activity that may occur. The CCTV system shall incorporate a UPS for 24hour autonomy.

CCTV cameras and associated DVR locations shall be as detailed on the accompanying Delta Green drawings.

Provision for future expansion of the system should be provided.

The system will be operated by the building occupant as such all user interfaces and control equipment shall be selected with this in mind.

The CCTV system shall have a facility to view all cameras remotely via an Ethernet connection.

All equipment, consoles, telemetry, switching and multiplexing, etc. must be proprietary, generally available products. This is to ensure that future maintenance to the system can be carried out by any installing company. The use of specialised in-house manufactured components will not be acceptable. This does not preclude the use of 'badged' products, providing the manufacturers are clearly stated and the product has not been modified or customized in any way.

The CCTV system shall comply with:

- NACOSS NCP 104, NSI code of practice for the design installation and maintenance of CCTV systems.
- BS EN 50132-7, Alarm systems. CCTV surveillance systems for use in security applications. Application guidelines.
- BS 8418, Installation and remote monitoring of detector-activated CCTV systems. Code of practice.

The CCTV system shall be designed, installed and commissioned by an NSI NACOSS Gold approved company.

The CCTV system shall include battery backup provision to provide 12-hour autonomy in the event of power failure. This shall be achieved via UPS or similar technology.

When the contract is considered to be complete, Practical Completion will be effective after fourteen consecutive days of uninterrupted, fault free operation.

Within the O&M the Contractor shall submit a full schedule of maintenance to be carried out on the system during the warranty period and under subsequent maintenance contracts.

Prior to practical Completion being awarded the Contractor shall provide a full set of manuals and operating instructions within the O&M manual. This is to include comprehensive descriptive brochures and technical manuals for all equipment forming part of the contract. It should include 'as-fitted' wiring and schematic diagrams. An A4

laminated sheet is to be provided with short form of operating instructions on one side, and a site diagram showing camera locations and pre-set positions on the other.

4.16 LIGHTNING PROTECTION

The Contractor shall include for employing the services of a Lightning Protection Specialist Contractor, who shall be responsible for the complete design, supply, installation and commissioning of a lightning protection installation all in accordance with the current edition of BS EN/IEC 62305 and BRE Digest 428.

Where it is not possible to utilise structural steel columns, suitably sized copper tape down conductors shall be installed behind rain water down pipes. High- level bonds are to be taken from the building frame to link to the sheet roofing and guttering.

Complete transient over voltage electronic systems protection system shall be designed, supplied and installed as necessary to comply with Appendix C of BS 6651 including incoming and outgoing cables to and from the building, including but not limited to the following:-

- Power supplies to external lighting, sprinkler, CCTV
- CCTV signal cabling
- Data/telephone
- Incoming building supply

The Contractor shall include for the comprehensive maintenance of the system, for a minimum duration of 12 months following formal Handover. Provision shall also be made for attending to faults and breakdowns during this timeframe. Proposed dates for 'maintenance' visits during this period shall be submitted to the Education Provider and BFC at handover and copies included within the O & M manuals. It is expected that these dates will make use of the School holiday periods wherever possible.

The specialist contractor shall be;

Orion Lightning Protection Ltd
Unit 8 Wickham Business Centre
Harwood Road
Harwood Industrial Estate
Littlehampton
West Sussex
BN17 7AU

Tel: 01903724218

or equal and approved.

As part of the works the Specialist Sub-Contractor shall carry out a risk assessment of the building to ascertain the Class of lightning protection system required.

For Tender purposes the Contractor shall allow for a Class 1 lightning protection system, depending on the outcome of the risk assessment the class of system will be reviewed.

The lightning protection system shall be designed, installed & commissioned in full compliance with BS EN 62305.

4.17 PHOTOVOLTAIC (PV) SYSTEM

The Contractor shall allow for the design, supply, installation and certification of the roof mounted solar photovoltaic array.

The final size and capacity of the PV system shall be the Contractors design responsibility, subject to final Part L, and EPC calculations. The reason for this is that the scheme may be subject to value engineering, where systems are changed this will have a knock on effect to building efficiencies which may mean an increase in PV is required.

The Contractor shall allow for bird netting or a similar anti-nesting solution to prevent birds nesting in the vicinity of PV panels.

The Contractor shall allow to liaise with the electricity network operator to ensure permission will be provided to connect the new PV system to the grid. The Contractor shall fully comply with EREC G83 or G59 as required and dependent on size of PV array.

Any relevant tree lines or higher adjacent buildings shall be taken into account when assessing the output from the PV array.

The Contractor shall install an A/C isolator adjacent to the PV Inverter connected back to a local distribution / panel board. Final connection of the PV system shall be by the specialist PV installer.

A new PV array with peak output of 5.6 kWp shall be provided to provide renewable power generation to the development. The specialist sub-contractor shall be responsible for sizing and designing an appropriate array and holistic system.

As a guide the new PV Array shall comprise 14 No. 400W panels, utilising Solar Edge inverters or equal and approved to achieve previous mentioned design criteria. Final selection and arrangement of PV equipment shall be developed by the specialist sub-contractor.

The PV system shall comply with Engineering Recommendation G83, specifically G8 3/2-1 & G98.

4.18 EARTHING AND BONDING

The Contractor shall supply 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 and protection against indirect contact shall be by earthed equipotential bonding and automatic disconnection of supply.

A main earth bar of copper mounted on insulated bobbins shall be installed in the switchrooms and substation and shall provide connections points for the following:

- Earthing conductors to electrodes.
- Switchboard earthbars.
- Local piped services, including mains water and gas.
- Structural steelwork and support systems.
- Clean earthing bars to communications rooms.
- Transient Voltage Surge Suppressor.

All equipotential bonding shall be carried out using LSOH cables coloured green/yellow.

Armoured cables shall be terminated by means of a proprietary cable gland c/w earth tag. Means of earthing shall not be solely reliant on the gland termination to the steel plate, a separate earth cable lead shall be provided between gland and equipment earth terminal.

Where necessary to comply with the cable calculations for fault levels, supplementary earthing cables shall be provided, installed adjacent to the associated supply cable.

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 and metallic trunking systems shall be mechanically and electrically continuous throughout their length. Brass continuity links shall be fitted to all trunking joints.

Distribution boards shall be earth bonded to adjacent structural steelwork, process services and electrical containment systems.

Final circuit protective earthing shall be achieved through the use of separate earthing conductors, using LSOH insulated singles installed in conduit/trunking.

GENERAL EARTHING NOTES

All connections for equipotential bonding must be in locations where examination of terminations can be easily carried out.

Supplementary bonding conductors shall have a minimum CSA of 2.5mm² if mechanically protected or 4mm² if mechanical protection is not provided.

2.0 OPERATING AND MAINTENANCE DOCUMENTATION

4.19 BUILDING USER GUIDE

The Contractor shall be responsible for the production of building services related information for inclusion within a simplified building users' manual or guide, designed to a format to be agreed with the Client, to provide sufficient information in a clear, explicit form for the use of End Users within the building. The purpose of the manual will be to explain how automated systems operate, where User interface is possible and where it is not and how to operate the building services installation in the most efficient manner whilst maintaining occupant comfort. This shall include but is not limited to:

- Explanation of heating local controls.
- Details of opening windows.
- Implications of misuse of installed services – e.g. covering emitters.
- Details of installed security systems etc.
- Explanation of building wide lighting control systems.
- Explanation of the Nurse Call system.

An additional section of the Building User Guide shall provide Facilities Management with a non-technical summary of the operation and maintenance of all installed systems including the Building Energy Management System (BEMS) and all local controls.

The manual may be produced in electronic format for distribution via the intranet – to be agreed with Client prior to production.

4.20 OPERATING AND MAINTENANCE MANUAL

Operating and maintenance manuals are to be provided for the contract works and are to be produced by the named technical authors detailed in the Services Specification. In-house manuals as produced by the contractors shall not be accepted as a substitute.

Provide hand over documentation comprising of:

- As installed services drawings for all services at a scale of 1:50 for general layouts and 1:20 for plant room layouts. Provide 3 no. paper print copies plus copies on CD Rom in AutoCAD 2007 and Adobe PDF format. 3 no. copies at A3 photo-reduced size are to be provided in the O&M manuals.
- 1 no. copies of hard bound Operating and Maintenance manuals providing health and safety information, full description of the operation and maintenance of the services, manufacturers' literature of the installed services and equipment and A3 copies of the as installed drawings. Provide three copies of the complete O&M manual and all certificates on CD Rom as Adobe PDF file.

The contractor shall develop an O&M Manual format for review by the client and M&E consultant prior to full development and completion for submission. The manual shall provide full details for the method of operation and method of maintenance for each of the services provided to the building. It shall include recommended maintenance regimes and all associated manufacturers' literature specific to the buildings services.

4.21 BUILDING LOG BOOK

The Contractor shall provide a Building Log Book prior to handover. The Building Log Book shall be project specific and follow the format as outlined in CIBSE TM31.

The Building Log Book shall be issued in both hard and soft format issues.