



IES Oldbury
Waste to Energy Development

Mechanical & Electrical Services
Performance Specification

Preliminary Issue

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1 INTRODUCTION

This Performance Specification and any document included herein have been generated to assist the Contractor with understanding the mechanical and electrical system requirements for the Waste to Energy Development at Union Road, Oldbury, West Midlands.

This document should be read in conjunction with all other Tender documents issued.

It is not intended for and should not be relied upon by any other third party. No rights or responsibilities are undertaken to any third party

The Contractor shall be responsible for the design and installation of all systems described within this and associated Tender documentation and other Employer's Requirements referred to within such that the building, facility and its engineering services ultimately function as a complete and fully integrated system.

1.1 THE PROJECT

The Project is to develop a waste to energy Recycling Plant on a brownfield site at Union Road, Oldbury, West Midlands.

The facility will process waste material which is left after ELVs are shredded, recovering metals, plastics and aggregates which would then be sent on to re-processors.

The remaining material - wood, foam and plastics - would then be treated using gasification technology developed by US company Chinook Sciences to generate up to 32 megawatt hours (MWh) of electricity, with just 5,700 tonnes of material left at the end of the process expected to be sent to landfill.

The proposed development will comprise of two processing stages to be developed concurrently:

Stage 1 which will be operated by EMR will process 250,000 Tonnes of raw Shredder Residue (SR), transported to the facility by road (with the possibility of future rail transport) from EMR shredders around the country. Some refined SR and sent offsite for further reprocessing. The remaining combustible waste is retained on site for processing in Stage 2.

Stage 2, which will be operated by IES, using a gasification process patented by Chinook Sciences to generate some 32 MWh electricity/year from the combustible material that would otherwise go to landfill. This stage of the process will also allow recovery of additional metals glass and aggregates that would otherwise go to landfill.

The construction of the above will also include provision of external yards, roadways and associated civil works

1.2 THE CONSTRUCTION SITE

The success of the works will be reliant on several key issues which the Services Contractor must take due cognisance of within their tender and provide demonstration that adequate thought and costs have been allowed:

- Interface with other Service Providers
- Incorporation of Specialist Contractor Requirements
- Off-site fabrication / pre-engineering

- Just in time deliveries

The Services Contractor should during the Tender Period visit the site to establish for himself the area of the works, scope of works and any constraints which could affect the tender.

1.3 DEFINITIONS

The terms used within this specification have the following meanings;-

- | | |
|-------------------------------------|---|
| • Client;- | Innovative Engineering Services Ltd (IES) |
| • Specialist Process Provider | Chinook Sciences Ltd |
| • Project Manager;- | Not Appointed |
| • Architect / Lead Design | TBA |
| • Civil & Structural Engineer;- | TBA |
| • Fire Consultant;- | None Appointed |
| • Contractor ;- | Vinci Construction UK Ltd |
| • Services Contractor :- | The Mechanical & Electrical Services Contractor appointed by the Principle Contractor |
| • Services Engineer;- Engineers Ltd | Hulley & Kirkwood Consulting |
| • Quantity Surveyor;- | TBA |
| • CDM Coordinator | TBA |

1.4 RELATED DOCUMENTS

The Services Contractor must take full cognisance of the following 'Briefing Documents':

- Design team drawings
- Design team specifications
- Contract programme including all works phasing requirements

In areas where drawings or specifications have omitted some service which may be required to meet the performance levels within the documents listed above, it will be assumed that all associated costs with their delivery have been allowed at this stage, these should be separately highlighted in the tender submission

The Mechanical and Electrical "Standards of Workmanship" Specifications, included within the appendices to this document, must be read in conjunction with this document.

The Particular requirements within this document shall take precedence over the Mechanical and Electrical Standards of Workmanship Specifications.

2 SCOPE OF WORKS

2.0 GENERAL

The Services Contractor shall be responsible for the Design, Supply, Installation, Working Drawings, Commissioning, setting to work and handing over of the Mechanical & Electrical services installations to the Contractor.

The design shall be fully co-ordinated and include preparation of design, co-ordination, construction, installation and as-fitted record drawings, details and design, operation and maintenance manuals, input to the production of health and safety information such as designers risk assessments and contribution to the Health & Safety File.

The Services Contractor shall be responsible for the design and installation of each system such that the building services fully integrate with systems and equipment required to enable the operational processes to be undertaken within the development.

Where applicable, the Services Contractor shall obtain and demonstrate approvals and compliance with the following:-

- Insurance Company - Test Certificates
- Gas Authority
- Water Authority
- Planning Officer
- Building Control Officer
- Environmental Health Officer
- Fire Officer and LPC
- Local Byelaws/Acts
- British Standards and Codes of Practice
- British Gas Reports and Recommendations
- Building Regulations

The Services Contractor shall be responsible for ensuring that all proposed equipment complies with the specified requirements identified herein.

The Services Contractor shall provide to the Contractor fully documented Quality Assurance Procedure (QAP) in accordance with ISO 9000 prior to commencement of draughting, procurement or installation. The Service Contractors QAP must be provided in concert and agreement with the Contractor's procedures.

The QAP must detail specific procedures related to the tendered project and not be generalised. The QAP shall be provided by the Services Contractor at tender, its content subject only to the Contractor's comment.

Where a Services Contractor or Supplier is not an ISO 9000 registered company he shall declare such at tender and operate a system for the project that is in accord with the principles of ISO 9000.

The following generalised scope of works reflects the work content for the Services Contractor;-

2.1 MECHANICAL, ELECTRICAL & PUBLIC HEALTH SERVICES COMMON WORKS

- § Preliminaries
- § Allowance for regulatory compliance e.g. Building Regulations, CDM requirements etc.
- § Provision of Technical Submissions
- § Provision of Working Drawings
- § Installation and Setting to Work
- § Commissioning
- § Demonstration & Full Client Training
- § Making good of defects during Defects Liability Period
- § Provision of As Installed Drawings
- § Provision of O&M Manuals
- § Provision of Building log Book

Specific Mechanical Services Works

- Site Natural Gas distribution.
- Site Mains Water distribution.
- Compressed air plant and compressed air site distribution.
- Heating Systems Installation.
- Cooling Systems Installation.
- Ventilation Systems Installation.
- Hot and Cold Water Systems Installation.
- Above Ground Drainage (Foul Waste & Rainwater).
- Building Management System (BMS) to network and control all installed systems.

Specific Electrical Services Works

- High Voltage Distribution & Switchgear (33& 11kV)
- Low Voltage Distribution & Switchgear
- Electrical Containment & Distribution
- Low Voltage Sub Mains Cabling and Containment
- MCB Distribution Boards, Switchgear and Installation
- General Lighting Luminaires, installation.
- External Lighting Luminaires, installation
- Emergency Lighting Luminaires, installation,
- IT Installation
- Small Power
- Fire Detection and Alarm System
- Power supplies associated with mechanical services equipment.
- Earthing and Equipotential Bonding Systems
- Security Systems
- Induction Hearing Loop System
- Disabled Persons Call Systems
- As Installed Documentation

Exclusions

- Provision of Active Network Equipment for IT Installation and peripheral devices i.e. Telephone handsets, faxes, printers etc.
- Fire Fighting Extinguishers.

2.3 DESIGN & SCOPE

Specific contractual design responsibilities shall be as set out as within the following table:

Summary of Design Activities					
Main Activity	Activity	Responsibility			Comments
		Consultant	Services Contractor	Other	
Set Out Generic Brief	Mechanical and electrical requirements brief as Contractor's requirements for the final installation.			ü	Client
Set Out Brief	MEP services performance brief to reflect Client's Requirements	ü			
Drawing Production	Sketch drawings / indicative layouts and schematics.	ü			To demonstrate the design Intent and a means of achieving the design brief and also possible services plant space and distribution routes.
Calculations	Building thermal model		ü		To determine range of temperatures in summer, steady state design heat gains and losses. Establish level of ventilation required to meet temperature maxima.
Drawing Production	Schematic drawings.		ü		Services Contractor to develop indicative Schematics provided.
Drawing Production	Multi-service spatial co-ordination drawings.		ü		Mechanical discipline to take the lead in the spatial co-ordination process of MEP works and other specialist trades. Includes input to architect's reflected ceiling plans and full integration of building fire plan and engineering strategy.
Drawing Production	Detailed design drawings.		ü		Include full integration of building fire plan and engineering strategy.
Drawing Production	Installation drawings.		ü		
Drawing Production	Installation wiring diagrams.		ü		

Summary of Design Activities					
Main Activity	Activity	Responsibility			Comments
		Consultant	Services Contractor	Other	
Drawing Production	Manufacturer's drawings.		ü		'For Comment' and 'Construction' status.
Drawing Production	Builder's work drawings.		ü		
Drawing Production	Record drawings.		ü		
Drawing Production	Specialist suppliers drawings		ü		
Design Calculations	Confirmation of incoming mains sizing.			ü	
Drawing Production	Confirmation of Building Services plant and system sizing.		ü		To be submitted for review prior to placement of orders
Design Calculations			ü		
Plant/Equipment Technical Submissions	Final confirmation of plant and equipment selections and manufacturers details		ü		To be carried out after co-ordinated design layouts produced but prior to final equipment order confirmation. To be submitted for review.
Surveys	Sufficient to produce reasonable Services information and set out the performance brief.	ü			
Surveys			ü		Services Contractor to undertake all Surveys deemed necessary in order to establish full understanding, conditions, implications and scope of works to be undertaken
Surveys	Establishment of site acoustic constraints.			ü	Specific criteria set out by specialist
Design Calculations	Acoustic design calculations to demonstrate achievement of internal and external acoustic design criteria for Building Services Plant & equipment		ü		All assumptions should be stated where specific constraints have not been set out. If SC deviated from specified equipment they will be required to submit acoustic calculations to show compliance with requirements.

Summary of Design Activities					
Main Activity	Activity	Responsibility			Comments
		Consultant	Services Contractor	Other	
Building Regulations Submission	Provide timely information to the Contractor to enable planning conditions to be discharged related to Building Regulation compliance.			ü	Include participation in meetings to establish and refine the building fire plan and engineering strategy. The Contractors appointed Specialist shall undertake this duty with input as necessary from the Services Contractor.
EU Energy Performance of Buildings Directive	Appoint accredited person to carry out certification of the Buildings Energy Rating		ü		
Utilities	Negotiate / liaise with Utility Providers in order to obtain all necessary information to enable services Infrastructure design to be completed.		ü	ü	Provide all supporting information in timely manner.
Document production	The Services Contractor shall provide O&M manuals.		ü		Manuals and record drawings shall be compiled during the contract and be available for the first commissioning of the engineering services. Practical completion shall not be given until final copies (without unresolved Comments from engineer) are provided.
Document production	CDM regulations documentation, specific risk assessments.	ü	ü		Manufacture / installation works shall not commence until the documentation has been returned without any outstanding comments from the consultant & contractor. All comments shall be addressed prior to final copy being issued for inclusion in the Health and Safety File

Summary of Design Activities					
Main Activity	Activity	Responsibility			Comments
		Consultant	Services Contractor	Other	
Document production	Schedule of rates		ü		The contractor shall submit a Bill of Quantities with a total that matches the contract price. The BOQ shall list all materials, equipment and quantities applicable to the works. The schedule is to be broken down for each service element.

2.4 DESIGN & DESIGN DEVELOPMENT

The aim of the design solution is to provide a scheme which meets the 'briefing documents and Contractors Proposals, without detriment to reliability of service whilst complying with all relevant statutory legislation.

The Tender Drawings show the intended general arrangement of plant and equipment, but do not detail the whole work involved and are diagrammatic to show the design intent in certain particulars.

The Services Contractor shall prepare proposed system design, equipment and system installation drawings and submit them to for comment in accordance with Clause 2.10 of this specification

Where significant deviation from equipment positions depicted on the Tender drawings appears necessary, the Services Contractor shall consult the Contractor to check that the proposed rearrangement is acceptable.

Adequate space provision and access for installation, testing, maintenance and replacement shall be made in accordance with section 2.12 of this specification.

During the Building Regulation compliance review process the Services Contractor will advise the Contractor of any specialist requirements for the building services over and above those already specified.

The Services Contractor shall retain full responsibility for the Services Installation & System Operation.

2.5 DESIGN STANDARDS

The Mechanical, Electrical and Public Health design & Installation shall be compliant with all current Legislation and Standards and Guidance Documentation.

This shall comprise but not be limited to the following indicative list.

This list is not exhaustive and best practice will be used at all times.

Building Regulations
Energy Performance of Building Directive (including Certification).

British & European Standards
HSE Approved Code of Practice & Guidance.
CIBSE Guides.
Energy Conservation Act.
British Gas Council Codes of Practice.
Electricity at Work regulations
Relevant HVCA Design Guidance Publications.
Electrical Safety, Quality and Continuity Regulations 2002.
The Gas Safety Regulations.
Health & Safety Executive, Legal Series 8.
The Clean Air Act.
All Government Laws and / or Acts
The Control of Pollution Act.
Specific Requirements of the Local Electricity, Gas or Water Authority.
Requirements of the Local Fire Officer.
Health & Safety at Work Act.
CDM Regulations 2007
Loss Prevention Council Recommendations
Relevant Codes of Practice
National Joint Utilities Group Publications
British Council for Offices Guidelines
Radiological Protection Advisors Requirements
Advisory Committee for Control of Dangerous Pathogens
Electro-magnetic Interference Guidelines
Insurance Company Requirements
Building Services Research & Information Association Code of Practices
Public Utility Company and / or Statutory Authority regulations, specifications, and requirements

Where new standards are introduced or existing standards revised during the contract, the Services Contractor shall pro-actively notify any new requirements and the likely effects in a timely manner. Proposed changes may then be jointly agreed installation prior to implementation.

2.6 SITE VISIT

The Services Contractor shall visit site during the tender period and shall satisfy themselves of the following:

- 1) The local conditions
- 2) Nature and accessibility of the site
- 3) Storage space for materials within designated site compound area.
- 4) The position of all relevant services and drains
- 5) Space available for the execution of the works.

The Services Contractor shall include in his tender for all costs necessary to take account of the above and arrange for delivery of materials so that no congestion occurs and shall include for all additional handling and transporting due to site conditions.

No claim shall be allowed in the settlement of the account in respect of anything mentioned in this item, neither will the lack of knowledge or ignorance of conditions be accepted as justifying such a claim.

2.7 COORDINATION RESPONSIBILITIES OF THE SERVICES CONTRACTOR

It shall be the responsibility of the Services Contractor to arrange, attend and chair working drawing production meetings and the individual responsibility of each of the Engineering System Installers to attend the same meetings.

The purpose of the meetings shall be to resolve the effective production of the co-ordinated multi-disciplinary composite Installation / Working and Builder's Work drawings.

No allowance will be made for abortive works by any of the works packages due to lack of knowledge of each specific discipline's requirements.

The Services Contractor shall also be required to produce all co-ordination drawings and appoint a co-ordination manager. For the avoidance of doubt, this shall include the production of fully co-ordinated multi-services and single service drawings for each area at the appropriate scale identified within BSRIA Technical note BG6 2006. These drawings may be developed from the final Services Engineer's Design Drawings in conjunction with updated architectural and structural layouts, with the Services Contractor assuming full responsibility for the co-ordination of services.

2.8 BUILDERS WORK DRAWINGS

All necessary Builders work Drawings required to enable installation of the items addressed under this works package specification shall be supplied under this Works Package in good time.

The Services Contractor shall provide all necessary technical information to other Work Package Contractors as required.

Any information required by the Services Contractor to enable progression and completion of the works to programme shall be formally requested by the Services Contractor in a timely manner.

The suitability of the proposed equipment shall be checked by the Services Contractor to ensure that all equipment offered is designed to be accommodated within the spatial area constraints identified on the Tender drawings allowing for maintainability access.

Under no circumstances shall equipment be ordered by the Services Contractor that does not fit into the space available.

The standard builders work and painting requirements of this Services Contract shall be as follows:

Drilling of all holes for all fixings and supports and other items where fixing is by means of screws, plugs and expanding type fixings. Note that neither the internal or external faces of the external cladding of the building are to be amended, i.e. by drilling or any other type of fixing system, without prior written agreement of the cladding system provider and the Contractor.

Foundation bolts, stays, brackets and other fixings shall be supplied by the Services Contractor. The Services Contractor shall provide for the Contractor proper and sufficient Drawings or Templates of all items requiring foundation bolts or other fixtures and all plant required to be built into or otherwise affecting the building structure.

The Services Contractor shall ensure that adjustments to foundation levels to accept plant, bedding and grouting of plant on foundation and bases, and grouting in all other fixings is adequately and properly preformed and that the levels and adjustments previously made to the plant by the Services Contractor are not thereby disturbed.

2.9 THE SERVICES CONTRACTORS DRAWING PRODUCTION RESPONSIBILITIES

The Services Contractor shall, within two weeks of appointment or on demand thereafter prepare a Drawing schedule of all his proposed Drawings required for comment.

The schedule shall indicate the following:-

- § Drawing number and revision number.
- § Drawing title and service.
- § Scale.
- § Latest date required on site.
- § Date required for final comments.
- § Date for submission for comments.
- § Date on which comments were received.
- § Date of commencement of drawing production.

The Services Contractor shall revise and update his drawings schedule as necessary on a monthly basis taking into account any revisions which may take place

No allowance will be made for abortive works by any of the works packages due to lack of knowledge of each specific discipline's requirements.

The Services Contractor shall at an early stage of the contract co-ordinate with the Main Contractor and agree:

- 1 Precise positioning of all electrical accessories with respect to room fixtures and fittings, furniture and mechanical plant such as radiators, convector heaters, extract fans, heating and ventilation controls etc.
- 2 Precise positioning of all conduit, cable trunking, cable tray and cable routes with respect to mechanical services and room fixtures and fittings.
- 3 Positions of all holes to be cut / formed by the Contractor.

Any areas of conflict shall be brought to the design team's attention immediately.

The Services Contractor shall note that the mechanical and electrical services drawings are diagrammatic and should not be scaled to determine exact positions of equipment.

2.10 THE DRAWING AND DESIGN INFORMATION SUBMISSION PROCESS

Full technical submittals shall be made by the Services Contractor covering all items of selected plant and equipment for review prior to placement of orders.

The Services Contractor shall be responsible for selecting Plant, Equipment, Components & materials to meet the specified performance and duties.

Where these differ from provisional selections the Services Contractor shall ensure they are fully compatible with all other system parameters, components and design requirements.

The Services Contractor or his specialist supplier shall be responsible for re-calculating all flow rates required for fans and pumps to match actual duties required from the equipment that the Services Contractor intends to procure

The Services Contractor shall submit working drawings, calculations and plant technical submissions for comment via the 'A / B / C' process. The comment procedure shall entail the reviewer applying a status to each of the Installer's drawings as follows;-.

Status 'A'.

The reviewer has no further comment, the drawing / submission remains subject to the Service Contractors Design Responsibility.

Status 'B'.

The reviewer has comments on the drawings / submission but subject to the incorporation of those comments the drawing / submission may be used for construction purposes at the Service Contractors risk. The drawing/submission must be revised to incorporate any comments and re-submitted for comment.

Status 'C'.

The drawing/submission is unacceptable and will have to be redrawn, or in the case of a technical submission re-selected, and resubmitted for comment.

The intention of this comment procedure is that all drawings/submissions should obtain Status 'A'.

No works shall be carried out on site unless they have been granted 'A' status (the Services Contractor may precede at his own risk with B status drawings – however the Services Contractor shall ensure all comments have been incorporated).

NO INSTALLATION DRAWINGS SHALL BE ALLOWED TO PROCEED BEYOND 'C' STATUS UNLESS THERE HAS BEEN A MULTI-SERVICE COORDINATION DRAWING / SECTION PRODUCED BY THE SERVICES CONTRACTOR THAT HAS ACHIEVED AT LEAST 'B' STATUS FOR THE SAME AREA.

The Services Contractor shall fully understand this when issuing design and installation programmes and shall ensure that sufficient lead-in is allowed to achieve this.

2.2 INSTALLATION STANDARDS

2.2.1 GENERAL

All services equipment shall be installed in accordance with best working practice.

Equipment shall be selected, designed and installed in a manner which is fully compatible with the Environment in which it is to be installed, the functionality of the space and shall fully co-ordinate with the surrounding finishes.

2.2.2 ACCESS TO PLANT & EQUIPMENT

All Plant and equipment shall be designed and Installed in such a manner that components may be accessed, maintained, removed and replaced without unreasonable difficulty and without compromising personnel safety.

The installation shall, as a minimum shall comply with the following:-

- Manufacturers' recommendations,
- BS 8313 (Accommodation of Building Services in Ducts)
- BSRIA Application Guide 11/92: Design for Maintainability
- BSRIA Guide - A Design Framework for Building Services
- BSRIA Technical Note T3/79: Space Requirements for Building Services Distribution Systems
- DEO (W) DMG08 Space Requirements for Access, Operation and Maintenance
- CIRIA C686 Safe Access for Maintenance and Repair

All items of plant requiring regular maintenance shall be accessible from floor level or via permanent access walkways.

All items of plant shall be arranged such that they can be removed without dismantling any elements of permanent structure and without compromising normal access and escape routes.

2.2.3 "AS INSTALLED" DRAWINGS

The "As Installed" Drawings provided by the Services Contractor shall comprise the documents listed in the following paragraphs.

These "As Installed" Drawings shall be produced in .pdf and .dxf format. And in AutoCAD .dwg format compatible with AutoCAD LT version 2010.

In the event that the Contractor requires use of a more recent release version to suit his working methods then he shall provide the client with a fully licensed compatible version of that same release at his expense.

All drawings are to be reproduced in accordance with BS EN ISO 5457 "sizes and layout sheets".

All such documents shall clearly be endorsed "**As Installed**" near to the title block.

Manufacturer's drawings or sets of drawings are to be produced to a scale consistent with that used for the Sub-Contract Drawings and shall show the following:-

- (a) The general arrangement and assembly of component parts of all machines and equipment which may require servicing.
- (b) The internal wiring of each piece of electrical equipment incorporated in the works, together with physical arrangement drawings, where necessary, to locate and identify the component parts.

Comprehensive diagrams or sets of diagrams are to be produced which shall show:-

- (a) The principles of the arrangement and operation of each of the various services as related to the primary distribution point, other principal components and zoning of distribution etc.
- (b) All power and control wiring and including size, type of conductor or pipes used and identifying the termination points of each.

Provide comprehensive schedules illustrating procedures for fault finding and for action in the event of equipment or system failure.

Provide comprehensive schedules of spare parts, lubricants, etc. including itemised specifications, identification numbers and sources of supply.

2.2.4 REVIEWABLE DATA (RD) – DESIGN & INSTALLATION / WORKING DRAWINGS

The Services Contractor shall produce fully coordinated Design and subsequently Working Drawings and a full technical submittal for all equipment.

These drawings and documents must be submitted to the Contractor for review as "Reviewable Data" (RD).

The provision of RD information is a Contractual Requirement that must be met by the Services Contractor.

The Services Contractor shall provide the following information at RD Stage;

- A list of proposed equipment and plant manufacturers and M&E Services Sub Contract installers for approval.
- Samples of proposed equipment, where requested
- Equipment Selections and manufacturers drawings and detailed information
- Fully coordinated Working / Installation Drawings
- Commissioning Programme
- Commissioning and Test Data

The Services Contractor shall agree the issue programme for RD with the Contractor.

This shall include any interim issues dependent upon the project phasing.

2.2.5 COMMISSIONING

The Services Contractor shall provide a detailed commissioning programme **at least 8 weeks before commencement of the programmed commissioning period.**

This shall be produced as bar chart in Microsoft Project format and shall include the following information:

- § Contractual key dates
- § Mechanical and Electrical commissioning periods (at system level e.g. Pumps, fans, etc.)
- § All required sub-contract attendances
- § Contact telephone numbers for the Contractors representatives and any other subcontractors involved during commissioning.
- § All demonstration dates for witnessing by the Contractor
- § All demonstration dates for witnessing by the Clients Representative
- § Critical paths and dependencies
- § Snagging periods for the Contractor his appointed specialist and the Client's representative.

This is not an exhaustive list however and the Services Contractor shall ensure that all testing and commissioning information and demonstrations for all systems shown therein shall be carried out.

Immediately prior to Practical Completion all system consumables (e.g. air filters, water filters, automatic water treatment chemicals) are to be changed and all water strainer baskets cleaned by the Services Contractor.

2.2.6 SITE INTEGRATION TEST

A site integration test will be required on Completion of the Engineering Services but prior to Practical Completion.

This test shall cover all building systems and is performed during simulation of a loss in the utility power to the building.

This test shall be performed after all equipment and sub-systems have been tested and verified as operational.

The tests are to be undertaken to establish that:-

- The equipment automatically restarts once utility power is lost and the emergency supply has been energised.
- On loss of utility power to determine if all systems function and operate as per the design Intent.
- On return of Power, verify that Services and systems operate and restart automatically as applicable.

2.2.7 BUILDING OPERATOR'S MANUAL

In addition to meeting the requirements of the Contractor and those set out in detail in the Mechanical and Electrical Services Specifications, the Services Contractor shall provide Building Operating Manual documentation developed and produced using BSRIA Application Guide BG1/2007 as the main template and incorporating requirements of this Services Performance Specification.

A Building Services Log Book shall also be provided using CIBSE Guide TM31 as the template.

Three Final copies of the bound manual will be provided by the Services Contractor. 2 Prints of each "As Installed" drawing is required for initial comment.

Building Operators Manuals will be required for project Practical Completion

2.2.8 BUILDING REGULATIONS COMPLIANCE REVIEW

The Services Contractor shall be responsible for installing, commissioning and setting to work the M&E systems in order that they comply with the requirements of Approved Building Regulations Document Part L2a (2010 edition).

2.2.9 ABNORMAL HOURS WORKING

The works will be undertaken within normal working hours.

The Services Contractor shall make due allowance within his tender and state what "Out of Hours" allowance (if any) has been included.

Should "Out of Hours" working be included within his tender due allowance for this including the full time attendance of a supervisor level employee who can accept and implement Instructions forthwith should be included.

2.2.10 ENGINEERING SPARES

Provide spares in accordance with the following schedule:

- Lamps – 10No. of each type utilised.
- MCB's – 2No of each type utilised.
- Fire Alarm Break Glasses – 5 No.
- Emergency Test Keys – 5 No.
- Radiator Vent Keys – 5 No.

2.2.11 POST COMPLETIONS SUPPORT / PROJECT DE- BRIEF

Full Client training of the Building Services is to be carried out at handover of each phase and on completion of the project.

2.2.12 MECHANICAL AND ELECTRICAL FACTORY WITNESS TESTING AND INSPECTION

Not Applicable

2.2.13 BUILDING CONSTRUCTION

The new Buildings being Constructed under the Main Contract works will take the form as noted below.

Due allowance within the Tender for complying with and integrating into the following Construction(s), shall be included

a) EMR Building

Will Comprise a Portal Frame Steel Building as follows;-

Length: 83040mm formed in 12no. 6920mm bay modules.

Width: 158000mm stanchion centres formed in 4no. equal spans.

Height Above Floor Level: 9, 11 and 13m to eaves.

Roof: Pitch of Roof: 9 degrees (nominal). Sheet Steel PVC plastisol coated

Future Extension: No provision for future extension.

Expansion Joints: Not required with Construction but will be required for Services design relevant to Service.

Purlins: Galvanised cold rolled purlins at 1800mm maximum centres to accommodate profiled steel cladding

Louvre Framing: Framing has been included to the 5no Louvers on the East Elevation and the 32no Louvers on the West Elevation.

Industrial Doors: 2no. 4000mm wide x 6000mm high roller shutter doors.

b) RODEC Building

Length: As tender drawing

Width:

Height Above Floor Level: 15300mm to underside haunch.

Roof: Pitch of Roof: 6 degrees (nominal). Sheet Steel PVC plastisol coated

Future Extension: No provision for future extension.

Expansion Joint: Not required with Construction but will be required for Services design relevant to Service.

Purlins: Galvanised cold rolled purlins at 1800 maximum centres to accommodate profiled steel cladding

Crane Beams: Crane beams along B3- 21 and A3-21.

Industrial Doors: 3no. 5000mm wide x 6000mm high roller shutter doors. 7no. 4000mm wide x 6000mm high roller shutter doors.

Internal office (Over 2 Levels): 7500mm wide x 19000mm long.

Services Floor Loadings; - 0.15 kN/m²

c) MCC Room 1

Length: 16000mm

Width: 9100mm

Components consist of: rafters, stanchions, eaves rails, bracing, galvanised cold rolled purlins and sheeting rails.

d) MCC Room 2

Length: 16000mm

Width: 9100mm

Components consist of: rafters, stanchions, eaves rails, bracing, galvanised cold rolled purlins and sheeting rails.

e) MCC Room 3

Length: 14400mm

Width: 7500mm

Components consist of: rafters, stanchions, eaves rails, bracing, galvanised cold rolled purlins and sheeting rails.

f) MCC Room 4

Length: 17600mm

Width: 3850mm

Components consist of: rafters, stanchions, eaves rails, bracing, galvanised cold rolled purlins and sheeting rails.

g) Service Load Allowance; - TBC

2.2.14 SITE UTILITY SERVICES

2.2.14.1 GENERAL

New services infrastructure will be provided to support the site development.

At the highlighted demarcation point, building boundary, indicated on drawings the Services Contractor shall be responsible for extending the incoming services to the supply points as follows:

2.2.14.2 GAS

A Medium Pressure Gas supply will be provided by others adjacent to the site off Union Road. From the point of connection, a new buried gas main shall be laid with branches to feed the EMR and IES buildings.

The IES building gas supply shall terminate within a suitable enclosure with a gas safety solenoid valve directly linked to the BMS and Fire Detection & Alarm system for automatic isolation. Further distribution pipework beyond this point will be provided by others.

The EMR building gas supply shall be complete with a gas safety solenoid valve directly linked to the BMS and Fire Detection & Alarm system for automatic isolation. Gas pipework complete with a gas sub-meter shall be extended to feed heating system plant installed within the EMR building.

All works shall be carried out by an approved "Gas Safe" contractor.

The Services Contractor shall undertake all liaison with the Client nominated specialist to ensure that their requirements in terms of supply volume and pressure are met.

2.2.14.3 WATER

A Mains Water Supply will be provided by others adjacent to the site off Union Road. From the point of connection, a new buried main shall be laid to serve the EMR and IES buildings as detailed on the associated drawings.

Site wide fire hydrant connections shall be provided from the buried mains in suitable locations every 90-120m. Additional isolated branch connections shall be provided to supply process water to meet the Client nominated specialists requirements.

Offices within the IES and EMR building shall be provided with sub-metered water supplies.

2.2.14.4 FIRE HYDRANT PROVISION

Underground Fire Hydrant points shall be provided at every 90-120 metres around the perimeter of buildings, all installations shall comply with the requirements of BS.EN 9990 and BS 5499 respectively.

2.2.14.5 ELECTRICITY

A new 33kV, 35MW High Voltage supply shall be provided by Western Power Distribution to the Site as a direct Client order.

This provision requires a significant off site Infrastructure upgrade to Oldbury Primary Substation which is to be undertaken by Western Power.

The Site supply will terminate within a site customer substation.

The Utility provider will supply install test & commission the following

a) 1 No 33kV 3 Section Switchboard and equipment comprising;-

- 1No Circuit Breaker (Network Connection)
- 1No Switch Disconnector (Customer Connection)
- 1No Voltage Transformer Compartment

b) 1No Wall mounted relay cabinet for protection & Interposing relays for telecontrol connection,

c) 110V & 48V batteries & Chargers

Western Power have advised the following supply Characteristics;-

a) Maximum Export Capacity	35MW
b) Maximum Import Capacity	TBA
c) Nominal Voltage	33,000V + / - 6% Three Phase
d) Frequency	50Hz + / - 1%
e) 33kV Fault Level at Union Road	6.22 kA (355.7 MVA) Three Phase (See note below) 1.43kA Single Phase

Note;-

The figures are based on a single 132/33 kV transformer at Oldbury and Generation in- feed from a second generator on the network.

2.2.14.6 TELECOMMS

2No below ground cable ducts arrangements are to be installed from Union Road to the building intake positions to enable BT and one other telephone service provider to install future cabling for connection to the telecommunications network.

The duct route will comprise of 2 No PVC 90mm dia ducts and dedicated pits installed as suitable locations

3 MECHANICAL SERVICES

3.1 SCOPE OF WORKS

The scope of Mechanical Services work includes the design, supply, delivery to site installation, testing, setting to work, commissioning, training and the provision of all relevant drawings and Operating and Maintenance for the following Services and or systems:

- Site Natural Gas distribution.
- Site Mains Water distribution.
- Compressed air plant and compressed air site distribution.
- Heating Systems Installation.
- Cooling Systems Installation.
- Ventilation Systems Installation.
- Hot and Cold Water Systems Installation.
- Above Ground Drainage (Foul Waste & Rainwater).
- Building Management System (BMS) to network and control all Building Services installed systems.

3.2 DESIGN AND INSTALLATION STANDARDS

The Works shall be designed, installed and commissioned in accordance with documents listed within Clause 2.5 of this Specification, current accepted good practice and any specific requirements of this Specification and associated documents and / or drawings.

Unless stated otherwise, this shall be to the recommendations of the Chartered Institution of Building Services Engineers (CIBSE) and the Heating and Ventilation Contractors Association (HVCA).

The installation shall comply with relevant British Standards, Codes of Practice, Building Regulations and the requirements of Statutory Authorities, as well as the particular requirements of the Employer, stated herein. All services equipment shall be installed in accordance with best working practice.

3.3 PLANT & SERVICES DISTRIBUTION

The contractor shall design, provide and install all galvanised steel secondary support systems to suit the designed Services plant weights and arrangements.

The finished colours of all external plant shall be agreed prior to the order of any such plant, for tender purposes, items of plant shall have a standard manufacturers finish.

Services shall be run at high level in accessible locations and distributed horizontally within ceiling voids where present.

Vertical distribution shall be via dedicated riser shafts.

The Services Contractor shall be responsible for the coordination of all Mechanical, Electrical, and Public Health services.

Where required the Services Contractor shall identify and highlight access provision requirements within solid ceilings to provide access to maintainable items of plant or components that form part of the Building Services

Where services are exposed, particular attention shall be paid to the design, installation standard, and quality of finish and co-ordination with other services and other elements of the building design.

Where services penetrate fire compartment divisions, all required fire stopping/ fire dampers and proprietary support frames etc. shall be provided and installed to maintain the Fire Integrity and rating of the Compartmentation line.

The Services Contractor shall provide and install all Statutory and necessary signage and labelling to ensure the Health and Safety of all personnel is not comprised.

Provision for both Mechanical Services System and Building expansion shall be provided within the design of Building Services Systems.

Expansion provision shall be clearly indicated on design drawings.

3.4 MECHANICAL PLANT AREAS

The Services Contractor shall position and install all items of plant and services in accordance with the detailed design drawings.

3.5 DESIGN INTERFACE

The Service Contractor shall make due allowance with other Service providers to ensure a clear interface provision is allowed or allocated.

The Following Services Design is being provided by others:

i) Incoming utilities Infrastructure Works i.e. Gas & Water beyond the site boundary. (This work is being procured as a direct Client order with the appropriate Utility)

ii) Installation of the Process Equipment, this is being undertaken by Specialist, Chinook Sciences Ltd, or Contractors appointed on their behalf

3.6 ENVIRONMENTAL DESIGN CRITERIA

The following Design Criteria shall be utilised as the basis of the Mechanical Services Design

3.6.1 IES BUILDING

External design conditions

Winter	-3°C db, Saturated
Summer	28°C db, 20°C wb

Internal design conditions

Offices	21°C winter / 24°C summer \pm 2°C
MCC Rooms	20°C winter / 20°C summer \pm 2°C
Warehouse Area	Unheated / Ambient Conditions
Office Areas	10 l/s per person @ 1 person per 7.5m ²
Cleaners Cupboards	3 air changes per hour (Extract Only)
WC Areas	6 air changes per hour

3.6.2 EMR BUILDING

External design conditions

Winter	-3°C db, Saturated
Summer	28°C db, 20°C wb

Internal design conditions

Offices	21°C winter / 24°C summer \pm 2°C
Warehouse Area	16°C winter / Un-controlled summer
Office Areas	10 l/s per person @ 1 person per 7.5m ²
WC Areas	6 air changes per hour
Warehouse	2 air changes per hour

3.7 NOISE

Building Services Plant external noise emission levels shall comply with local Planning / Environmental authority requirements and statutory noise nuisance Regulations.

For residential and commercial neighbours: British Council for Offices document 2009 – Guide to Specification Fluid velocities within ductwork and pipework shall be limited to CIBSE recommendations.

Air velocities within ducts and discharge velocities from diffusers shall be selected to meet the internal acoustic criteria.

3.8 VIBRATION

As a minimum to comply with the requirements of the British Council for Offices document 2009 – Guide to Specification.

3.9 AIR FILTRATION

Centralised mechanical fresh air ventilation plant shall use a minimum of grade G4 primary filtration and grade F8 final filtration.

3.10 VENTILATION

Fresh air shall be sourced at high level via weatherproof louvres.

The distance between any fresh air intakes and sources of odour or contamination shall be sufficient to avoid a reduction in the quality of fresh air delivered to occupied areas.

3.11 OFFICE HEAT LOADS

The Services contractor shall design, size and install the Mechanical Services to meet the stipulated criteria.

Specialist equipment (sensible) loads:

The contractor shall use CIBSE data to determine occupant, solar, and infiltration loads.

3.12 INFILTRATION & AIR PERMEABILITY LIMITS FOR THE EXTERNAL ENVELOPE

This section is provided here for reference with regard to expectation and impact upon thermal models generated to determine building heating and cooling loads.

The Services Contractor shall liaise with the Contractor to confirm the impact on thermal capacity of the building.

The Contractor will appoint an independent third party testing agency to test and measure the air permeability of the external envelope.

The testing agency shall carry out a visual survey and advise the contractor on works which should be carried out prior to testing.

Test procedures will be in accordance with CIBSE TM23:2000, AATMA TS1 and Building Regulations.

Tests shall be conducted in stages, as recommended by the testing agency, with the whole building being subdivided as necessary to suit the largest practical test volume. leakage rate not exceeding 10m³/hr/ m² at a test pressure of 50 Pa.

The testing agency shall provide a comprehensive report of their survey, testing and results, and identify outstanding problems if the target leakage rate is not achieved.

It should be noted that the specified leakage rate is for assessment of building fabric performance and should not be assumed in the sizing of heating, cooling or ventilation plant.

All heating sizing shall be based on infiltration rates as recommended in CIBSE guidance.

3.13 IES BUILDING

3.13.1 OFFICE AREA VENTILATION

The office area is to have a dedicated supply and extract system to deliver conditioned fresh outside air to the ground floor occupied areas within the building.

The conditioned air shall be ducted horizontally within ceiling voids.

The air handling unit supply and extract fans shall have inverter drives.

All ductwork shall be leakage tested to standards set down in HVCA Document DW 144.

Leakage testing shall be carried out in accordance with HVCA DW 143.

The air handling plant shall incorporate heat recovery equipment with a minimum efficiency of 75%.

All condense drains shall discharge into local plant room floor gullies via traps.

All air-handling units shall have magnahelic type gauges to allow local pressure reading.

Volume control dampers shall be provided to part of each ducted supply and extract ventilation system, including all branch connections to assist with testing and commissioning.

Selected Volume Control Dampers shall be fully accessible and be selected such that they can be adjusted across their range to enable fine adjustment of the flow rate.

Volume control dampers that can only adjusted in stepped increments will not be acceptable.

Fire dampers will be installed within any fire breaks to maintain the fire integrity of a compartment or zone in accordance with the Fire Strategy and / or as required by the Fire Officer or other such authority.

Duct mounted silencers shall be provided to meet both the internal and external limiting noise criteria.

Duct mounted access panels shall be provided in accordance with HVCA document DW144 to support future periodic internal cleaning, and all ducts shall be internally cleaned before hand over. The Contractor shall allow for 'bagging' any open ends of the ductwork installation during installation to minimise contamination.

This will include a heat recovery air-handling unit which will draw fresh air from the external louvers located within the main building external facade.

The Air Handling Unit / Extract Fan will provide tempered fresh air to the office spaces under the dictates of a time switch / temperature signal from the B.M.S system.

Once supply airflow has been established, as sensed by differential pressure switch located across the supply fan, the electric heater battery will be enabled.

The re-couperator damper will be positioned to achieve free cooling/heating, acting on signals received from the comparison of supply/extract and external air sensors.

A differential pressure switch located across the supply fan will provide an alarm signal at the control panel and B.M.S. in the event of airflow failure.

Operation of the electric heater thermal cutout shall provide an alarm signal at the control panel and B.M.S.

Differential pressure switches will be provided across the supply panel and extract panel filters, which shall provide alarm signals at the control panel and B.M.S when the filters requires changing.

On plant shut down, the supply fan shall continue to run for a pre-set period to dissipate residual heat build-up from the heater battery.

A differential pressure switch located across the extract fan will provide an alarm signal at the control panel and B.M.S. in the event of airflow failure.

3.14 TOILET EXTRACT

A twin fan extract unit, duty and standby with automatic changeover upon one of the fans failing to operate shall be supplied and installed to remove air from the WC areas.

The unit will be mounted locally within the ceiling void and extract through ceiling mounted extract valves. The extract fan unit will exhaust to an external louvre and ventilate to atmosphere.

The toilet extract fan(s) will be suitable for switching enabled by local PIR sensors with run on timers.

The fan will be supplied with integral automatic changeover panel, which will be monitored by the BMS for fault condition.

Make up air to spaces shall be drawn from adjacent areas via transfer ducts and / or grilles.

The make-up airflow rate shall be 85% of the total extract rate. Cross talk attenuation shall be provided where necessary.

3.15 MESS ROOM EXTRACT

A dedicated extract fan will be installed to the Mess room. The extract fan unit will exhaust to an external louvre and ventilate to atmosphere.

3.16 SUPPLEMENTARY AREA VENTILATION

The following areas shall be served with their own dedicated ventilation system;

- Showers and WC's - extract system with make-up air provided by a central fresh air system
- Staff Lockers and rest rooms - extract system with make-up air provided a central fresh air system
- Kitchenette areas - extract system with make-up air provided by a central fresh air system

The ventilation plant for these areas shall consist of duty and standby fans with automatic changeover upon one of the fans failing to operate.

Extract units shall be suitable for monitoring and remote switching via the BMS

Make up air to spaces shall be drawn from adjacent areas via transfer ducts and / or grilles

The make-up airflow rate shall be 85% of the total extract rate.

Cross talk attenuators shall be provided where necessary to meet the acoustic criteria.

3.16.1 NATURAL VENTILATION

Where practicable areas shall be naturally ventilated to satisfy the appropriate operational requirements of the installed equipment:

3.17 DOMESTIC COLD WATER

The Services contractor shall provide a new incoming metered potable supply to the ground floor plantroom.

The storage tank shall be an externally flanged sectional cold water storage tank, divided equally and provided with appropriate drain valves to support future cleaning of each section without interrupting the supply of cold water to the building.

The tank shall be sized suitable for storing sufficient water for 8 hours of continuous demand.

Cold water shall be boosted via an Inverter driven booster set (duty and standby) to ensure a minimum working pressure to all plant and outlets throughout the building.

The booster pumps shall have duty and standby arrangements and will be monitored by the B.M.S for common fault condition.

The cold-water storage tank will be equipped with high/low level float switches; both float switches will activate alarms at the B.M.S.

In the event of storage tank low level, the B.M.S will prevent the booster set from operating.

The cold water supply and plant shall be designed by the contractor to serve the following areas:

- Toilet areas (WCs, WHBs, water heaters, etc.).
- Shower areas.
- Cleaners rooms.
- Staff welfare facilities i.e. kitchenette, refreshment room.
- Any Wash down locations.

4No Bib taps with a hose union connection shall be provided at locations within 10M of nearest Cold water main, with appropriate back flow prevention device (Final positions to be agreed)

All cold water supplies shall be installed in accordance with ACoP L8 – The control of Legionella bacteria in water systems.

Dead legs within the cold water distribution shall be minimised.

The domestic cold water system shall be insulated.

Water pipework material and valves shall fully comply with the water supply (water fittings) Regulations and shall be WRAS approved.

3.18 DOMESTIC HOT WATER

Domestic hot water to all sinks, WHB's etc shall be provided by local instantaneous point of use electric water heaters.

Showers shall be provided with thermostatically controlled Electric Instantaneous units to generate their own hot water on demand.

Heaters shall be concealed from view in a safe accessible location within the areas

The supply systems shall be complete with all necessary pressure relief valves and discharge drains.

Water heaters shall be installed in accordance with the manufacturer's recommendations.

Suitable provision shall be provided for a safe visible means of determining the operation of the units pressure / temperature relief valves.

Each appliance will have a suitably located service valve fitted for isolation purposes

The entire domestic hot water system shall comply with ACoP L8 – The control of Legionella bacteria in water systems.

The domestic hot water system shall be insulated.

All sanitary ware is Armitage Shanks standard range or similar.

3.19 WAREHOUSE PRODUCTION AREA VENTILATION CONTROL

The Warehouse areas will be mechanically ventilated to 2 air changes per hour.

This will be achieved by installing extract fans and low-level mechanical louvers for the makeup supply air.

Within the main sorting hall, the extract fans will be automatically controlled via carbon monoxide sensors to provide a short-term boost facility by increasing the air change rate to 5 air changes per hour on demand.

The Warehouse internal temperature will also be monitored and controlled, extract fans will be initiated if area reaches any of the Pre-set conditions.

The production area will be divided into a number of control zones.

The temperature/air quality within each zone will be maintained at the required conditions by modulation of ventilation louvers and switching of extract fans, acting on signals received from the average reading of multiple temperature and CO sensors located within the zone.

All extract fans will be monitored by the BMS for airflow failure.

3.20 RODECS MCC ROOM VENTILATION SYSTEMS

Air Handling Units will be provided and Installed to serve the following rooms with tempered air,

- a) Upper MCC Room (MCC1)
- b) Lower MCC Room (MCC 2)
- c) Control Room (MCC 3)
- d) PLC Room (Rodecs 1 – 4)

The Air Handling Unit / Extract Fan will provide tempered fresh air to the rooms at the dictates of a time switch signal from the B.M.S system.

Both supply and extract fans will be complete with duty / standby motors, which in the event of duty motor failure, will automatically switch to the standby motor and instigate an alarm via the BMS.

Once supply airflow has been established, as sensed by differential pressure switch located across the supply fan, the electric heater battery shall be enabled.

The supply air will be maintained at a constant temperature by modulation of a heater battery thyristor controller acting on signals from a supply air temperature sensor.

The re-couperator damper will be positioned to achieve free cooling / heating, acting on signals received from the comparison of supply/extract and external air sensors.

The differential pressure switch located across the supply fan shall provide alarm signals at the control panel and B.M.S. in the event of airflow failure.

Operation of the electric heater thermal cut out shall provide an alarm signal at the control panel and B.M.S.

Differential pressure switches will be provided across the supply panel / bag and extract panel filters, which shall provide alarm signals at the control panel and B.M.S when the filters requires changing.

On plant shut down, the supply fan shall continue to run for a pre-set period to dissipate residual heat build-up from the heater battery.

A differential pressure switch located across the extract fan will provide an alarm signal at the control panel and B.M.S. in the event of airflow failure.

Both AHU supply and extract fan motors will be equipped with inverter drives to achieve fan speed control.

The rooms served by the Air Handling Unit are intended to be maintained under a positive pressure of 50 pascals.

In order to achieve this, each room will be equipped with a differential pressure sensor, the lowest signal from which will be utilized to ramp up the speed of the supply fan to increase room pressure.

If the main power supply should fail, then the primary UPS system will support the load.

Critical UPS supported Systems to be supported.

It is anticipated that this method will provide approximately 10 Minutes of power. After this 10 minutes from the primary UPS has ceased, the backup UPS purely dedicated to air handling plant will commence.

The backup UPS will allow the air handling equipment a run on time of 30 minutes to help dissipate any residual heat from the motors. This will only activate when the building power supply fails and the primary UPS has been used.

3.21 UPPER MCC ROOM – LOWER MCC ROOM – PLC CONTROL ROOM

The rooms will be air conditioned by a split A/C unit.

Allow to suitably off set the heat generated within the rooms by introducing a DX air conditioning system and a suitable ventilation system to cope with the specified demand as set out in the IES Control Rooms HVAC specification- Revision A.

The maximum control room temperature will be at 20 degrees C.

No humidity control is required.

The BMS will monitor the units for common fault.

A temperature sensor will monitor space temperature and raise an alarm at the BMS when the temperature rises above 20DegC.

A pressure sensor will monitor space pressure and raise an alarm at the BMS when the pressure drops below 50pa.

Additional filtration will be added to the Air Handling unit which will be used to reduce any dust.

3.22 FILTER MCC ROOM & COMPRESSOR EXTRACT SYSTEM

Provide ventilation to and from each of the 2no compressors, these are dedicated and will directly connect to each of the units. We have assumed we can connect to louvres on the nearest face of the external cladding and will not be required to terminate at high level.

Provide a dedicated supply and extract to the Filter MCC Room, again terminating at a louvre within the nearest external facade.

The extract fans will be time switch enabled and monitored for common fault by the BMS.

The Compressor Room space temperature will be monitored by the BMS.

When the temperature exceeds a pre-set level, the extract fan will be enabled.

The extract fan will be monitored for fan failure and raise an alarm at the BMS.

If the main power supply should fail, then the primary UPS system will start. This will power only the critical plant items, of which the air handling equipment to the Filter Room is one.

It is anticipated that this method will provide approximately 10 minutes of power. After this 10 minutes from the primary UPS has ceased, the backup UPS purely dedicated to air handling plant will commence.

The backup UPS will allow the air handling equipment a run on time of 30 minutes to help dissipate any residual heat from the motors. This will only activate when the building power supply fails and the primary UPS has been used.

3.23 COMPRESSORS

Supply and install 2no fully packaged compressors, each at 800 m³/hr @ 6 bar. Run and terminate the pipework to the required locations as detailed within the Gas Pod cleaning system. This limits the required runs to the enclosure only.

An additional 40 outlets have been allowed for as per the client's requirements.

The final drops and connections will be undertaken by the client. However the drop positions will be agreed with the client prior to installation.

Provide additional small system within each of the MCC Rodec rooms.

The compressors will be time switch enable and monitored for common fault by the BMS.

3.24 TRANSFORMER ROOMS

The Transformer Room space temperature will be monitored by the BMS.

When the temperature exceeds a pre-set level, the extract fan will be enabled.

The extract fan will be monitored for fan failure and raise an alarm at the BMS.

3.25 COMPRESSOR BUILDING A/C SYSTEMS

Provisions to suitably off set the heat generated within the rooms by introducing a DX air conditioning system and or a suitable ventilation system to cope with the specified demand as set out in the IES Control Rooms HVAC specification-Revision A.

The maximum control room temperature will be at 20 degrees C.

No requirement for humidity control

No requirement for an N+1-type system.

Condensers will be placed within 20m of the areas served.

3-No Split A/C Systems will be monitored for common fault by the BMS.

3.26 NATURAL GAS INSTALLATION

Connect to the incoming gas main adjacent to the main office. From there install a gas solenoid valve and ECV.

The pipework will then be distributed through the warehouse to the combustion chambers and Power Islands externally. We will allow for final connections to the units and will purge up to our isolation valve.

The solenoid valve will be installed where the gas enters the building.

The solenoid valve will close on operation of the fire alarm panel or operation of local emergency knock-off button.

3.27 WAREHOUSE MAINS & TANKED COLD WATER

Connect to the incoming supply notionally positioned adjacent to the main office. From there run through the warehouse to the 2no 10,000-litre tanks in external plant area.

Provide a booster set to be installed which will then feed the following areas

- Main Office & Amenities Building
- Auxiliary Office Building
- Turbine buildings. (Power Islands)

All final connections will be made by suitably sized isolation valves, where we are connecting to any of the clients equipment connection requirements shall be made in advance.

Pipework where deemed necessary will be trace heated to prevent freezing. All services will be chlorinated prior to handover.

Current water regulations will be strictly adhered to.

3.28 BUILDING MANAGEMENT SYSTEM

3.28.1 GENERAL

The Building Services will be controlled and / or monitored under the dictates of a Building Management System

The system shall comprise of local control panels, each of which serves local plant/control equipment located throughout the building and networked to a central user-friendly graphics based supervisor (Position to be agreed).

The control panels and their associated plant controlled via the BMS are as follows:

a) Main Offices

Office Air Handling Unit
Toilet Extract Unit
Mess Room Extract Fan
Cold Water Booster Set
Cold Water Storage Tank

b) Rodecs MCC Room No1

Ventilation Air Handling Unit
Upper MCC Room Temperature & Pressure Monitoring/Alarm
Lower MCC Room Temperature & Pressure Monitoring/Alarm
Control Room Temperature & Pressure Monitoring/Alarm
PLC Room Temperature & Pressure Monitoring/Alarm
Air Conditioning Systems Alarms
Production Zone No1 Ventilation Control (Extract Fans/Louvre's)

c) Rodecs MCC Room No2

Ventilation Air Handling Unit
Upper MCC Room Temperature & Pressure Monitoring/Alarm
Lower MCC Room Temperature & Pressure Monitoring/Alarm
Control Room Temperature & Pressure Monitoring/Alarm
PLC Room Temperature & Pressure Monitoring/Alarm
Air Conditioning Systems Alarms
Production Zone No2 Ventilation Control (Extract Fans/Louvre's)

d) Warehouse Production Zones 3 & 4

Warehouse Production Zone No3 Ventilation Control (Roof Mounted Extract Fans and Low Level Louvre's)

Warehouse Production Zone No4 Ventilation Control (Roof Mounted Extract Fans and Low Level Louvre's)

e) Compressor Building

Packaged Air Handling Unit
Compressor Enabling/Fault Monitoring
Compressor Room Extract Fan

Transformer Room Extract Fan
Air Conditioning Systems

f) Building Gas Safety

Gas Solenoid Valve

3.28.2 BMS FRONT END SUPERVISOR

This shall take the form of a central computer supervisor, running a colour graphics driven software programme.

The central computer shall have the following minimum specification: -

Minimum P4 desktop computer with 1 GB RAM, 80 GB hard drive, DVD/CD, 17" LCD colour monitor, keyboard, mouse and Windows operating system.

3.29 EMR BUILDING

3.29.1 OFFICE AREA VENTILATION

The office area will have a dedicated supply and extract system. This will include a heat recovery air-handling unit which will draw fresh air from the external louvers located within the main building external walls.

Then air will blow across the heat exchanger, where heat from the extract air will be sacrificed to the fresh air. To bring the air temperature in line with CIBSE guidelines and electric heater battery will be installed.

From the air handling unit spiral ductwork will be distributed through the ceiling voids to ceiling mounted 4 way diffusers. The extract air will terminate using bell mouths within the ceiling void and drawing air from the office space to keep the ceiling void at ambient room temperature.

All to comply with DW144.

Fire dampers will be installed within any firebreaks as required by the Fire Officer or other such authority.

Volume control dampers will be installed within the system to allow for even balancing of the air.

The Air Handling Unit/Extract Fan will provide tempered fresh air to the offices at the dictates of a time switch signal from the B.M.S system.

Once supply airflow has been established, as sensed by differential pressure switch located across the supply fan, the electric heater battery will be enabled.

The supply air will be maintained at a constant temperature by modulation of a heater battery thyristor controller acting on signals from a supply air temperature sensor.

The re-couperator damper will be positioned to achieve free cooling/heating, acting on signals received from the comparison of supply/extract and external air sensors.

A differential pressure switch located across the supply fan will provide an alarm signal at the control panel and B.M.S. in the event of airflow failure.

Operation of the electric heater thermal cutout shall provide an alarm signal at the control panel and B.M.S.

Differential pressure switches will be provided across the supply panel and extract panel filters, which shall provide alarm signals at the control panel and B.M.S when the filters requires changing.

On plant shut down, the supply fan shall continue to run for a pre-set period to dissipate residual heat build-up from the heater battery.

A differential pressure switch located across the extract fan will provide an alarm signal at the control panel and B.M.S. in the event of airflow failure.

3.29.2 MAIN OFFICE TOILET EXTRACT UNIT

A twin fan extract unit will be supplied to remove the vitiated air from the WC areas.

This will be mounted within the ceiling void and terminate through ceiling mounted extract valves. The extract fan unit will terminate at an external louvre and ventilate to atmosphere.

The toilet extract fan will be enabled by a time-switch signal from the BMS.

The fan will be supplied with integral automatic changeover panel, which will be monitored by the BMS for fault condition.

3.29.3 MAIN OFFICE MESS ROOM EXTRACT FAN

A dedicated extract fan will be installed to the Mess room. This will be mounted within the ceiling void and terminate through 4 way ceiling mounted diffusers.

The extract fan unit will terminate at an external louvre and ventilate to atmosphere.

The Mess Room extract fan will be initiated by a time switch signal from the BMS.

The BMS will monitor the fan for airflow failure.

3.29.4 MAIN OFFICE COLD WATER & DRAINAGE

Provide an incoming mains/tanked cold-water supply only. This will feed 2no electric water heaters located within the WC and kitchen areas, also feeding each of the appliances.

Showers shall be thermostatically controlled and be electric, to generate their own hot water.

Each appliance will have a service valve fitted for isolation.

Provide all above ground drainage.

All sanitary ware is Armitage Shanks standard range or similar.

The packaged cold-water booster set will be monitored by the B.M.S for common fault condition.

The cold-water storage tank will be equipped with high/low level float switches.

Both float switches will activate alarms at the B.M.S.

In the event of storage tank low level, the B.M.S will prevent the booster set from operating.

3.29.5 WAREHOUSE AREA VENTILATION CONTROL

Allow to mechanically ventilate the warehouse areas to 2 air changes per hour.

This is achieved by installing extraction fans and low-level mechanical louvres for the makeup air.

Within the main sorting hall where the materials arrive, the extract fans will have two speed fans to increase the air change rate to 5 air changes per hour if required. This allows further control in the area if the build-up of contaminants is high from the JCB's i.e. remove excessive Carbon Monoxide build-ups.

The internal temperature will also be monitored, which will activate the extract system if area reaches any of the pre-set conditions.

The production area will be divided into 4-No control zones.

The temperature/air quality within each zone will be maintained at the required conditions by modulation of ventilation louvers and switching of extract fans, acting on signals received from the average reading of multiple temperature and Co sensors located within the zone.

All extract fans will be monitored by the BMS for airflow failure.

3.29.6 WAREHOUSE AREA HEATING SYSTEM

Provide 2no gas fired Air Handling Units, these will produce heated air which shall be distributed down high velocity ductwork and terminate with jet nozzles.

This system allows full use of the floor area.

3.29.7 TRANSFORMER ROOM

The Transformer Room space temperature will be monitored by the BMS.

When the temperature exceeds a pre-set level, the extract fan will be enabled.

The extract fan will be monitored for fan failure and raise an alarm at the BMS.

3.29.8 BUILDING GAS SAFETY SYSTEM

Connect to the incoming gas main adjacent to the main office. From point of supply install a gas solenoid valve and ECV.

The pipework will then be distributed through the warehouse to the combustion chambers and Power Island externally. Allow for final connections to the units and will purge up to our isolation valve.

The solenoid valve will be installed where the gas enters the building.

The solenoid valve will close on operation of the fire alarm panel or operation of local emergency knock-off button.

3.29.9 WAREHOUSE MAINS & TANKED COLD WATER

Connect to the incoming supply notionally positioned adjacent to the main office.

Allow to run through the warehouse to the 2no 10,000-litre tanks in the external plant area.

Provide a booster set to be installed which will then feed the following areas

- Main Office Building
- 3no 35mm Drop points around the warehouse.

All final connections will be made by suitably sized isolation valves, where we are connecting to any of the clients equipment connection requirements shall be made in advance.

All pipework will be trace heated to prevent freezing. All services will be chlorinated prior to handover.

Current water regulations will be strictly adhered to.

3.30 MECHANICAL CONTROLS

3.30.1 OVERVIEW

The complete system shall be controlled using a building management system

The system shall comprise of local control panels, each of which serves local plant / control equipment located throughout the building and a central user-friendly graphics based supervisor (Position to be agreed).

Each control panel will be equipped with fascia mounted user interface for interrogation of local Trend outstation.

3.30.2 BMS FRONT END SUPERVISOR

This takes the form of a central computer supervisor, running a colour graphics driven software programme.

The central computer shall have the following minimum specification: -

Minimum P4 desktop computer with 1 GB RAM, 80 GB hard drive, DVD/CD, 17" LCD colour monitor, keyboard, mouse and Windows operating system.

3.31 PUBLIC HEALTH SERVICES

3.31.1 GENERAL

Drainage shall be designed and installed as specified below

3.31.2 FOUL DRAINAGE

The above ground foul drainage shall be a vertical system of drainage with soil, waste and vent pipework designed to transport the discharges from the sanitary appliances, refreshment point, kitchenette, etc. all over the building, to the below ground drainage system.

The Design for above ground drainage system shall be based on the information contained in this specification and guidance provided in the following documents:

- Building Regulations – Approved documents
- BS EN Codes of Practice – 12056 (Primary Ventilated System)
- Local Water Authority (Severn Trent Water) byelaws
- Manufacturers printed instructions

The above ground foul drainage system shall be a primary ventilated single stack system.

The ventilation pipe shall be suitably (following BS EN 12056 – 2 and Building Regulation) terminated at roof level.

In order to minimise the roof penetrations, ventilation pipes from the group of nearby stacks shall be suitably connected together at high level to have a single vent pipe to the roof for the group.

All pipework shall be concealed from view, where possible, except in store or Plantrooms unless required by the Contract Administrator.

The pipework shall be fully accessible for maintenance purposes.

No pipework shall be routed through electrical switch rooms, electrical ducts, IT rooms or similar water sensitive areas.

All small-bore waste pipe work and fittings shall be polypropylene or muPVC. manufactured to BS 5255 using a solvent or mechanical jointing system

All pipework shall be supported in accordance with Manufacturers requirements both in the vertical and horizontal plane using the manufacturers' proprietary supporting system.

Internally routed pipework shall be acoustically insulated where it is routed through sensitive areas.

Fire collars shall be provided and installed at interfaces with Fire Compartment Walls & Floors.

3.31.3 PLANT ROOM DRAINS

Discharges from equipment in the plant room shall be taken to a trapped floor gully, which connects to the nearest foul water drainage stack.

3.31.4 OVERFLOWS

W.C. cistern overflows shall discharge to the flush pipe using a suitable arrangement approved by the local water company.

3.31.5 RAIN WATER DRAINAGE

By Others

3.31.6 INSPECTION AND TESTING

All drains shall be tested with air after being jointed, but before being concealed.

The air test shall be applied as follows:

Air pressure equivalent to 100mm head of water shall be held for 5 minutes without further pumping, with loss not exceeding 25mm for satisfactory testing.

Where gullies or other appliances are connected, a 50mm test should be applied with maximum loss of 12mm over a 5-minute period.

After completion of air testing, performance tests shall be carried out in accordance with BS EN12056.

In the event of failure of any test, or the occurrence of infiltration, the defect shall be located and repaired and the test repeated until it is found satisfactory.

A final Test Certificate shall be submitted following successful testing of the entire drainage works.

4 ELECTRICAL SERVICES

4.1 GENERAL

The specification describes the minimum quality of work, workmanship and materials acceptable in instigating these works.

The works shall be instigated to the programme as detailed within the main contract documentation.

This specification together with other documents issues as part of the Tender Documentation for this project describes the minimum quality of work, workmanship and materials acceptable in instigating these works.

Any new works installation shall be in full compliance with the 17th Edition Regulations of Electrical Installations (BS7671) as issued by the Institute of Electrical Engineers and all relevant British Standards, Health and Safety Regulations and CIBSE Guidelines.

The works shall also be carried out in accordance with Standards of Workmanship laid down by the National Inspection Council for Electrical Installation Contracting (NICEIC)

Allowance must be made for the supply and installation of all equipment necessary for a complete electrical installation. No omission from this description shall relieve the installer from his obligation to carry out the whole of the works specified.

In the event of conflict between information in any document the most onerous requirement or condition will apply.

The Electrical Services Contractor shall fully co-ordinate his works with all other services installations, trades and that of the Principle Contractor.

4.1.1 DESIGN STANDARDS

The Mechanical, Electrical and Public Health Services Installation shall be carried out in accordance with the following standards.

Where new standards are introduced or existing standards revised during the contract, the Services Contractor shall pro-actively notify any new requirements and the likely effects in a timely manner. Proposed changes may then be jointly agreed installation prior to implementation.

This list is indicative, but not exhaustive and best practice will be used at all times.

Building Regulations (including Part L2a 2006 and Part F 2006).
Energy Performance of Building Directive (including Certification).
Greater London Authorities (GLA) Renewables Toolkit
BS 7671 2008 - 17th Edition Requirements for Electrical Installations
HSE Approved Code of Practice & Guidance.
CIBSE Guides.
Energy Conservation Act.
British Gas Council Codes of Practice.
Regulations under the Electricity Acts.
Relevant HVCA Design Guidance Publications.
Electrical Safety, Quality and Continuity Regulations 2002.
The Gas Safety Regulations.
Health & Safety Executive, Legal Series 8.

The Clean Air Act.
The Control of Pollution Act.
Specific Requirements of the Local Electricity, Gas or Water Authority.
Requirements of the Local Fire Officer.
Health & Safety at Work Act.
CDM Regulations 2007
Relevant British Standards and Codes of Practice
Relevant European Standards
Radiological Protection Advisors Requirements
Advisory Committee for Control of Dangerous Pathogens
Electro-magnetic Interference Guidelines
Building Services Research & Information Association Code of Practices

4.1.2 GENERAL PRINCIPLES

Layout of Electrical Controls Equipment and Service Runs

Layouts of all electrical plant, distribution gear, switchgear and service runs shall be neat safe and logical. Positions shall be chosen to afford easy access for operation, maintenance and replacement of any item of equipment, or of the associated cables etc. Layouts shall also allow for future extensions where necessary or as described elsewhere.

The Electrical Services Contractor shall fully co-ordinate his works with all other services installations, trades and that of the Principle Contractor.

No structural elements of the building, e.g. columns, beams or slabs shall be removed, cut, notched or deformed during the Electrical Services Installation.

Provisions for Future Extensions to Installations

1. Final Circuits

The design of every new final circuit is such that it can be extended to accommodate additional loads of up to 20% of its original design current without exceeding any of the limitations of the circuit.

2. Distribution Boards

Spare outgoing circuit ways equal to 20% of circuit ways already used have been left in every new distribution board, reasonably distributed over the phases or poles of supply within Distribution Boards.

The design of the electrical installation is such that extra load may be added to any distribution board up to 20% of the original design current. Such additional load will not cause any circuit limitation to be exceeded.

3. Switchboards

Provision has been made in relation to new switchboards such that extra outgoing protection devices can be added in quantities equal to 20% of the outgoing devices originally fitted, and of frame sizes and ratings which are likely to be needed in future. This shall be achieved by leaving spare space and provisions within switchboards.

The design of Main LV switchboards and or panel boards is such that they can be extended by addition of cubicles or sections to one end. Space shall be allowed to at least one end of every freestanding switchboard for an extension of 1 metre in length (allowing for proper access even after the extension is added).

The incoming circuit, circuit control device and busbars of every switchboard is such that extra loads can be added up to at least 20% of the original design current without exceeding any circuit limitations

4. Grouping of Equipment

Where equipment or groups of equipment are mounted in switch cupboards or switch rooms, or elsewhere, sensible space provision shall be left for possible future distribution boards, switchgear or other controls to be added to the group.

5. Trunking and Cable Trays / Basket

Spare width shall be allowed on every new cable tray equal to at least 20% of the space already occupied and sufficient for at least one cable of the largest diameter already installed to be installed at a future date

Spare space shall be allowed in every trunking compartment for additional cables having an aggregate overall cross sectional area of at least 20% of the area already occupied by cables, without exceeding the space factor limitations of the IEE Wiring Regulations.

4.1.3 LOAD BALANCING

The installation has been designed and installed as to give a load balance across phases as far as practicable. On completion of this phase of works any distribution board affected by these works shall be checked for Load balancing.

A schedule of recommendations for any load re balancing shall be provided by the Services Contractor for consideration by the Client.

The Services Contractor shall then undertake any load rebalancing necessary subject to receipt of client comment

4.1.4 SYSTEM OF WIRING AND MISCELLANEOUS REQUIREMENTS

New wiring systems shall be of types which are entirely suitable for the services with which they are associated in terms of providing for correct functioning of the services and equipment and of being compatible for the voltage, current and frequency of supply.

All wiring systems shall comply with the requirements of BS 7671 (IEE Wiring Regulations) and the requirements stated elsewhere in the specification.

The mechanical strength and rigidity of all wiring systems will be suitable to withstand the dangers of mechanical damage or Electrical forces which might occur during the construction and/or operation of the building.

4.1.5 CABLE COLOUR CODES

To be in compliance with BS 7671: 2008

4.1.6 SPARES TOOLS AND KEYS

All tools and keys required for operation and maintenance of switchgear, distribution equipment, Luminaries etc shall be provided and issued to the Client

4.1.7 ELECTRIC SHOCK NOTICES

All statutory signage on Electric Shock, First Aid Procedures and Shock warning notices to be provided and installed to all Substations and Switchrooms by the Services Contractor.

4.1.8 RUBBER MATS

6mm (15KV) Fluted Rubber Matting to BS921 1976 600mm wide (min) is to be provided by the Services Contractor. This shall be provided and installed to the front of and run the full length of any new Main LV Switchboards.

4.1.9 MECHANICAL SERVICES DUCTS, RISERS AND SHAFTS

Certain of the ducts, risers and shafts in the building as denoted on drawings are reserved for use by mechanical services (i.e. for pipe work and ductwork etc). This segregation philosophy shall be maintained consequently, these shall not be used for electrical services.

Likewise Mechanical services pipe work shall not be run in risers designated for Electrical Services.

In addition Electrical Services are split between Landside and Airside Electrical Installations from LV Switchrooms down to and including final sub circuits

This philosophy is to be maintained for the new services Installation and any modifications undertaken under this phase of works.

4.1.10 DRAWINGS

The Services Contractor shall provide as necessary a schematic drawing of the final project Electrical Distribution System, mounted within the respective LV Switchroom for all distribution systems.

These drawings shall be provided within all LV Switchrooms.

4.1.11 RECORD DRAWINGS

Not Applicable

4.1.12 ELECTRICAL SUPPLIERS & MANUFACTURERS

The Contractor shall provide technical submissions for all major services components demonstrating compliance with the specification

4.1.13 SERVICES SHUTDOWNS

Once systems are energised and handed over either in part or full, the Services Contractor shall provide a minimum of 5 working day's notice in writing of any subsequent intended M&E Services Shutdown required.

The notification shall clearly identify;-

- Reason for the required shutdown
- Works intended to be undertaken within the shutdown period
- Anticipated shutdown duration including start and completion times
- Method Statement for work intended to be undertaken
- Attendees including any M&E Services Contractors that will be present
- Any input required from others

4.1.14 SAMPLES

Where requested, samples of any product intended for use for the electric installation shall be provided and submitted for approval prior to order and installation at no extra cost to the contract.

All samples will be returned to the Electrical Services Contractor on request.

4.1.15 LABELLING OF EQUIPMENT & ACCESSORIES.

All accessories (Sockets, switch plates, isolators, fused connection units) etc shall on completion of the installation be labelled with permanent labels.

Every item of switchgear, distribution boards, isolators, fuse switches etc. shall be labelled with engraved laminated plastic labels indicating the source of supply for the board and the board reference

The front plate of all socket outlets and lighting switches shall have clear legible printed permanent adhesive type labels fitted (red on white background) giving circuit reference as indicated on distribution board schedules.

The labelling reference format shall be agreed prior to any labels being procured and installed.

4.1.16 SITE INSTALLATION AND ELECTRICAL EQUIPMENT PROTECTION

Electrical equipment shall not be Installed until the building external walls are complete, the building is watertight, and internal structural work on walls and floors is substantially complete.

Suitable Protection against mechanical damage and from ingress of water, building debris and vermin shall be provided and maintained continually throughout the works including periods of storage installation and after installation.

4.2 HV DISTRIBUTION

Extensive High Voltage Distribution Infrastructure Works are required for this development to provide an electrical infrastructure that is able to distribute HV electricity throughout the site.

The infrastructure requirements extends from the incoming point of connection provided by the Regional Electricity Company (REC) at 33kV to include site distribution at 11kV via Power Distribution sub stations that shall be strategically located to suit the site's electrical demand..

The infrastructure shall also incorporate for synchronised operation of 2 No, 20MW (26.25MVA) 11kV Generators and associated Protection & Control provided and installed by others.

The site is to provide a strategic export connection via 2no 20MW (26.25MVA) 11kV Generators connected to a common connection on the consumers 11kV Main Switch panel busbar.

The mains HV supply to the site is to be provided by the Regional Electricity Company (REC) at 33kV

A second 11kV supply of 2.5MVA capacity is to be provided to provide a 'Temporary Construction Supply' in advance of the 33kV connection. The

supply will ultimately be used as an emergency supply in the event of 33 KV supply failure. Allow for 11kV transformer, switchgear and connections as detailed on the HV single line schematic

The relevant supply characteristics as advised with the REC are as indicated within Section 4.5 of this specification.

The Services Contractor shall provide a complete site HV electricity Distribution system from the REC's point of supply, (the Utility provider 33kV Metering Circuit Breaker) with HV and LV switchgear and all associated auxiliary equipment.

The Services Contractor shall include all liaison with the REC and the Process Equipment supplier in order to understand their respective Installations & Interface, including Control & Protection, Control Relays, Control Signals, Control Transformer Voltage Ratio's etc to ensure co-ordination with the design, installations and commissioning.

The location of all HV/LV transformers and switchgear, and the routing of all site cables and shall be indicated on drawings and agreed prior to commencement of the site Installation

All works shall be undertaken and co-ordinated with both the Contractor and REC's programme of work, the date for the REC's installation to be complete, and the date for power to be switched on to suit the construction programme, including building drying and other mechanical and electrical engineering systems testing.

Substations will be provided via HV/LV (11kV/400V) MIDEL / Oil transformer(s) (subject to client approval) to a 400/230V 3-wire plus separate earth and protective conductors (TN-S) site distribution system designed and Installed to BS 7671.

On completion of the Commissioning the on-load site voltage at the Substation Main LV switch boards shall be adjusted to 400/230V

4.2.1 SYSTEM DESCRIPTION

The HV distribution system comprises of an incoming/main 33kV HV switchboard interconnected with a 33/11kV Transformer which in turn feeds a main site 11kV Switchboard. Refer to separate H&K specification for full details.

From the Main 11kV Switchboard suitably rated and sized 11kV distribution cabling is to be provided to connect with remote substations located across the site at strategically located positions to suit the site electrical demands.

The REC supply comprises of a single radial feed HV feed at 33kV directly from an upgraded remote off site REC primary substation (Olbury Primary Substation).

The feed shall terminate at the incoming / main HV switchboard.

The main 33kV HV switchboard is to be located within a new Substation to be constructed on the site to REC Requirements adjacent to which the Consumers Substation shall be constructed.

The Main 33kV & 11kV Switchboards shall be constructed as a free standing single section switchboards.

2 No 11kV 20MW (26.25MVA) Generators shall be provided and Installed by others together with associated Control & Protection.

These Generators shall also connect to the Consumers Main Site 11kV switchboard via individual suitably rated radial supplies.

Remote site substations across the site shall be interconnected by an HV Ring Circuit which shall be operated in an open ring format.

The normal operational open point is to be determined and agreed.

The HV distribution cables shall be run externally within ducts and / or at high level internally within Buildings contained on suitably sized and routed cable containment.

All HV distribution cables shall be above ground with all HV cable connections to HV equipment made from above.

The interface between HV cable and transformer shall be via extensible and non -extensible ring main units.

4.2.2 CONTROL REQUIREMENTS

Standard protection utilising an open ring circuit methodology shall be adopted. With Electronic IDMT and earth fault protection relays being provided within the REC's switchgear, HV switchboard and local ring main units.

Earth fault indicators shall be provided on each leg of the ring main unit to identify section of HV cable affected.

The HV Generators shall be provided with synchronisation equipment (By Generator supplier) and G59 relay protection that prevents them from operating under mains supply failure.

4.2.3 CO ORDINATION & GRADING STUDY

The Services Contractor shall undertake a full co-ordination study of the HV and LV electrical infrastructure to ensuring suitable grading and co-ordination is achieved between protective devices to protect plant and equipment in the event of a fault.

The study shall fully co-ordinate with the settings provided by and for the REC equipment using protection devices settings provided by the REC when available.

This study shall be provided and any feedback comments incorporated in good time prior to energisation of any HV Equipment.

The Co Ordination study shall be undertaken utilising an Industry recognised software package.

4.2.4 INTERLOCKING FACILITIES

The scheme shall include the provision of all necessary interlocking facilities for safety and or ensuring the system operates in line with the design intent

4.2.5 REMOTE TRIPPING

Remote tripping of the HV switchgear shall be provided at each substation by:

- Shrouded and / or shielded Pushbuttons located within the respective LV switchboard Room
- Transformer over temperature sensor

4.2.6 RESTRICTED EARTH FAULT PROTECTION

Restricted Earth Fault relay(s) shall be provided to trip the HV switchgear and to disconnect the HV/LV transformer(s) in the event of an earth fault in the transformer LV windings or in the LV cables between the transformer and the LV switchboard where transformers are located remotely and not connected via fault rated busbars.

4.2.7 AUXILIARY POWER SUPPLIES

30v DC auxiliary power supply and battery chargers to power all the necessary HV/LV switchgear protection inter-trips are to be provided and Installed.

Power Supplies shall be derived from nickel cadmium batteries with associated battery chargers located within a suitable steel enclosure which shall be remote from but installed within the same room as the switchboard.

Control facilities shall including the following:

- 1 Mains power supply and isolating switch
- 2 Indication lights: red for charging and green for a fully charged state
- 3 Fault relay with volt-free contacts to alarm the BMS system if the auxiliary power supply fails

4.2.8 PERMIT TO WORK SYSTEM

Prior to the Installation becoming live the Services Contractor shall arrange and rigorously implement on partial or complete energisation a Permit to works system.

4.2.9 SENIOR AUTHORISED PERSON (SAP)

The Services Contractor shall provide a suitably qualified and experienced Senior Authorised Person (SAP) to undertake all HV switching; isolations and issuing on necessary Safety Documentation (Permits to Work) etc. and supervise the Testing & Commissioning of the High Voltage System.

The CV for the SAP together with evidence of appropriate qualifications in this regard shall be submitted and approved prior to any works being undertaken

4.2.10 SWITCHGEAR LOCKS & KEYS

The Services Contractor shall supply a sufficient number of robust brass (or other approved material) padlocks to cater for the maximum simultaneous permutation of lockable items.

Padlocks provided for or on earthing mechanisms shall be coloured red and have different key numbers.

Two keys shall be provided for each padlock, with each key having a permanent label.

Padlocks shall be provided for the following items plus any others specified elsewhere in this specification:

- to lock circuit breakers in the service or earth position
- to lock shutters closed
- to lock voltage transformers in position
- to lock local/ remote selectors

A Suitable purpose made wall mounted key cabinet with a lockable glass front door shall be provided in every HV Substation or Switchroom to accommodate all of the associated padlock keys.

Every key hook is to be labelled with the appropriate key reference.

4.2.11 HV SWITCHGEAR

HV (33 & 11kV) Switchgear shall be provided in accordance with the following H&K Specifications:-

- **Specification For 1 No Free Standing Fixed Pattern High Voltage Cubicle Switchgear**

Switchgear shall be provided with short circuit ratings, current ratings, number of poles and protective device arrangements as indicated on the drawings or within the Specifications.

All HV switchgear and protective devices shall be provided from the same manufacturer.

All necessary loose equipment required for the operation of the high voltage switchgear, including tools, operating handles shall be provided and handed to the Contractor on completion of the works

Where it is proposed to site switchboards over formed floor trenches, the Services Contractor shall supply and install all necessary suitably sized support steelwork to span trenches.

Alternatively, Provide and Install all floor Rawlbolts type fixings required in accordance with Manufacturers Recommendations.

4.2.12 SITE DISTRIBUTION TRANSFORMER

A Continuously rated ground mounted 33kV / 11kV 35 MVA Power Distribution Transformer of the ONAN fluid filled type, rating as detailed for use on a 3 phase, 50Hz high voltage transmission system shall be provided and installed within the Consumers Site Intake Substation.

The Transformer together with all associated ancillaries shall be provided in accordance with the following Specification:-

- **Refer to separate Specification For 1 No 33kV / 11kV 35 MVA Power Transformer**

4.2.13 NEUTRAL EARTHING RESISTOR

In order to limit the current potentially flowing through the neutral point of the site 33 / 11kV 35MVA Distribution Transformer in the event of an earth fault to acceptable limits, a suitably sized 11kV Neutral Earthing Resistor (NER) shall be provided and installed connected to the star point of the supply Transformer.

The Neutral Earthing Resistor (NER) has been initially sized and rated at 11kV, 1500A, 6.35 ohms, 10 sec. including associated disconnectors etc.

This size shall be reviewed and verified as part of the detailed design and amended as necessary in order that the potential fault levels are limited to within acceptable tolerances of the equipment to be provided and installed by the Services Contractor

The Neutral Earthing Resistor shall comply with the following Specification;-

- **Specification For 1 No 11kV Neutral Earthing Resistor**

4.2.14 HV SUPPLY PROTECTION AND MONITORING

Overcurrent relays with inverse, very inverse or extremely inverse time characteristic shall be provided as required, backed up by instantaneous high set relays where appropriate.

Earth fault protection is by residual current or zero sequence current systems.

Arrangements shall be made such that the removal of a protection relay from its case "short circuits" the connected CTs.

All relays shall be provided with facilities for testing either by direct secondary injection at the relay or by such other method as is provided by the relay manufacturer and approved by the Contract Administrator.

Spare volt free contacts for inter-tripping and remote indication shall be provided to all relays.

Provide HV supply monitoring facilities together with associated current and voltage transformers.

4.2.15 HV CABLES

HV Cables shall be XLPE/SWA/PVC stranded copper 33kV and / or 11kV cabling to requirements of relevant British standards including BS 6622 with copper conductors and red outer sheath.

Where cables are to be laid in ground which may be prone to, or is waterlogged. Consult the intended cable manufacturer as to any special insulation or cable sheath materials which should be provided to suit all parts of the required installation.

The cables are to be installed in accordance with the cable maker's recommendations with regard to cable support spacing, minimum bending radius, cable spacing, pulling tension and grouping factors.

Where cables are laid in the ground, the cables shall be at least 0.8m deep and space between adjacent circuits of at least 1.8m apart for thermal independence.

Cables shall be laid on a bed of fine earth or sand. Coloured plastic marker tapes shall be placed in the ground above the buried 11kV cables.

Tiles or concrete slabs are to be provided in the ground above the buried 11kV cables.

Adequately sized UPVC ducts for cables shall be provided for Cables where they pass under areas of hard standing

Cables shall not be installed where the ambient temperature is below 0°C.

The Contract Administrator shall be informed of any damage which does occur to the cable during or subsequent to Installation, upon which the Contract Administrator shall provide instructions as to any repairs or cable replacement required.

All HV cables between equipment points of Termination are to be in continuous lengths, intermediate cable joints will not be permitted.

The Services Contractor is to Supply and fit permanent warning labels, red lettering on a white background, 'DANGER 11,000 VOLTS'.

These labels are to be Installed at 20 m intervals and within each cable draw pit along the entire length of each individual

HV cable installed within any building, subject to a minimum of 1No. label in every room or space through which such cables pass.

4.3 DIESEL DRIVEN GENERATOR

Not required for this project – A secondary 11kV supply will provide emergency back up to the site.

4.4 UN-INTERRUPTIBLE POWER SUPPLY UNIT (UPS)

From the 2.5MVA Transformer (site temporary supply or Main HV Switchboard see Main Schematic provide LV tails into the UPS Form 4 type 6B input switch panel.

Cabling from the “input panel” will supply the UPS modules and battery system to supply 2.5 MW of UPS @ 10minutes.

Cabling from “output side” of the UPS will supply a Form 4 type 6B output switch panel. This panel also incorporate “essential” supply requirements.

The UPS shall support critical systems as detailed on the schematic including:

- Power Islands 1 & 2
- PLC
- Filter Power
- Exhaust
- Air Compressors
- Lighting and Power

4.5 LV DISTRIBUTION

4.5.1 GENERAL

A comprehensive Low Voltage Distribution System and Cable Containment System shall be designed and installed by the Services Contractor to distribute low voltage electrical power, safely and reliably, around the site and within Buildings.

The LV Installation shall commence from the cables connecting secondary side of the 11000/433V Transformers comprising part of the Substations connecting the main LV switchboards to the mains intake, and finishing at the output terminals of all site process related (RODEC) panel boards, distribution boards, power distribution units, mechanical systems supply points and/or the

main switch input terminals of all items of equipment that have their own integral isolator.

The Specialist Process Provider will provide all installations subsequent to completion of the works all-outgoing from the Process LV Switchboards, Panel boards etc as noted on drawings to feed his process equipment

Electrical metering and / or Sub Metering shall be provided to enable measurement and recording of the energy usage of each LV supply (process related or domestic), locally or via the BMS.

The LV Distribution Design shall provide and achieve full electrical discrimination throughout the installation and provide Technical data and studies to confirm this requirement is achieved.

The Services Contractor shall liaise with the Principle Contractor for the provision of all necessary associated builders' work, excavations and penetrations including the provision of cable duct covers.

4.5.2 PACKAGED SUBSTATIONS

Packaged Substations are to be provided in accordance with H&K Specification reference

- **Specification For Package Substations**

The Switchboards shall generally comprise Main LV Switchboards constructed to BS EN 60439-1, Form 4 type 6, protected to BS EN 60529. IP31 comprising of ASTA Certified type-tested assemblies.

Protection devices shall comprise LV air circuit breakers (ACB's) above 1600 A

Space Provision within panels for Moulded Case Circuit Breakers shall be provided to protect each outgoing cable circuit against overloads or earth faults.

Power factor correction system controlled by an integral PFC sequencing relay is to be provided, Suitably rated De-tuned capacitors shall be installed.

The Services Contractor shall design supply and install all control and Electrical Interlock wiring between the Main LV Switchboard and any remote devices.

4.5.3 DISTRIBUTION BOARDS & LOOSE SWITCHGEAR

Lighting & Small Power Distribution Boards are generally of the type utilising MCB's to BS EN 60898 Type C or D or IEC 947-2 as appropriate provided within dedicated and or locked LV Switchrooms, Dedicated rooms / cupboards to support General Lighting & Small Power Circuits.

Location of distribution boards are as indicated on drawings.

The distribution boards have been located as close as possible to the geographical load centre they serve.

New distribution boards indicated on drawings shall be provided and installed. The quantities and location of Distribution Boards have been selected taking due account of the economic constraints of the design, safety of Building Operators and occupants, convenience of operation & maintenance and metering strategy.

New Distribution Boards shall be of the Miniature circuit breaker type, distribution boards will be of the metal cased surface mounted pattern (IP31).

The doors of all distribution boards will have a lockable cover fitted with a cylinder barrel lock with 3 no keys (All locks/keys shall be common.)

Every distribution board shall be completed with an integral main isolator of the fault making load-breaking type.

All distribution Boards shall have neutral & earth bars with dedicated terminals for each unit and test links. The earth bar shall have additional 20% spare terminals.

All distribution boards shall be adequately sized to accommodate all outgoing ways and make due provision for spare capacity as outlined within this specification.

All sub circuit MCB's shall be suitably rated for the circuit they protect, circuit breakers being of the same type i.e. B or C dependent upon application. All miniature circuit breakers shall be 10kA fault rated.

Residual current devices (RCD's) of 30mA sensitivity shall be provided to all small power circuits serving socket outlets unless their provision may cause nuisance tripping due to the nature of equipment served. RCD's shall be combined MCB/RCD single module type.

The outgoing circuit Distribution Board configuration shall be logically arranged to ensure that lighting and small power circuits are separated and grouped.

Type written circuit charts in transparent plastic envelopes shall be provided inside the cover of all Distribution Boards. These charts shall detail:-

- Circuit Arrangement i.e. radial / ring
- Load Details
- Protective device rating & type
- Conductor & CPC cable size & type

LV Switchboards and MCB Distribution Boards are generally labelled with a unique reference system the labels detail:-

- The origin of the incoming supply
- Details of the size and type of incoming supply cable
- Prospective short circuit current
- Earth Loop Impedance

Permanent Identification Labels shall be provided and installed to all distribution equipment, Label information to be agreed with the Contract Administrator.

Where devices are required to control outgoing circuits from distribution Boards they shall be installed in a housing of similar design and manufacture as the associated switchboard / distribution board.

Bulk supplies to specific items of equipment shall be terminated in a suitably rated Padlockable isolator switch disconnectors or sub main switch panel located adjacent to the equipment they are serving.

Switchgear and switch fuses with means of locking them in the open position shall be utilised

4.5.4 EXTERNAL FEEDER PILLARS

Where required externally located Low Voltage Feeder Pillars shall be provided to serve external lighting, signage and the like.

Feeder Pillars shall be ground mounted of Powder coated steel or GRP Construction to provide an IP 54 rating

Feeder Pillars shall be complete with hinged opening doors complete with a triangular key locking arrangement.

Integral equipment shall comprise of an incoming suitably rated isolator with outgoing ways provided as MCCBs and/or MCBs.

A Gland plate arrangement shall be provided for termination of steel wire armoured cable glands.

Where the feeder pillar contains equipment that is sensitive to moisture and / or temperature a tubular thermostat controlled heater shall be provided to the feeder pillar

Power supplies are also to be provided to:

- Within the recycling & storage area provide 7No purpose made multiservice units with commando type sockets and internal MCBs. Each unit shall have 1No 32amp TPN , 2No 110V SPN and 2No 24V SPN (for task lights) outlets.
- Crane and signage power.
- Roller shutter power.

4.5.5 ELECTRICAL METERING

Electricity Meters shall be provided and installed to all LV Switchboards including all associated Current Transformers, fuses and / or links.

On each mains LV switchboard, at the point of coupling with the incoming supply a meter to measure, display and record the true RMS voltage, current and the power factor instantaneous demand and maximum demand for KVA, KW and KVA_r and energy consumption kWh_r for each phase of the incoming supplies.

The ammeter shall measure currents between phase and neutral currents and the voltmeter to measure the voltages between phases and between each phase and neutral.

Multi-function digital energy electrical meters are to be provide on all switchboard outgoing circuit, the meters displaying Voltage (line and phase), Amperes, power factor, instantaneous demand, maximum demand KVA, KW and kVA_r and energy consumption kWh_r.

All meters are to be new meters and have MODBUS or equal communications protocol for linking into the BMS System

The Metering Current Transformers shall be fully compatible in terms of duty and Burden with the meter to be installed

4.6 ELECTRICAL CONTAINMENT SYSTEMS & DISTRIBUTION

4.6.1 GENERAL

Cabling for various electrical systems is to be located on or contained within suitable containment systems designed and installed by the Services Contractor.

Containment systems shall be of steel construction and of a galvanised finish

All outgoing sub main cables from the main switchboards shall be installed and supported on cable ladder

New containment installations shall maintain the same system segregation as installed at present, unless subsequent Regulation & Standard changes deem this unacceptable in which case a compliant containment system shall be provided

Any new cables will not be installed on containment systems that are already full to capacity, in this instance additional containment shall be installed

Any new Surface mounted containment installations shall only be permissible within

- Plant Rooms
- Services Risers and or cupboards
- Ceiling Voids

In offices and sanitary facilities the installation shall be fully recessed.

Generally low voltage power cabling shall be contained in galvanized, trunking / basket , and conduit and on tray.

Any additional Structured Cabling Systems containment will be segregated from other Services Containment these must provide separation distances in accordance with BS EN 50174-2 2001 and Section 4.12.6 of this specification

Where possible, as indicated on drawings cable routes shall be concealed within ceiling, building voids and finishes.

Where services are exposed, particular attention shall be paid to the design, installation standard, and quality of finishes, aesthetics and co-ordination with other services and other elements of the building design.

New containment systems, in addition to the required spacing factors, have an allowance for the installation of 20% more cabling for future use.

New cabling will not be installed within 150mm of any heating appliance or hot pipe work, and where in the vicinity, shall be installed below such pipe work or heating devices.

The Services Contractor is responsible for coordinating any new Installations with existing electrical and mechanical services Installations within the building to avoid clashes, particular attention shall be given to the coordination of Ventilation ductwork, piped services and electrical containment.

The Services Contractor shall provide measures to ensure that wet piped services will not affect electrical installations if leaks were to occur.

Fire barriers shall be installed or reinstated where cabling or associated cable containment systems penetrate new or existing fire compartment divisions.

The rating of the fire barrier shall be equivalent to the rating of the compartment being penetrated.

In addition acoustic seals will be provided to all walls and ceilings subsequent to installation of M&E Services.

Refer to architectural drawings for further details of fire compartmentation lines & zones.

The Services Installation shall ensure on completion that there is sufficient space to provide safe unrestricted access to allow equipment / installation to be installed, operated and maintained.

Containment within risers shall be fixed to wall mounted horizontal Unistrut brackets or a prefabricated support system. Floor penetrations shall be provided the full length of the riser wall with removable covers to enable future installation and / or modification.

Unless unavoidable new containment shall not be routed through Retail or third party areas.

4.6.2 PRIMARY & SECONDARY CONTAINMENT.

Cables entering emanating from or between LV Switchboards, Section Boards and final Circuit Distribution Boards will be installed and supported on galvanised cable tray / ladder or basket containment systems suitably fixed to take due account of cable weights including allowance for additional 20%

Provision shall be made to tee off each cable ladder/tray as necessary. All tees bends etc. shall be purpose made and manufactured, site fabricated bends tees etc. shall not be permitted.

In exposed areas Galvanised steel conduit shall be used between Primary Containment to trunking / trays and outlets or devices.

4.6.3 LOW VOLTAGE CABLES

All cables shall hold BASEC or European Equivalent approval.

Electrical Services Systems utilising the types of wiring as detailed below shall be provided and installed.

1. Main and Sub-Main Low Voltage Cable Systems:

Multicore XLPE/SWA/LSF 600 / 1000V grade with copper conductors and black outer sheath cables. N.B. Where two or more cables share a common route they shall be installed on cable containment provided and installed by the Electrical Services Contractor.

All Sub Main Cables are to be calculated on the basis of being installed single layer touching on Cable Tray or ladder or installed within Underground Ducts as appropriate, consequently all cables shall be installed in this manner.

Sub Main Cables shall be suitable fixed to containment with proprietary LSF Cable Cleats.

All cables passing through floors or walls will require fire stopping. The Services Contractor shall provide all necessary attendance to the Principle Contractor who will instigate this work.

All cables shall terminate in suitably rated isolators either integral to or adjacent to the equipment served. All cable routes shall be fully coordinated with other services and the structure by the Services Contractor to enable suitable access for maintenance and or future modification

2. Final Circuit Wiring of Lighting and Power Services.

To suit environment / conditions either:

- Cu/LSF multicore cables run on galvanised basket with galvanised conduits where below 4000mm above FFL
- Single core LSF 450/750V (6491B) insulated copper cables drawn into a galvanised steel conduit and steel trunking system.

3. Fire Detection and Alarm System and Voice Evacuation System.

Flexible red sheathed enhanced OHLS Zero Halogen, Low Smoke fire rated cables (Red Sheath) manufactured to BS 5839 Part 1 2002 Clause 26.2 d) to classification PH60 of BS EN 50200 shall be utilised, clipped direct or run on dedicated galvanised containment. Cables shall be Firetuf (Standard) or Firetuf Plus (Enhanced)

4. Wiring Associated with Other Services not listed above:

Suitable cables drawn into steel galvanised conduit and galvanised steel basket / trunking, or suitable armoured and LSF sheathed cables, as detailed below.

Wiring and cables of different systems shall be segregated into separate enclosures and segregated by steel dividers where run on common cable trays / baskets as required by wiring regulations.

Conduits and cables shall be concealed by running in suspended ceiling voids and beneath wall finishes. Chases in the building structure must be approved by the Contract Administrator and Contractor. Chases will not be permitted in concrete. Cable trays and trunking shall be concealed in ceiling voids where they exist. However, trunking shall only be installed where it is fully accessible.

The exceptions where Surface mounted Installations are permissible:-

1. Plant Rooms
2. Ducts
3. Service Shafts
4. Walls which do not have applied finishes or cavities which would hide the services. Such surface runs, however, will not be accepted where there is an alternative route by which the cables or conduits etc. could be concealed.
5. Main Floor areas

The routes of all surface cables, conduits, trunking and cable trays /baskets shall be neat and logical.

All conduits shall be installed vertically or horizontally to building lines / walls no diagonal runs of conduit shall be accepted.

Cables shall not be cast directly into concrete or floor screeds but must be contained within a suitable containment System

All electrical switches and accessories of all descriptions, whether flush or surface mounting, shall be complete with suitable boxes into which they shall be mounted.

Cables, cable trays, conduits and trunking shall be routed at high level in neat rectangular layouts and shall drop vertically via walls to service points or to describe equipment. Drops in open areas will not be permitted.

Except where stated otherwise in this specification no support shall be taken for any service from suspended ceiling membranes (i.e. tiles, grid systems, plasterboard etc). Support must be taken from the structural soffit. Final Fix items excepted.

Cable trunking and ladders / cable trays at high level shall generally be suspended to constant levels by mild steel drop rods or wall mounted off suitable cantilever brackets and shall change level as necessary to miss obstructions. The suspensions shall comprise mild steel rod of diameter at least 8mm (nominally) suitable for the weight of cables installed plus 20% spare capacity for future installations. Steel wire shall not be used as a means of Suspension for containment systems.

Conduit and rod suspensions shall include facilities whereby they are free to move under the influences of expansion and contraction etc. Suspensions shall be robust such that there is no danger of collapse or other failure. Suspensions shall be such that their length is readily adjustable.

In areas where the soffit of the ceiling is occupied by luminaires and/or pipework or ventilation ductwork, cable trays and trunking may be supported by cantilever brackets subject to suitable fixing surface being available. These shall be treated and protected as other supporting steelwork. Trunking shall be positioned so that no part is closer than 50mm from the wall.

Except where specified otherwise luminaires shall be supported from the true ceiling by steel suspension wires of adequate strength such that no weight is imposed on suspended ceilings.

A minimum of two wires suspensions shall be provided to all modular and or linear fluorescent luminaires

Generally conduits which run at high level shall be mounted close to the true ceiling (or roof) and shall only set down to miss obstructions.

All secondary steelwork necessary to support electrical services shall be included in the tender.

All fixings to structural steelwork shall be affected by means of suitable clamp on devices provided by the Services Contractor. Drilling of structural steelwork for fixing for support will not be permitted.

Where cables pass through walls and floors which require fire stopping the Electrical Services Contractor shall provide all attendance necessary to the main contractor who will instigate the work.

Within Plant rooms, services shall generally run at high level and drop to serve plant, equipment and detectors etc. Conduits or cables dropping more than 900mm in open space shall be fixed to angular section steel, Dexion, Unistrut

or similar support running from ceiling to floor. These supports shall be supplied and installed by the Electrical Services Contractor.

In plant rooms, where required, purpose made brackets or floor fixed angular section steel up stands shall be provided to mount switches for local isolation and switching.

Where conduit or other systems, serve outlet points or lighting switches in areas with walls having plaster, tiled or panelled finishes, the boxes shall be installed such that they finish flush with the surfaces of walls. Extension pieces shall be provided where necessary to affect this.

Cable sheath colours shall be as detailed below;-

- Fire Alarm Systems – Red
- Emergency Lighting Systems – White.
- Public Annunciation / Voice Annunciation Systems - Black
- Low Voltage Sub Main Power Cables – Black
- High Voltage (33,000 / 11,000 Volt) Power Cables - Red

The types of cables, sizes of conductors, number of cores, design current, maximum volt drop and type of protective conductor for sub circuit cables have been designed and need to be installed in accordance with BS 7671.

4.6.3.1 External Cables

External cabling where required shall be XLPE/SWA/PVC with copper conductors.

Cables shall generally be installed in ducts laid in the ground or on suitably sized and supported Galvanised Cable tray where run in free air.

Cables shall enter buildings in a duct(s) with easy bend to floor level within the electrical intake position.

On completion of any cable installation in cable ducts, the ducts shall be sealed with a water-resistant compound to prevent the ingress of water; ducts shall also be sealed at any cable draw pits.

4.7 GENERAL LIGHTING

4.7.1 PROPOSED LIGHTING INSTALLATION

The Services Contractor shall supply and Install a complete artificial lighting Installation and suitable controls throughout all buildings that will meet the design criteria and reflect the Operational, Functional architectural and aesthetic requirements of each area and location respectively.

Lighting systems shall be designed in order achieve a uniform and adequate illumination level in all areas to suit the mode of operation and the function of the area being illuminated.

Normal service lighting systems has been designed and installed to meet the guidelines and criteria of the Chartered Institute of Building Services Engineers Code for Interior Lighting and BS EN 12464.

Illumination levels shall be in accordance with the CIBSE Lighting Guides has been followed wherever they are relevant.

The design and Installation shall provide good quality colour appearance and colour rendering.

The recommended levels of illuminance and luminance shall be achieved by the selection of particular luminaire, lamp source and optical control, together with the selection and recommendation of the associated environmental reflectance properties.

Lighting controls shall be suitable selected to ensure that all luminaires and ancillary controls are compatible with the environment in which they are installed.

4.7.2 LIGHTING DESIGN CRITERIA

The Lighting Design shall comply with current lighting design documentation including amendments available at the time of tender.

Unless specifically stipulated below the lighting, uniformity and Glare levels stipulated within the Chartered Institute of Building Services Engineers (CIBSE) shall be used as the design criteria.

Compliance with The Building Regulations in Particular Part L 2010 with regards to lighting requirements shall also be achieved.

The average maintained illuminance values, for the particular areas of the buildings, are to be as detailed on the H&K Performance Drawings

The lighting system shall be designed to provide a uniformity of illuminance of not less than 0.8, over the task area and a diversity of illuminance, over the core area, not exceeding 5:1. Screen Type Negative Polarity Positive Polarity

The following Reflection Factors shall be utilised within lighting Calculations;-

Ceiling 70%, Walls 50%, Floors 10-20% (dependent upon floor finish & colour)

In undertaking the design the vertical illuminance of surfaces within an environment, in conjunction with, the recommended horizontal working plane illuminance shall also be considered.

4.7.3 TYPES OF LUMINAIRES

Luminaires shall be selected to meet the design criteria and reflect the aesthetic requirements and the environment into which they are to be installed within each area

Luminaires shall be supplied complete with all specified diffusers, lamps, gaskets, seals etc as necessary.

The Services Contractor is advised that he may offer alternative suppliers for new luminaires as part of a separate bid provided that they are aesthetically similar in appearance to selected luminaires and full details of the alternatives are given.

Written approval from the Contract Administrator is obtained during the tendering period for any such alternative.

Should an alternative Luminaire be proposed then the Services Contractor shall be responsible for ensuring the luminaires performance is equal to or better than the Luminaire specified.

All new luminaires shall be supplied complete with suitably rated lamps, power factor correction and fixed terminal blocks.

All fluorescent luminaires shall be complete with diffusers / louvres as detailed.

Luminaires shall be fixed / mounted in accordance with manufacturer's requirements / details.

No manufacturer's transfers, logo's etc shall be visible on any Luminaire.

All fluorescent lamps shall comply with the following:-

- a) T5 fluorescent lamp ranges, 4000K, Triphosphor, colour-rendering index Ra 85, colour rendering group 1B.
- b) Compact source TC - fluorescent lamp ranges, 4000K, colour rendering index Ra 85 colour rendering group 1B.

High frequency control gear shall be used on all luminaires and luminaire control gear shall operate at a power factor of 0.9 lag or better.

Luminaire ballasts shall comply with BS EN 60929, BS EN 61347, 2000/55/EC and the following criteria:

- Efficiency > 90%
- Harmonics - Comply with BS EN 61000-3-2
- Mean time to failure - 50,000 hrs. at max ambient temperature, operating 24 hours per day
- Lamp failure - Ballast to sense end of lamp life and extinguish tube; ballast to automatically reset after supply has been isolated and restart upon replacement of lamp.
- Over voltage - provide protection to BS EN 61000-4-5

In order to prevent damage or unnecessary cleaning no diffusers / louvres are to be fitted to luminaires until a maximum of one week prior to handover.

Luminaires shall be installed only where they are easily accessible for maintenance.

Manual, PIR, Dimming and daylight linking / control as noted within this specification shall be provided as a means of lighting control to enable the artificial lighting to be switched off as an energy saving measure.

4.7.4 LAMPS

All Luminaires are to be provided complete with lamps, where practicable from one manufacturer.

Lamps to meet the following specification;-

- i) T5 fluorescent lamp ranges, 4000K, Triphosphor, colour-rendering index Ra 85, colour rendering group 1B
- ii) Compact Fluorescent Lamps - 4000K, colour rendering index Ra 85 colour rendering group 1B

Tungsten Halogen or Filament Lamps shall not be used

4.7.5 KEY AREA LIGHTING DESIGN SOLUTIONS

The Lighting solutions are to be developed utilising the following guidance;-

i) Circulation areas

The lighting in circulation areas (including reception, main entrance and lobbies,) generally to comprise recessed Compact Fluorescent and / or LED down lighters together with accent lighting luminaires.

ii) Office areas

Recessed Modular Luminaires compact source down light luminaires are to be designed and installed to meet CIBSE Lighting Guide LG7 criteria.

iii) Staircases

Office Staircase lighting to comprises surface, wall mounted luminaires using either T5 or 2D lamps, each with a perforated metal opal diffuser with a body colour finish to match the interior design colour finish.

iv) Toilets

In toilet areas the lighting comprises a combination of recessed Compact Fluorescent down light luminaires, each with decorative attachment,

v) Plantrooms and Stores

Plant rooms and stores have surface mounted Linear Fluorescent luminaires each with diffuser or controller attachments and, where applicable, IP rated corrosion resistant or vandal proof type luminaires.

vi) Canteen areas

Ceiling mounted surface suspended pendant, and /or recessed compact source fluorescent luminaires, complete with decorative attachments.

vii) Process Areas

Surface / suspended mounted linear T5 fluorescent sealed luminaires, complete with vandal proof controller attachment to IP 65 rating, are installed on lighting trunking along main pedestrian access routes

or

Discharge Luminaires with suitably rated Metal Halide lamps

Where this option is to be utilised, certain luminaires shall be provided with auxiliary lamps to enable instantaneous light output on switching. Auxiliary luminaires shall be automatically switched off after a pre-determined time period.

Final co-ordination of the Lighting with specialist equipment where known is to be undertaken as part of with detailed design

4.7.6 LIGHTING CONTROL

Various methods of lighting Control are required and to be incorporated as detailed within this section.

The Lighting control system(s) shall provide(s) selective and variable switching via manual or automatic means to enable illuminance and luminance levels to be adjusted, to facilitate an energy efficient mode of control and operation and to enable luminaires to be systematically switched off during periods of non-occupancy of the space(s) or during periods outside of the normal core operating hours of the building.

The requirements for Lighting Control are specifically detailed below; however the same general requirements will apply to other lighting installations within the building.

General Areas

Method of lighting control

Circulation Areas

Local wall mounted, manually operated lighting control switches, wired and connected as one way and two-way lighting control circuits as appropriate

Supply and install key operated override switches for the 24-hour security lighting circuits, comprising designated emergency luminaire circuits, within corridors and lobbies.

Office areas

Presence detectors and photocell daylight linking sensors.

Staircases

Supply and install locally wall mounted, manually operated, lighting control switches.

Ensure switches are wired and connected as two-way and intermediate lighting control circuits as appropriate and located at every landing access door.

Toilets

Supply and install ceiling mounted presence detectors to automatically operate the luminaires upon movement

	<p>of occupants in each such space, and to de-energise the luminaires after a pre-determined time delay period, unless reset upon detection of continuing or further movement of occupants.</p> <p>Ensure that all presence detectors are suitably located to effectively detect normal movement of people throughout the space.</p>
Plantrooms and Stores	<p>Supply and install, locally wall mounted, manually operated lighting control switches</p> <p>Ensure that all switches are wired and connected as one-way and two-way lighting control circuits as appropriate and located at every entry and exit door of rooms.</p>
Canteen areas	<p>Supply and install ceiling mounted presence detectors to automatically operate the luminaires upon movement of occupants in each such space, and to de-energise the luminaires after a pre-determined time delay period, unless reset upon detection of continuing or further movement of occupants.</p>
Process Areas	<p>Supply and install, locally wall mounted, manually, at key locations including access routes to and from the area.</p> <p>Ensure that all such switches are wired and connected as one-way and two-way lighting control circuits as appropriate and located at every entry and exit door of such rooms.</p>

4.7.6.1 Manual Control

Light Switches shall be of the rocker bar grid switch type ganged to suit location.

Flush mounted switches are to be installed throughout the main internal areas of the building.

Within plant rooms, stores and Process Areas semi-exposed locations install surface mounted switches.

All lighting control switches to be installed at 1000mm from finished floor level to underside, unless detailed elsewhere in this specification.

Local manually operated switches are positioned adjacent to all respective access doors to and from each area.

Install white moulded finish faceplates within flush mounted installations and metal clad style switches for surface mounted installations within plant rooms and process areas etc.

Each switch shall be complete with white insert, cover plate, pressed steel box and earth fly lead, together with neon indicator insert where particularly detailed.

16A single pole pull cord switches, of the appropriate way type, complete with neon indicator and of white moulded finish shall be provided where required or specified

Switch plates shall be of a metal clad finish.

Switches shall be rated at 20A per pole assembly grid switch type, with rocker or ket switch inserts single or double pole as necessary and shall be one two way or intermediate as appropriate and shall be in single or multi-gang plates as necessary with white moulded rockers

In Plant rooms or areas of surface installation switch units shall be metal clad type.

All external light switches shall be IP 44 rated.

Where multi-gang switches of 4 gangs or more are used switch plates shall be engraved or labelled in a manner to be agreed with the Contract Administrator to define their use.

Miniature circuit breakers shall not be used as lighting switches.

Where contactors are used to control lighting circuits as indicated on drawings they shall utilise 230 Volt coils and be of a suitable duty for the nature of the load they are switching.

Unless absolutely necessary different phases within a same switch enclosure shall be avoided, however if required provide and install phase barriers between switches, or other suitable phase barriers or voltage warning labels (e.g. "Danger 400V").

Warning labels are to be permanently fixed internally and externally to every such switch.

The lighting control switches shall be from the same range to match socket outlets and other accessories:

4.7.6.2 Time Switches Control

Where Time switch Control shall be provided, all time switches comply with BS EN 60730.

Where provided within its own enclosure it shall be afford ingress protection to BS EN 60529 - IP55

Time switches shall be of the electronic digital type with a liquid crystal display with battery back up and have a programme capability, - 6 on and 6 off operations per day and have 2No switching channels as a minimum

An override facility shall be provided to the time clock

Time switches shall have a Inductive switching capacity of 10A at 230Volts.

4.7.6.3 Photoelectric Control Units

All photoelectric control units comply with BS 5972.

4.7.6.4 Daylight Sensors

Where applicable or specified Daylight sensors can be incorporated into lighting control systems to control the lighting in areas which are effectively day lit.

Areas with daylight factors below 0.5% are classified as non-day lit.

Daylight Sensors shall have adjustable sensitivity range with remote set up and / or override via remote infrared controller and shall be either surface or flush mounted to suit the nature of the Installation in which it is located.

Locate daylight sensors in a position which is representative of the daylight level in the area under control

4.7.6.5 Combined Daylight and Occupancy Sensors

Combined sensors are to be used where possible dependent upon and to make the best use of the switching strategy.

Positioning should be as the criterion for satisfactory location is different for daylight and occupancy sensing.

4.7.6.6 PIR Lighting Control

PIR occupancy sensing to be provided where indicated within this specification and / or on drawings.

The sensor shall be located such that it detects persons entering the space to automatically switch lighting on.

The sensors shall have a minimum inductive switching capacity of 5A at 230Volts with adjustable sensitivity and switching delay

Lighting shall then remain on until no movement is detected, lighting shall then be switched off after a pre-set time.

A Manual key override switch shall be provided in each area that is PIR Controlled to enable lighting to override the PIR Detector for maintenance purposes.

PIR's shall be either surface or flush mounted to suit the nature of the Installation in which it is located and its operation.

4.7.7 **LUMINAIRE INSTALLATION**

The Luminaires shall be installed complete with fixings, suspensions, glassware, louvres, diffusers, reflectors, optical controllers, control gear and lamps, together with all required ancillary components, accessories and attachments, as described within this specification.

Luminaires shall be installed throughout the building(s) within all locations including: recessed and semi-recessed type luminaires within suspended ceiling areas, (comprising either a removable lay-in tile or a plasterboard sheet with plaster skim finish); ceiling mounted surface luminaires, in plant rooms and stores, etc.; and wall-mounted luminaires of both the decorative and functional type.

The Principal contractor shall be provide a plywood or similar strengthening back pattress for all surface and recessed compact luminaires contained within an individual ceiling tile where the ceiling system is not capable of supporting the luminaire weight.

In plant rooms ensure the luminaires are positioned to coordinate with the layout and installation of all mechanical plant and associated equipment.

It shall be possible for the luminaires to be easily removed from below ceilings subsequent to installation.

The Services Contractor shall ensure that his work is phased to fit in with the programme for the installation of the ceiling system.

Fixing of luminaires to surfaces shall comply with the standard specifications, care being taken to ensure that the finished appearance is of a high standard.

Hidden fixings shall be used for luminaires, where visible fixing screws shall match the colour of the luminaires.

All fixings shall be suitable for the purpose intended and shall adequately support the weight of the luminaire.

Where luminaires are supported directly from the ceiling T bar grid, ensure adequate additional fixings are provided by the ceiling installer to support the entire weight of every such luminaire and its attachments, without causing any distortion to the ceiling line or level.

Ceiling and wall mounted luminaires, where installed to plasterboard surfaces, are fixed via conduit boxes installed flush with the ceiling/wall face, with the conduit boxes supported directly from the conduit/trunking system or structure.

The Services Contractor shall ensure compatibility between the luminaire and the ceiling systems for proper installation.

Fire rated canopies or hoods shall be provided for recessed luminaires where installed within a ceiling which forms a fire Compartmentation line in order to maintain the integrity of the respective fire compartment or area.

Luminaires shall be provided with thermoplastic diffusers to comply with Category Tp (a), as defined in the Building Regulations.

All suspended luminaires shall utilise propriety 'cable drop' accessories for final connection.

Every luminaire shall be accurately aligned, to fit flush and square against adjacent/ abutting structures or surfaces to provide a neat straight and true appearance in their relation to the building structure.

The Lighting System installation shall be in accordance with the co-ordinated reflected ceiling plan drawings.

All luminaires are to be complete with a fused terminal block to BS 1363.

All luminaires are to be provided with high frequency (HF) control gear.

All luminaires intended for installation in areas without suspended ceilings shall have all conduits and fixings installed in a neat and orderly manner with each luminaire fixed directly on two conduit boxes forming part of the fixed conduit installation.

The Services Contractor shall allow for conduit, etc. to be installed in cavities or builders work chases where possible, as building work progresses in these areas such that the fair faced wall finished is not marked.

The Services Contractor shall ensure that every luminaire is accurately aligned, to fit flush and square against adjacent/ abutting structures or surfaces to provide a neat straight and true appearance both of them and in their relation to the building structure.

The luminaire installation shall be set out in accordance with the coordinated reflected ceiling plan drawings and the Architect's detailed room loaded layout drawings. The positions of all windows, door swings, roof lights and fitments etc. shall be considered when undertaking this process

Suspend linear T5 fluorescent luminaires, shall be fixed using galvanised steel suspension chains fixed to the containment system by hook back plates, to a level AFFL, with final connection to every such luminaire using a lighting busbar system or a plug-in ceiling rose with heat resistant flexible cable of the appropriate grade and rating.

4.7.7.1 Wiring & Containment System

Trunking & Conduit

Refer to previous sections

Lighting Busbar system

Lighting busbar system may be utilised where appropriate

The lighting busbar system will comprising steel galvanised finish with segregated control cables compartment, 20A rated 3No. copper /aluminium busbar, single circuit, tap-off connections at every 1200mm suitable for fused plug-in units with 5m of flexible armoured cable.

Final connections to busbar systems via shall be via direct end feed connectors with connections to luminaires via plug-in ceiling roses and heat resisting flexible cable, of the appropriate grade and rating.

Wiring system

Luminaires shall be Wired in final radial circuits emanating from local distribution boards

The Installation shall be wired throughout (Except where Lighting Busbar or a Modular Solution is adopted) using single core 6491B (XLPE-LSF) insulated cables with stranded copper conductors to BS 7211 rated at 450/ 750V, with a minimum conductor size of 1.5mm².

Lighting Circuit Cables shall be enclosed within a ceiling void mounted galvanised cable trunking with conduit system as noted above

Luminaires shall not be used as a means of through wiring.

Final connections to luminaires shall be via using 3 or 4 pin plug-in ceiling roses, with self-retaining plug and socket as appropriate, with 3 or 4 core 1.5mm² insulated and sheathed LSF heat resisting 850C high temperature flexible cable.

Such plug-in ceiling roses shall be installed within 1000mm of the luminaire they serve mounted to the associated trunking or conduit box.

The Containment and accessories are to be installed at a suitable height, within to facilitate future access for maintenance, from floor level.

Within plant rooms, semi-exposed and external locations and Process Areas the Installation shall comprise of a surface mounted galvanised conduit, IP rated luminaires and accessories.

A concealed conduit installation shall be provided to Building perimeter and / or main entrance canopy.

4.7.7.2 Commissioning

The Services Contractor shall :

- a) Set-up, prove the operation and function and fully commission the lighting controls together with its associated control devices.
- b) Set up, prove the operation and function and fully commission all individual control devices including switches, presence detectors, photocell sensors, and contactor/relay units etc.
- c) Carry out adjustments and calibration of all automatic control devices and systems to demonstrate optimum performance and operation.
- d) Record all control arrangements, settings, sequences and functions on completion of commissioning and demonstrations.
- e) Demonstrate the operation of all control functions to the entire satisfaction of the Contract Administrator after commissioning has been fully completed.

4.7.8 **ILLUMINATED SIGNAGE**

Power supplies shall be provided locally for any illuminated signage requirements. The power supply will terminate within a local fused connection unit mounted local to the sign, fitted with appropriately rated fuse links to BS 1362.

Final connections between the Fused Connection Unit and the sign will be undertaken by others.

4.8 **EXTERNAL LIGHTING**

A Comprehensive external lighting scheme shall be provided to illuminate all site access roadways, pedestrian routes, car parking areas and the perimeter of Buildings to enable safe access and egress for both pedestrian & vehicular traffic and enhance the security of the buildings and site.

The design and Installation of the External Lighting shall comply fully with the edition (including amendments) of British Standards, the Chartered Institution of Engineers (CIBSE) Lighting Guide and Planning Conditions appertaining to external lighting and the ILE Guidance Notes for the Reduction of Obtrusive Light

All street / road lighting complies with BS 5489, BS EN 60598, BS EN 40,

External Lighting shall meet local planning conditions

4.8.1 SYSTEM DESCRIPTION

A system of lighting shall be provided to cover all areas of goods vehicle movements, car parking areas and the building perimeter.

To the external perimeter of the unit provide metal halide flood lights at 6m from AFFL to achieve an average lux level of 15 Lux at floor level.

To the external plant areas utilise a combination of column mounted luminaires. Design to achieve an average lux level of 15 Lux at floor level.

Lighting control will be via a photocell and time clock arrangement switching contactors feeding outgoing circuits.

The external lighting will utilise Building and Column mounted luminaires incorporating Metal Halide lamps

Local feeder Pillars shall be provided as necessary to serve the lighting around the site, including any pedestrian or illuminated Site traffic signage.

Cabling to column mounted luminaires will, where possible, be direct laid in soft landscaping and ducted at each road crossing. Cabling to building mounted luminaires will be installed within the building trunking and conduit systems.

4.8.2 LUMINAIRES & LIGHTING COLUMNS

All luminaires are to be complete with lamps, diffusers, louvres, fused terminal block and support and fixing brackets in accordance with the luminaire manufacturer's requirements.

Luminaire ballasts shall comply with BS EN 60929, BS EN 61347, 2000/55/EC and the following criteria:

- Efficiency > 90%
- Harmonics - Comply with BS EN 61000-3-2
- Mean time to failure - 70,000 hrs. at max ambient temperature, operating 24 hours per day
- Lamp failure - Ballast to sense end of lamp life and extinguish tube; ballast to automatically reset after supply has been isolated and restart upon replacement of lamp.
- Over voltage - provide protection to BS EN 61000-4-5

6M Galvanised Steel lighting columns either root mounted or flange mounted suitable for mounting on a concrete foundation base are to be provided and installed true and plum

Lighting columns and Bollard Luminaires are to be complete with arm brackets either single or double arm to suit and suitable base boards for mounting suitable luminaire cut out unit, which are to be provided for every column to provide a local means of isolation.

The Lighting columns are to be installed with the column access plate facing away from any traffic.

All external luminaires are to be vandal resistant.

4.8.3 CONTROL REQUIREMENTS

All luminaires will be protected by the use of miniature circuit breakers located in the distribution boards and the operation by use of controls as outlined within this specification.

Where recommended by BS 7671, additional protection in the form of suitably rated RCDs shall be provided to electrical supplies serving such areas as kiosks, shelters, etc.

Central lighting control switching via locally mounted contactors at distribution boards / feeder pillars feeding the external lighting circuits is to be provided, operated via time clock / photocells

All lighting control contactors shall be of minimum of 25A rating and suitable for switching inductive loads with number of poles as required.

4.8.4 ASSOCIATED BUILDERS WORKS

The Principal Contractor will provide all necessary concrete bases for lighting columns, Bollard style luminaires and feeder pillars to meet the luminaire manufacturers' and/or Structural Engineer's details provided by the Services Contractor and all necessary ducting, excavation and back-filling of cable trenches. Fitting and levelling of all columns to be by the services contractor

4.8.5 CABLING

External lighting circuit cables installed underground, shall be multicore XLPE/SWA/PVC type, installed within below ground PVC ducts wherever the cables are laid under roads, paved areas or areas of hard standing.

Building Mounted luminaires mounted on the external building fabric shall be wired using single core 600/1000V grade LSF insulated cable installed in the building's conduit/trunking systems.

4.8.6 COMMISSIONING

The luminaire orientation, level and tilt shall be adjusted in line with calculated values during hours of darkness prior to commissioning.

As part of the commissioning process lighting level values shall be measured on site, recorded and presented as part of the "As Installed" Documentation

4.9 EMERGENCY LIGHTING

4.9.1 PROPOSED INSTALLATION

A Self-Contained Emergency Lighting System shall be installed to all areas to provide sufficient illumination to allow people to evacuate a building safely when the normal lighting has failed in an emergency situation.

Emergency lighting shall also be provided as specified in areas where the use of the space provides an inherent danger to means of escape.

The emergency lighting system shall indicate clearly and unambiguously all escape routes; internally and externally as required, provide illuminance along such routes and immediate external areas of escape routes so as to allow safe movement towards and through all exits.

All fire call points and fire fighting equipment provided along escape routes to be adequately illuminated via Emergency Lighting such that they can be located when the normal lighting has failed, and external escape routes are illuminated and emergency lighting is provided to open areas for anti-panic and escape lighting.

The Emergency Lighting system shall comply with BS.EN.1838, BS5266-7 and BS 5266-1: BS EN 50172

The category of emergency lighting system shall be M3 / NM3 as defined within BS5266-1 2005. (Operation of the emergency lighting on failure of the normal supply or individual circuits and the addition of maintained emergency lighting at designated areas and exit locations, 3-hour operation.)

The design & Installation of the Emergency Lighting Installation comply fully with the requirements of the layout drawings, this specification, the associated European and British Standards.

Emergency Lighting shall be provided as follows:-

Area	Lighting Level (Min)	Operating Time (within)
Defined Escape Routes (To enable safe exit of Buildings)	1 Lux	5 Seconds
Open Area (Anti Panic area) Lighting	0.5 Lux	5 Seconds
High Risk (Task Area) Lighting	10% of Maintained Illuminance for task But not less than 15Lux	0.5 Secs

Additional Emergency Lighting is also to be included has to illuminate;-

- Specific Hazards
- Fire Alarm equipment
- Fire fighting Equipment (where locations known)
- All Toilets
- All shower Areas

- Exits, externally in the immediate vicinity of final exits to aid safe evacuation.
- Electrical Riser cupboards that contain Distribution and or Control equipment.
- Communications Rooms

The supply and install of the complete emergency lighting installation and controls including all wiring, manual and automatic controls, luminaires, lamps and emergency supply equipment shall be undertaken by the Electrical Services Contractor.

The Electrical Services Contractor shall ensure that when luminaires are installed they shall not operate until the equipment is commissioned in order to prevent premature battery discharge.

4.9.2 EMERGENCY LUMINAIRES

Emergency Luminaires are to be self-contained luminaires incorporating their own secondary supply, via a rechargeable battery compatible with an emergency test system, a battery charger, control gear and lamp(s) within the luminaire body.

The Emergency Conversion units shall be complete with self-contained sealed nickel cadmium batteries, inverter and changeover module housed within the body of the luminaire or within a separate proprietary sheet steel ventilated box type enclosure fixed to the rear of the respective luminaire.

Emergency Lighting Battery autonomy shall be 3 hours unless specified otherwise in this specification.

Luminaires designated for Emergency use shall be complete with diffusers, reflectors, lamps, control gear and necessary support and fixing brackets etc

All luminaires are complete with high frequency control gear

Where emergency lighting is to be provided in areas and in main escape corridors, the main lighting luminaires shall be utilized and converted to also provide emergency lighting functionality by the system suppliers

Emergency lighting luminaires are to be complete with complete with EC standard exit legend (running man) at designated exit doors and changes in direction.

All Emergency luminaries shall be ICEL approved.

Exit route luminaires shall meet respective fire rating and comprise non-flammability type and protected to a minimum of IP 20

All emergency luminaires located directly above or adjacent to final access doors shall be fitted within an EC Standard Exit Legend such that all exits are clearly identifiable.

Visible Red LED indicators shall be provided for all emergency luminaries to indicate battery status.

4.9.3 WIRING

Wiring to Self-Contained Emergency luminaires shall be as per Lighting Circuit cabling, contained within the same containment system, all Wiring to these luminaires need not be segregated from Category 1 circuits.

Final connection to the Emergency luminaires for supply of mains power shall be via 3/4 pin 'klik' type plug and 3/4 core 1.5mm² CU/LSF heat resistant flexible cable (4core for emergency lighting), via glanded entry on rear of luminaire.

Where luminaires are recessed in plaster ceilings, position the 'klik' connector so as to be accessible once the luminaire is removed.

Where surface mounted luminaires are to be installed e.g. wall fixed in staircases, then Emergency Luminaires are to be direct wired, circuit wiring installed directly into the luminaires.

Ensure that lighting control accessories are to be selected and installed in keeping with the remainder of the Electrical Installation for the particular area

Provide accessories for small power and lighting controls from the same manufacturer and with the same finish.

4.9.4 EMERGENCY LIGHTING TEST FACILITY

Facilities shall be provided to enable periodic testing of the Emergency Luminaires.

Under this project this shall be achieved by the use of suitably located local test switches to break the circuit live supply to switch off the normal lighting luminaires and operate the emergency lighting luminaires for test.

Test switches shall be suitably engraved to indicate their function.

4.9.5 TESTING AND DOCUMENTATION

On completion of the Emergency Lighting Installation the Services Contractor shall fully test the complete lighting and emergency lighting installation in accordance with BS 7671:1992, BS.EN.1838, BS5266-7: 1999 and BS5266-1: 1999 including latest amendments and provide measured reading of all tests undertaken.

All documentation and certification required by British Standards and Enforcing Authorities shall be completed and issued by the Services Contractor.

4.10 SMALL POWER

4.10.1 GENERAL

The Services Contractor shall supply and install distributed electrical power supplies from Local Distribution Boards and connection points for all systems and equipment to be installed within the Buildings and supplies to external equipment at 400V/TP&N and 230V/SP&N 50Hz. as indicated on Room Data Sheets

Power supplies shall be provided to all systems and equipment such as Illuminated signage, mechanical plant, , access control systems, intruder alarm

systems, fire detection and alarm systems, BMS, ICT systems, ventilation, fan coil units, heaters etc.

Power distribution will be routed through accessible voids to socket positions.

Wiring for small Power Circuits will be LSF insulated single cables contained within galvanised trunking / conduit

4.10.2 SMALL POWER CIRCUITS

When undertaking the Detailed design of the Small Power Circuits the following shall be taken into account:-

a) For Circuits intending to support IT equipment:-

- High protective conductor currents in accordance with BS 7671
- Maximum number of appliances to prevent nuisance tripping when energising non-ups circuits on load
- Cumulative neutral currents at common points of coupling, e.g. rising main busbars
- *Means of isolation of equipment with multiple supplies*
- Circuits for extension into office furniture shall meet the requirements of and be in accordance with BS 6396
- segregated earthing arrangements if required
- Nonstandard earth pins on computer power outlets particularly if UPS supported

b) Circuit Grouping factors not exceeding 0.8, ambient temperature of 30°C, XLPE insulated conductors, and equally sized phase, neutral and CPC conductors.

c) Circuit components are to be sized to achieve disconnection times as indicated in BS 7671, Table 41.1.

d) General power, BS 1363 13A socket outlets for cleaning and maintenance purposes to circulation areas shall be 2g switched socket outlets wall or column mounted or due provision made within in all raised floor outlet boxes such that no area is more than 10m from a power outlet and they are at a maximum of 15m centres along a wall.

e) All socket outlet circuits will be protected at Distribution Boards with a suitably rated residual current device (RCD) with a 30mA trip.

f) Where underfloor busbar is used within raised floor office areas maximum spacing for busbars shall not exceed row spacing of 5m, and 2.5m from wall to enable, to enable access to floor outlet box power connections with a standard 3-metre manufacturer's plug-in lead.

g) Power supplies to all equipment associated with life safety and fire protection installations shall be fed via dedicated circuits and design in accordance with BS 9999.

h) Circuits shall be arranged to minimise disruption on a circuit failure and / or operation of a Protective Device

i) Socket outlets on different phase of the supply shall be spaced not closer than 3000mm apart.

j) In toilet areas provide supplies to fixed equipment as follows:

- Water heaters
- Shaver socket outlets
- Hand dryers
- Macerators
- Urinal control valves
- Disabled Toilet Alarm

4.10.3 CIRCUIT LOADINGS

Small power Circuits shall be designed based upon the following criteria unless specific information is provided;-

- Primary plant sized for 50W/m² small power loads
- Riser distribution sized for 50W/m² small power loads
- Distribution sized for 25W/m² - 35W/m² in office buildings

The power supply distribution system shall be complete in all respects such that all of the Systems and installations requiring electrical power are served with electrical supplies of sufficient capacity to suit the electrical demand required.

4.10.4 ACCESSORIES

All accessories are to be suitably identified by the provision of suitable permanent labelling.

In addition, Fuse connection units, control switches and isolators etc shall be engraved to indicate purpose and nature of the load they feed.

All accessories within 'damp' or 'wet' locations shall be IP65 rated.

The construction, method of installation and finishes of all socket outlets and accessories shall suit the function and surrounding finishes of the area concerned, unless otherwise specified, accessories shall have a brushed stainless steel finish.

All accessories installed in dado trunking shall be white moulded plastic flush finish.

In order to provide compliance with BS 8300:2009 for people with impaired vision the all sockets mounted on dado trunking shall have a surround of a distinctly differing colour to the white socket and structured cabling outlets mounted on it to make them easily distinguishable.

Accessories within plant areas shall be of the surface mounted metal clad type.

BS 1361 Socket Outlets

Socket outlets shall be of the 230 Volt AC type to BS 1363. All socket outlets and fused connection units shall be of the switched type except where unswitched fused connection units are necessary and shall be suitable for the connected equipment and the environment in which they are installed.

Power supplies directly serving systems and equipment shall be terminated in a suitably rated switch disconnect or fused connection unit mounted directly adjacent to the equipment being served.

Fused Connection Units

Fused Connection Units shall be located in an accessible location adjacent to equipment served, wired to equipment in white three core flexible cable min 85°C rated [or higher if necessary to suit equipment] insulated conductors.

Isolating switches

Where required Isolating switches shall be 20A flush-mounting, double-pole switched pattern, provided with cable outlets where necessary and cover plates finished to match lighting switches and socket outlets within same area

Isolators

Supply, install and connect suitably rated surface mounted suitably rated multi pole isolators for three phase Low Voltage power supplies for equipment within the buildings

The isolators are to a position adjacent to the equipment served

4.10.5 SPECIFIC REQUIREMENTS

Unless specified on project specific Data sheets small power provision shall be provided as follows:-

a) Plant rooms/ancillary buildings

Design the power socket outlet installations within the plant room and ancillary building, to provide power services for maintenance purposes within the areas.

Metal clad surface-mounted twin 13 amp switched socket outlets shall be installed in each of these areas and connect to the local lighting and power distribution board.

b) Office areas

Power for office based computer equipment is to be provided via Perimeter PVC 3 compartment trunking and provision of cabling to client supplied power poles

Provision shall also be made for other office equipment that requires power and data (photocopiers, printers, fax machines etc.)

c) Process Areas

Supply small power accessories to within the process areas as defined on the Room Data Sheets

All cable entries to panels, enclosures and trunking etc. are to be bottom entry.

All containment shall be galvanised steel with white plastic accessories.

Where indicated on Room Data Sheets supply and install combined enclosures with RCD protected twin socket outlet and 110v yellow 'commando' BS4343 socket, complete with integral transformer.

d) Specialist equipment power supplies

Where indicated on Room Data Sheets provide power supplies terminating in Suitably Rated local isolators or control panels to specialist equipment highlighted

Services Contractor to Liaise with other suppliers or installers as necessary to ensure correct supply provision is provided and installed to correct location.

e) External Systems Power Supplies

Provide and Install electrical supplies including distribution switchgear, distribution boards and feeder pillars and main cables and electrical distribution systems to the following external systems:

- a) Vehicle Barriers
- b) Rain water Harvesting
- c) Pumping stations Allow 2No. Supplies
- d) Road lighting
- e) Car park and amenity lighting
- f) Gate House
- g) Signage
- h) Weighbridge

4.11 VOICE & DATA COMMUNICATIONS SYSTEMS

4.11.1 GENERAL

The Services Contractor shall employ a specialist contractor to design, supply, install, test and commission and set to work a complete modular Cat 6 Structured and Fibre backbone cabling network to carry voice and data together with the associated galvanised steel containment system .

The Contractor or his appointed specialist shall provide a UTP CAT 6 Structured Cabling system, comprising the following:

- Equipment cabinets
- Patch and cable Management panels
- Blanking panels
- Horizontal cables
- Copper and / or Fibre Backbone cables
- Cable Connectors and outlet closures

This specification does not include for the provision of any active equipment which may be used on such an infrastructure this will be provided by the Client and / or their specialist agents.

This section also excludes the provision of Voice & data supplies to any Temporary Site cabins and / or accommodation.

All associated power and containment systems are to be installed as per the specialist contractors' requirements, and co-ordinated with all other services.

4.11.2 VOICE AND DATA NETWORK OVERVIEW

Install a structured cabling system to support voice and data outlet provision as denoted on Room Data Sheets

The appointed Specialist is solely responsible for carrying out the installation, including proving its operation, to comply with this Specification and all the associated standards

The Specialist's design and installation is to include all distribution frame cabinets and outlets with cables fully terminated at both ends to provide a complete and continuous cabling system.

Telephone handsets, exchange facilities, computer data processing equipment and connections to external communications networks will be provided by others and not provided within these Contract works.

The Installer is to provide a network of cable basket access routes for the installation of the specialist voice and data cables in compliance with this section of the specification

The Specialist shall liaise fully with the Installer to inform him of his requirements and provide details of cable routes prior to installation of the cables so that the cable containment system installed will be sufficient for the initial installation and expansion up to a full flood wired solution as described herein.

Outlets will be terminated on moveable 4 way termination blocks or mounted in perimeter dado trunking as set out in the room data sheets and specification.

Conduits are to be provided from high-level cable trays to individual outlets or dado trunking as required.

Floor boxes are to be supplied by the electrical installer as per this specification,

The Services Contractor electrical installer shall provide the removable floor box compartment modules for the structured cabling outlets to the specialist for his installer.

RJ45 outlets are to be installed by the specialist. Cat 6 RJ45 outlets are to be of the angled type to allow for non-stressed cable exit from wall and floor box mounted outlets.

Internal telephony links and copper and fibre links between floor distribution cabinets are to be provided as per this specification.

4.11.3 REGULATIONS AND STANDARDS

The Data/Communications Installation shall be designed and installed in accordance with the following:-

Copper standards

BS EN 50173: 2002 (Information Technology – Generic cabling systems)

BS EN 50174-1: 2001 (Information Technology – Cabling installation Part 1 Specification and quality assurance)

BS EN 50174-2: 2001 (Information Technology – Cabling installation Part 2 Installation planning and practices inside buildings)

TIA/EIA-568 B-SET: 2001 (Commercial Building Telecommunications Cabling Standards).

- Part 1 General Requirement.
- Part 2 Balanced Twisted Pair Cabling Components.
- Part 2-1 Transmission Performance Specifications for 4 pair 100 ohm Category 6 Cabling.
- Part 3 Optical Fibre Cabling Components Standard.
- Part 3-1 Additional Transmission Performance Specifications for 50/125 Optical Fibre Cables).

TIA/EIA-569-A: 1998 (Commercial Building Standard for Telecommunications Pathways and spaces).

- A-2 Furniture Pathways and Spaces.
- A-3 Access Floors.
- A-4 Poke-Thru fittings.
- A-7 Cable Trays and Wire ways.

ISO/IEC 11801: 2002 Issue 2 (Information Technology – Generic cabling for customer premises)

TIA/EIA-606-A: 2002 (Administration Standard for Commercial Telecommunications Infrastructure)

TIA/EIA-607: 1994 (Commercial Building Grounding and bonding requirements for Telecommunications)

TIA/EIA-TSB67: 1995 (Transmission performance specifications for field testing of unshielded twisted-pair cabling systems)

BS EN 50310: 2000 Application of equipment bonding and earthing in buildings with information technology equipment

Fibre Standards

TIA/EIA 568 B-SET: 2001 (Commercial Building Telecommunications Cabling Standards)

Part 3 Optical Fibre Cabling Components Standard

BS EN 50173: 2002 (Information Technology – Generic cabling systems)

ISO/IEC 11801: 2002 Issue 2 (Information Technology – Generic cabling for customer premises)

TIA/EIA-607: 1994 (Commercial Building Grounding and bonding requirements for Telecommunications)

TIA/EIA 569A: 1998 (Commercial Building Standard, for Telecommunications Pathways and Spaces)

TIA/EIA-606-A: 2002 (Administration Standard for Commercial Telecommunications Infrastructure)

BS7718: 1996 Code of Practice for Installation of Fibre Optic Cabling

BS6701: 1994 Code of practice for installation of apparatus intended for connection to certain telecommunication systems

4.11.4 CABLE CONTAINMENT & ROUTING

The Services Contractor shall supply and install dedicated cable containment systems to accommodate the IT System(s)

The Primary Containment systems shall comprise Deep Sided Cable tray / Basket with Conduits emanating from this Primary Containment to final outlet locations.

Primary Containment is to be provided at high level and low level under the raised access floors (where provided) to provide wire ways to structured cabling outlet locations.

Wire way containment shall terminate within suitable back boxes at each outlet position.

All conduits to accommodate IT cabling shall be installed complete with draw wires for installation of structured cabling by the appointed specialist.

The containment systems shall be such that no cable(s) shall be unsupported throughout any of its length.

Where dado trunking is indicated outlets shall be mounted as an integral part of this system.

The containment system shall include all containment necessary to accommodate the new Fibre backbone cabling (via Diverse routes) from the Main Server Room to the Hub Room or final equipment / outlet destinations.

Containment will run via risers, voids, service ducts etc, to final locations.

No other cables shall be installed within the same tray / trunking or conduit system designated for structured cabling use. Separation of power and data cables must be in accordance with BS EN 50174 Part 2.

Cableway networks shall be carefully planned to ensure that adequate routes are provided and sufficient space is allowed for the installation and removal of cables and future access.

Cable bending radii must be provided for together with space for maintenance and cross over, where cableways pass other services.

When planning the cable routes all due consideration shall be given to the voice and data cable and equipment electromagnetic compatibility to ensure that they function correctly.

Cable trays must be a minimum of 300mm from any other cable tray in all directions carrying any other service.

Where cables are run on cable tray and pass through walls, floors and fire compartments they shall be sleeved to provide adequate protection.

Vertical Distribution

Vertical distribution is considered to be the cableway risers up the building.

Vertical distribution cableways shall be cable tray installed to ensure easy installation/removal of cables. A 50% allowance for future Information Technology needs shall be included when planning routes and primary containment sizes

Horizontal Distribution

Horizontal distribution via ceiling / floor voids is to be provided as indicated on the Tender drawings.

Either enclosed trunking or a deep-sided open cable tray shall be used throughout for the horizontal distribution. Particular attention shall be given to -

- a) The transition from vertical to horizontal distribution.
- b) Exit points from risers
- c) Crossing points between cabling and other services.
- d) Bends, T-junctions and branches.

A 20% allowance for future Information Technology needs shall be included when planning the routes and primary containment sizes.

Multiple links to the same Server / Hub Room shall not share the same route, but shall be diversely routed.

The tray should terminate directly below a cabinet if floor fed or connect to the cabinet if ceiling fed.

Data Containment sizes shall be based upon the following criteria;-

Conduit

25mm diameter	=	6 cables
20mm diameter	=	4 cables

Cable Tray

50mm	=	30 cables
100mm	=	66 cables
150mm	=	128 cables
225mm	=	220 cables
300mm	=	350 cables

4.11.5 BACKBONE CABLING

Fibre backbone cabling shall comprise the installation of both single and multi-mode fibre cables between Hub / server rooms.

All fibre cables will be fully supported along their route by a new cable containment system, supplied by the Services Contractor.

4.11.6 CABLING SPECIFICATIONS

a) Fibre Cables

Multi-core fibre cables shall be conform to the following specification;-

Internal use:

Loose tube, internal or internal/external, low smoke zero halogen (LSZH) cable.

External use:

Loose tube, internal/external, low smoke zero halogen (LSZH), duct rated, corrugated taped cable.

Multimode fibre
62.5/125µ

Single-mode fibre
9/125µ

All cables shall be suitable for operating within operating temperature -10°C to + 70 °C

All fibre optic cable used for the backbone shall be loose tube fibre cable. Fibre cables installed external to the building or in damp conditions shall have a moisture barrier. Fibre cables installed within the building must use flame retardant sheath with low smoke zero halogen (LSZH) Characteristics.

a) Copper Cables

Category 6 ,unshielded twisted Pair (UTP), four pair, 0.52 (24AWG) bare solid copper conductors, Low Smoke, Zero Halogen (LSZH) cable – Purple Sheath, complying with IEC 332-1c as a minimum.

4.11.7 CABINET REQUIREMENTS

Floor mounted freestanding cabinet(s) shall be utilised within Server room; these will be 42U x 800mm deep x 800mm wide.

Wall mounted freestanding cabinets shall be utilised where remote from the Server room Size to be determined by contractor.

The Floor Standing Cabinet(s) shall comply with the following as a minimum;-

- Adjustable 19" mounting posts front and rear
- Lockable & removable steel vented drop in side panels
- Lockable hinged & vented steel rear door
- Lockable hinged & vented steel front door
- Large cable entry facility within base and top of cabinets
- Earthing points
- 100mm high steel plinth to enable correct bending radii of cables or set of four feet.
- 2 x vertical Zero U 32A Switched, Managed & Networked PDU with 21 x IEC 320 C13 & 3 x IEC 320 C19 power outputs installed in the rear of each cabinet and connected via IEC 309 32A 2P+E "Commando" plug to the UPS critical distribution board utilising diversely routed power cabling
- Horizontal 19", 1U cable tidies
- Vertical Zero U cable tidies
- Cable tidy's for fibre and Category 6 patching.

2No IEC 60439 16A 230 Volt 13A socket outlet will be provided to each cabinet location.

Cable tidy's shall be installed above and below each set of forty eight Category 6 ports and above and below each set of three fibre patch panels.

Vertical cable tidy's shall be installed down each side of the front and rear of the cabinet. Vertical "Slotted Trunking" should be used. Cable tidy measurements 120 mm wide x 80mm deep.

Cable containment should also be installed between the cabinet(s) and any cable routes, where cables route via ceiling trays.

All cabinets are to be earth bonded in accordance with good working practise, BS 7671 and prEN 50174

Where indicated that space allowance shall be provided for active network equipment is to be allowed due allowance shall be made for adequate cooling.

Within the server room the cabinet(s) shall be located such that full access for inspection and maintenance is available (i.e. allowance for doors to be fully opened) to all sides of the cabinet and adequate airflow is prevalent.

Separation between mains and telecommunications cabling shall be maintained in accordance with pr EN 50174.

Patch panels will be provided and installed by the Services Contractor or his appointed specialist.

4.11.8 FIBRE PATCH CORDS

These will be provided and installed by the Client

4.11.9 FIBRE OPTIC PATCH PANELS

The fibre optic patch panels shall be supplied and installed for the termination of Fibre Optic Cables within the communications cabinets.

19 inch 1 U Fibre patch panels shall be fitted with low loss connectors/couplers. Unused connections shall be protected from dust and dirt with a purpose made cover.

Fibre optic cables terminating within the distribution facility shall be terminated on SC Patch Panels within the 19" rack Patch Cabinet, Single Mode fibres shall be terminated utilising FCPC Patch Panels.

Sufficient clearance between the bulkhead positions and door (where fitted) must be allowed for patch cable connections.

4.11.10 STRUCTURED CABLING INSTALLATION

Cables shall have a maximum route length of 90M from the server room / hub cabinets which shall not be exceeded

Joining or any connections of any cable will not be permitted between the patch panel and the outlet, cable runs shall be continuous.

Cables should be secured by LSF ties. Standard nylon cable ties must not be used to secure cables to containment and may only be used as a cable retainer at the patch panel and outlet in accordance with manufacturer's instructions.

The structured cabling system equipment shall comply with current TIA/EIA and ISO standards

The structured cabling flammability performance must meet IEC 60332-1 as a minimum.

All telephony equipment will be provided, patched and connected into the structured cabling system by others.

Cable shall be grouped in bundles not exceed 24 cables per bundle.

Sheathing shall not be cut back further than 30mm from connection point on jack or patch panel.

Twist in pairs should be maintained up to point of termination to reduce Near End Cross Talk as required by ISO/IEC 11801:2000. A maximum untwist of 13mm from the point of termination is required.

Any mechanical damage to cables comprising but not limited to kinks, Insulation damage (nicks, cuts), and evidence of cable compression during installation or during the course of the Contract shall be removed and replaced in their entirety.

Due to differences in installation between cable manufacturers, installers MUST refer to manufacturer's instructions prior to installation of any CAT 6 cabling or equipment. All equipment must be procured from a single manufacturer.

Minimum bending radius for CAT 6 cable shall not be exceeded

Cabling must be covered by a 25-year warranty.

A labelling and administration system must be designed into cable in line with EN 50174 or ISO 14763-2 or TIA/EIA 606.

Installation practises shall be generally compliant with pr BS EN 50174-2 and shall be wholly compliant with the Installation recommendations of the system manufacturer.

Holes drilled through walls or floors for routing cables shall be suitably sleeved to prevent damage to cables.

Delay skew of the permanent links shall be better than 30 nanoseconds to ensure satisfactory video operation.

Structured cabling system shall comply with EMC requirements of EN 50288 and ISO 11801 2nd edition and shall not degrade EMC performance of any connected equipment.

All cable shall be laid in by hand and if drawn in and not exceed an installation tension of 110N and have a breaking tension of 400N.

4.11.11 CABLE TERMINATIONS

Within the server room / hub rooms, cables should be terminated on RJ45 patch panels located within Floor standing 19" rack patch cabinets

Multi-mode fibre cables should all be terminated on SC patch panels in the 19" rack patch cabinet. Single-mode fibre cables should be terminated on FCPC patch panels.

CAT6 cables should all terminate on CAT6 RJ45 sockets at the remote end and a CAT 6 RJ45 panel in the 19" rack patch cabinet at the server room.

4.11.12 FLOOR DISTRIBUTOR

Floor distributor facilities shall be located so that horizontal copper cable runs do not exceed 90M.

Horizontal cables shall terminate within the distribution facility on patch panels mounted within suitably sized cabinets designed and located to facilitate ease of access and shall incorporate cable management.

40% of the cabinet space should be left unpopulated for future expansion.

Where horizontal and backbone cabling terminate within the same cabinet they shall be accommodated on separate patch panels and labelled accordingly.

Patch cable management shall be provided by the Specialist Contractor. A minimum of 1u of cable management shall be provided above & below every 48 ports of cable management.

4.11.13 OUTLETS

The quantity of voice and data outlets, together with Primary cable containment are indicated on Room Data Sheets

Outlets shall be double, triple or quadruple shall be provided dependent upon requirement as indicated on Room Data Sheets

Containment shall comprise all wire ways and back boxes at outlet locations.

Faceplates will be provided and cables terminated to them by the Appointed Specialist Contractor

All outlets in areas other than plant rooms or block work finish walls shall be recessed.

Care should be taken not to coil or crush cable when faceplate is finally applied to back box.

Copper outlets shall be presented into the work area as an RJ 45 Connector. The outlet shall have a shuttered cover to prevent the ingress of dust and other contaminants and shall only be installed when the environment is free of dust and other contaminants.

All outlets shall have facilities for labelling on either the faceplate or module

4.11.14 CABLE LABELLING

UTP CAT 6 cables should be numbered at each ends of cable. This number should relate to the server / hub room where the cable originates, the RJ45 patch panel within the cabinet and the outlet number of the patch panel,

Fibre Optic Cables should be numbered at each end of cable.

Multi-core voice cables should be numbered at each end of cable. This number identifies the cable as being a voice cable, it also shows the destination se and the quantity sever / hub room of cables to that sever / hub room,

4.11.15 UTP CAT 6 OUTLET LABELLING

CAT6 outlet connections should be labelled as xx/yy/zz, where :-

xx - Communications Room reference

yy - patch panel ref (A-Z)

zz - socket number on patch panel (1-24 or 1-48)

Label identification shall be by way of a printed slide label running under a protective polycarbonate mask. Separate colour panel masks or slide label strips will be used to identify different services.

4.11.16 FIBRE OPTIC LABELLING

Fibre patch panels should be labelled as follows:-

Label one should show the Fibre patch panel number. This number should be the next vacant number taken from WFDC fibre optic drawing / schedule. This label should be mounted on the left hand side-fixing bracket of the fibre patch panel.

Label two should show the numbered ports of the source fibre patch panel, the destination server room and the fibre patch panel within the destination server room, i.e. 1-24 To S1 FPP01. Where two cables enter one fibre patch panel two labels shall be required, i.e. 1-24 To S1 FPP01 & 25-32 To G1 FPP02 (example only).

4.11.17 TESTING & COMMISSIONING

100% of cables must be tested to IEC 61935 with a level III cable tester, cabling must be tested in both directions.

As part of the Witness testing procedure the Employers Agent or his appointed representative will require to witness cable tests to verify previously obtained results.

Adequate notice will be given to the Contract Administrator of the dates for testing and commissioning of the system so that the appointed representative may be present to witness the testing.

Any cables that are found to be outside acceptable test criteria will be replaced at the Contractors expense.

All completed installations shall be fully tested in accordance with current ISO/IEC standards, which detail the specification requirements for UTP Category 6A Performance.

Every copper UTP cable will be tested for at least the following properties:

- Wire-map
- NEXT
- PS-NEXT
- ELFEXT
- PS-ELFEXT
- ATTENUATION
- ACR
- PS-ACR
- PROPAGATION DELAY
- DELAY SKEW
- RETURN LOSS
- LENGTH
- IMPEDENCE

All fibre optic cable will be tested for length and link loss using either an OTDR or light source & power meter at 850nm & 1300nm (for multimode fibres) and 1310nm & 1510 nm (for single mode fibres). This test is to be carried out in

both directions. This will ensure that the loss budget of the link is within specifications.

For all tests using an OTDR 50M (minimum) launch leads will be used and results recorded.

The test instrument used must as a minimum comply with the accuracy requirements of ANSI/TIA/EIA 568-B Level III. All test results shall be recorded, presented to the Contract Administrator and included in the certification hand over documentation.

4.11.18 MISCELLANEOUS

All telephony equipment will be provided, patched and connected into the structured cabling system by the Client.

Planning, quality control, documentation and earthing must be according to EN 50174 parts 1 and 2.

Telephone Handsets.

Telephone handset will be free-issued by the Client and installed by the Services Contractor or his appointed specialist.

Equipment Acceptance

All IT equipment offered shall be subject to a technical review and approval of the Client / Contract Administrator prior to order of any equipment.

Documentation

Documentation should be supplied in electronic and printed formats, drawing to be supplied in AutoCAD compatible format.

The final O&M manuals will be supplied at Project Practical Completion and will as a minimum include the following

- Test results
- Guide to understanding the test results
- Test certificates
- Drawings indicating cable routes, outlet ID numbers and communication room locations. These will be supplied in CAD format (dxf or dwg) together with two (2) hard copies.
- CAT6 outlets locations of installed outlets and outlet number, i.e. S1/A/01.
- Schematic diagram(s)
- Cable numbers, source and designation
- Connection details and referencing for all fibre and copper cables
- Cabinet layout diagram(s)
- List of components used
- 25 Year Warranty certificate

Documentation should show Multicore voice cable logical connections from Communications Rooms to destination. DP, Krone panels should also show number of pairs to be patched, the destination server / hub room and patch panel ID.

4.11.19 FIRE PROTECTION

Where cables have to be installed through Fire Compartmentation walls or soffits Fire stopping should be provided to maintain the integrity of the Compartment Wall.

If the cables are UTP CAT 6 and installed on a tray passing through a Fire Protection Wall, then the tray should have a metal surround and be fire stopped using the appropriate Intumescent bag which can be easily removed and replaced to aid future cable installation & modifications.

4.11.20 BRITISH TELECOM SERVICE PROVISION

New BT Infrastructure including cable & equipment will be provided to serve the Building.

2No 100mm dia Dedicated Cable ducts and pits shall be installed from the site boundary to the Main Server Room for the use of British Telecom

A BT frame shall be provided and wall mounted in location to be agreed with BT.

Cables to this frame shall be provided by BT from the point of entry into the Building on a dedicated Communications Tray provided by the Services Contractor

From the BT frame, BT will install cables to the server room location.

4.12 FIRE DETECTION & ALARM SYSTEM

4.12.1 GENERAL

The Services Contractor shall provide a complete fire alarm and detection system covering every part of the building including interfaces with other systems which as a consequence of a fire alarm condition must change their status.

The Fire Detection & Alarm system Installation & Operation must accord with the development Fire Strategy.

The Services Contractor shall appoint an approved Installer / specialist to undertake these works who as a minimum undertake the following:-

- Accept review and complete the design as indicated on Tender drawings
- Detailed design of Smoke Aspiration System to areas detailed on drawings.
- Provide all necessary wiring diagrams and technical support to the Services Contractor.
- Supply all equipment for installation by the Services Contractor.
- Undertake software programming to incorporate the requirements of this scheme.
- Undertake all final connections and commissioning to Systems.
- Provide all necessary documentation and certification for inclusion with O&M manuals and updating all existing manuals, logbook and record drawings to reflect the extension to the Scheme.

The fire detection & alarm system is to be an analogue addressable system complemented with Aspirating Detection.

The systems will comprise of main control panels in each building and a number of sub / mimic panels (Repeater Panels), automatic detectors, manual call points, electronic type sounders, Xenon Flashing Beacons short circuit isolators, etc.

The design shall be such that the system can be easily extended or modified and shall be an open protocol system including all loop devices.

The detailed design and layout of the complete fire alarm and detection system comply with the requirements of Building Control and the Clients fire insurer. Any conflict between the requirements of these parties and those stated in this specification shall be brought to the attention of the Services Engineer by the Services Contractor before any works commence.

4.12.2 STANDARD AND TYPE OF SYSTEM

A comprehensive Fire Detection & Alarm system shall be provided throughout the building.

The system shall meet the requirements of both Type P1 and Type L1 of BS 5839 Part 1: 1:2002 + A2:2008, therefore manual call points, automatic detectors and alarm devices shall be provided throughout.

The system shall be an analogue, addressable system designed for low false alarm potential.

The system will be a two-stage alarm system zoned according to fire strategy document. Exact Fire Alarm Cause / Effect strategy is to be agreed.

The system shall be supported from the Essential Power Supply in the event of a power failure to prevent the battery draining whilst the generator is supporting the essential building load.

Every individual manual call point and automatic detector shall be individually and uniquely identified at the control panels.

The descriptive text displayed on the Fire Alarm panel shall be agreed prior to software programming of the system.

Removal of a manual call point or automatic detector shall cause a fault signal to be generated at the control equipment.

So as to minimise disruption during maintenance and testing, the system shall incorporate provisions whereby individual detectors and call points can be tested without either sounding an alarm or requiring the complete system or more than one zone to be disabled to prevent an alarm.

The wiring of the complete fire alarm and detection system shall be automatically monitored so that failure, whether to open circuit or short circuit, will result in a fault warning at the control equipment.

Where cable ring systems are used these shall incorporate short circuit isolation devices at suitable intervals

4.12.3 CONTROL AND POWER SUPPLY EQUIPMENT

The Main Fire Detection & Alarm control panel and mimic diagram shall be provided in the Ground Floor Main Reception Area.

Mimic/Repeater panels shall be provided as indicated on drawings. These panels will give no control facility but will provide information only.

The number of fire alarm system devices to be included on each loop will be dependent upon the Specialist fire alarm system supplier. The Services Contractor shall allow for all points and devices as necessary, leaving 20% spare capacity on each loop.

The system shall include a rechargeable standby battery capable of maintaining the system in operation for at least 24 hours quiescent mode, after which sufficient capacity shall remain to provide operation of all alarm sounders (including future sounders) for at least 30 minutes.

Battery recharge time shall be in accordance with BS EN 54.

Fire alarm loops may accommodate all ancillary fire alarm equipment on to cable loops.

Interface units may be installed on to loops to supply sounder circuits which shall be configured as monitored radial circuits.

Sounders may be installed directly onto the loops or originate from the fire alarm panel or local floor units.

It will be the specialist supplier's responsibility to check and confirm circuit loadings including the allowance for spare capacity on each loop.

Interface units shall be installed on to loops to control power supply units for magnetic door holders as required.

Zone/short circuit isolators shall be provided and installed to the system loops as required.

The Fire Alarm Specialist shall in liaison with the Principle Contractor provide schedules itemising all addressable points listing the item description references, which are to be displayed on the main control panels upon activation of such a device.

These schedules shall be submitted for comment allowing sufficient time to prevent any delay to the progress of works.

On acceptance of the schedules the Fire Alarm Specialist shall Programme the systems to reflect the agreed schedule of address points and locations. Ensure that the correct text and verify by test.

4.12.4 FIRE ALARM CABLES & INSTALLATION

Fire Alarm Cabling shall be undertaken in suitable fire rated cabling. Generally, fire rated cabling shall be soft skin type (enhanced grade PH60 as stated in BS 5839-1: 2002) to CWZ category to BS6387 with copper conductors and an overall red sheath of LSF material and installed on galvanized cable tray or Basket Tray.

Where two or less cables are installed they may be clipped direct to the surface with mechanical protection provided as necessary.

Where cables are surface mounted they shall be enclosed within a galvanized conduit system below 2500mm AFFL. to protect from mechanical damage.

2c 1.5mm² cabling with red sheath shall be utilised for field loop wiring

4c 1.5mm² cabling with red sheath shall be utilised for field loop wiring

Junction boxes should not be used unless absolutely necessary, in which case they should be installed within an easily accessible location, labelled "Fire Alarm Junction Box" and contain din rail mounted terminals. The location of any Junction box shall be recorded on "As Installed" Drawings.

Under no circumstances shall Junction Boxes be utilised on any Network cables, cables used for this application must be point to point between respective panels.

Cable fixings are to be fire rated stainless steel type, no plastic tie wraps are to be utilised unless the cables are contained within a suitable horizontal containment system such as a cable tray or basket. That is mechanically fixed to the building structure.

It is the Services Contractor's responsibility or his appointed Specialist to size the cable containment system as required.

It shall be the responsibility of the Services Contractor to plan his own cable routes with regard to the sequence of wiring of ancillary fire alarm equipment.

The Services Contractor shall ensure that he is fully aware of the manufacturers technical parameters associated with maximum cable lengths

of loops and number of devices per loop; these shall therefore not be exceeded.

The Services Contractor shall ensure that when loop wiring is being tested cables are not connected within equipment i.e., call points, sensors, alarm bells, interface units etc. Failure to comply with this requirement may result in damage to equipment which will be deemed to be the responsibility of The Services Contractor

The Services Contractor shall ensure that wherever fire barriers are penetrated with fire alarm wiring, proprietary fire stop units are to be installed. Fire stop units are not indicated on the drawings therefore it shall be the responsibility of The Services Contractor to identify all quantities/locations of fire stopping required.

4.12.5 CAUSE AND EFFECT

The Fire Detection & Alarm System Cause & Effect matrix shall clearly indicate what occurs to systems under a Fire Alarm Condition to any part of the system.

This shall be developed by the system Specialist appointed by the Services Contractor. The system specialist will undertake all liaisons with other system supplies in order to obtain information as necessary to compile the Cause & Effect Matrix.

The Cause & Effect Matrix shall be submitted for comment and approval prior to any software programming of the Fire Detection & Alarm System Control Equipment.

The system shall be capable of providing stage evacuation and a search period after activation of a single device prior to full evacuation of the building.

On fire alarm all sounders will produce a continuous tone output.

4.12.6 INTERFACE UNITS

The Fire Alarm panel will also provide control via addressable Interfaces of remote devices or systems.

Addressable interface units either single or 4 channel with 24V DC 2ampere rated contacts are to be installed to control inputs and/or outputs of remote equipment not directly connectable to the loop circuit.

Interface units are to be installed for, but not limited to the following: -

- a) Door Détentes - To initiate doors to close on activation of alarm system
- b) Gas Solenoid Valves - To isolate gas supplies to building on activation of alarm system
- c) Mechanical Plant - Isolate all supply air mechanical services plant.
- d) Electrically operated doors – to provide free egress / access on activation of alarm system.
- e) Passenger / Goods Lift – To drive the lift to the ground floor position and park with the doors open. (Unless Fire at Ground Floor in same Fire

zone as Lift in which case Lift to return to First Floor and park with doors open).

- f) Fire Dampers – to provide a signal to actuate smoke / fire dampers
- g) Car Park Barrier – To raise barrier on fire condition
- h) Fire Doors – Close on fire condition
- i) Aspirating Fire Detection System
- j) Fire Smoke Curtains / Shutters

A manual override fireman's switch provided by others is to be located under the fire detection and alarm panel. This will provide auto / manual / off control of ventilation plant for the building.

Interface units are to be located within dedicated Electrical Services Cupboards and / or Plant Rooms located where they are fully accessible. They are not be located where visible or above suspended ceilings within voids.

All interface units are to be provided with any necessary 230V 50Hz SP & N supplies with local isolation being provided, by the use of unswitched, fused, neon indicated fused connection units. All power supplies for interface units are to be from the same phase regardless of their location within the Building.

It should be noted that interface units are to act as a switching facility only for détentes and not as a power supply unit. The Services Contractor shall ensure the compatibility of power supply units to be switched from interface unit's advice versa. Détentes in areas are installed to operate individually for each independent floor/area/fire zone of the development.

Interface units may be installed to provide input/output control of mechanical services equipment.

Interface units installed adjacent to mechanical services panels are to be wired as part of the fire alarm loop(s) installed in that particular area. The Services Contractor shall ensure that the maximum number of interface units installed per loop is not exceeded.

Interface units in plant rooms shall be installed as close as possible to the mechanical services control panel (BMS compartment side). Wiring from the interface unit to the electrical control panel shall be carried out by The Services Contractor.

The Services Contractor shall co-ordinate the Mechanical Services to ensure he and all other parties are fully aware of installation and technical details associated with the interface of fire alarm equipment with the mechanical services plant/control equipment.

Details of power supplies are to be as requested by the fire alarm system manufacturer / supplier. Local isolators to interface units are to be labelled 'Interface Reference No Isolator'.

It shall be the responsibility of the Services Contractor to identify the types and quantities of all interface units required, in compliance with his intended system.

All interface units will be required to be individually programmed during and on completion of the contract.

Interface Units are to be fully labelled to identify the system with which they Interface

4.12.7 MANUAL CALL POINTS

The Services Contractor shall supply and install flush mounted resettable manual call points (Not Break Glass) in the positions as detailed below, with the exception of Plant Rooms which will be surface mounted.

Manual call points (Break glass units) meeting the requirements of BS EN 54 - Part 11 shall be provided for the initiation of a fire signal manually by depressing the re settable element.

10 No Manual Call Point reset keys shall be provided on completion of the works.

Manual call points shall have status LED's to indicate health (Normal) status and the other to indicate Fire Activation. A Facility shall be provided for the action of the call point to be tested by the use of a special key without opening the unit.

The call point shall not be re-settable until the frangible element has been reset.

The break glass units shall be of two different patterns as follows, all finished red and having the wording 'Fire - Manual Call Point'.

a. Recessed

These units shall be provided with pressed steel boxes with conduit knockouts suitable for recessing into walls. The units shall overlap the box.

b. Surface

These units shall be mounted on to boxes with conduit knockouts and made from moulded plastic with facilities for maintaining earth continuity.

Manual call points shall be surface/recess mounted as per the lighting and small power installation to the particular area.

4.12.8 AUTOMATIC DETECTORS

The Services Contractor shall supply and install automatic detectors in compliance with the requirements of a Type P1/L1 system as defined in BS 5839-1:2002+A2:2008

All automatic fire sensors shall be suitable for mounting direct to standard BESA boxes and shall be compliant with BS EN 54 Part 5, 7 or 15 as applicable.

The Services Contractor shall ensure that he is fully aware of the various sensor base options associated with his system and shall be responsible when ordering equipment to ensure that he has specified the correct sensor base required e.g., sensors with remote LED units.

The exact types of smoke detectors (ionisation or obscuration type) and heat detectors (i.e., with or without rate of rise sensors) shall be of the most suitable types, so as to provide early detection of fire whilst minimising potential for false alarms.

The type of automatic fire alarm sensor to be employed throughout the project may be of the combined optical/heat sensor or separate units, as determined by the services contractors selected specialist's system.

Sitting and spacing of automatic detectors shall satisfy the requirements of BS 5839-1:2002+A2:2008, BS 6266:2002, and other relevant codes and standards, and manufacturers recommendations and shall be Co-ordinated with the proposed ceiling plan,

Where fire alarm sensors are to be mounted directly beneath suspended ceiling tiles they shall be fixed to standard BESA boxes.

All detectors, bases and heads shall be white in colour.

Removal of a detector head or call base from the base shall cause a fault signal to be registered at the Fire Alarm panels.

4.12.9 ASPIRATING SMOKE DETECTION SYSTEM

The specialist supplier shall design, Install Test & Commission all equipment required in order to provide a fully functional and operational smoke aspirating system to the areas denoted on drawings.

The system shall be provided, designed & Installed in accordance with the requirements detailed in the BFPSC Code of Practice for Aspirating Detection Systems, approved and listed by the Loss Prevention Council. (LPCB) and shall be in compliance with BS EN 54-20.

The system shall be designed to meet the requirements of Class C of BS EN 54-20

The designer & installer shall provide evidence of flow/pressure calculations for the system to ensure optimum sampling performance. These calculations shall be undertaken utilizing computer aided design software depicting 3D isometric drawings of the pipe network.

The high level aspirating smoke detection system shall be installed to provide to detection of a fire within this areas covered by this system.

The system shall incorporate a high performance laser based particle detection system based on the principle of forward light scatter, a high efficiency aspirator and a network of sampling pipes connected back to the aspirator, designed to sample air from within the protected areas.

The aspirating system will continually draw air into an ABS pipe network by a highly efficient aspirator which shall then pass through a 3-stage filter to eliminate dust and dirt particles from the sample prior to it entering the sampling chamber for smoke detection.

The aspirating smoke detectors shall provide continuous analogue profile of ambient air conditions.

The detector shall continuously monitor all internal and external components, and signal warning in the event of any malfunctions including; filter contamination, detection chamber operation, air flow in sampling pipes

outside normal limits, microprocessor functioning correctly, power supply, etc.

The detector shall incorporate a dual technology system for the automatic discrimination of signals from non-fire related sources such as dust. The system shall automatically adjust itself to eliminate any deterioration in performance caused by a build-up of contamination.

The system shall offer a wide range of threshold sensitivity adjustment at the detector.

The output from the detectors shall be fully programmable to enable sufficient time for investigation prior to initiating an alarm condition.

The laser detector chamber, aspirator, and control electronics shall be housed in a single purpose designed housing suitable for wall mounting, which shall be located within Dedicated Electrical services cupboards and shall be located such they are fully accessible for maintenance.

Multi-channel detectors shall incorporate individual laser detector chambers for each channel housed in a single enclosure. These chambers shall be electronically monitored to constantly maintain protection to all areas irrespective of whether the system is in quiescent or alarm condition. Each channel shall have the facility to be programmed with different operating parameters.

Where detectors are connected to each other in a network configuration each detector should have facilities for the provision of electrical isolation from both open and short circuit loop faults.

Connections to other Systems

The detection system shall incorporate a minimum of two (2) alarm levels. A minimum of one of these alarms and fault shall be connected to the main building Fire Alarm system. Other alarm levels shall be used either for pre-warning signals to the Fire Alarm system or to initiate local warning, first stage alarm on a coincidence release activated gaseous extinguishing system, equipment shut down.

The detector shall have an input(s) programmable for the following:

Remote sensitivity override

Remote isolate

Remote reset

Remote day/night mode switching

Reference detector

The detector shall incorporate either an RS232 or RS 485 serial interface. This shall be used to facilitate remote diagnostics/fault finding to component level and provide access to the detectors internal chart recorder and memory. The serial interface shall also enable upload/download of programming software and connection of a printer for hardcopy records of system events etc.

Sampling Points

Sampling holes shall be provided appropriately sized to achieve the performance as specified and calculated by the system design, shall not be at more than 5-metre intervals for installations complying with BS.5839: Part 1.

Each sampling point shall be identified in accordance with Codes and Standards.

Consideration shall be given to manufacturer's recommendations and standard in relation to the number of sampling points and the distance of the sampling points from the ceiling or roof structure and forced ventilation systems.

Sampling points will be fitted with removable end caps

Capillary Sampling Network:

Where suspended ceilings are installed, the sampling pipe shall be installed above the ceiling, and capillary sampling points shall be installed on the ceiling and connected by means of a capillary tube.

The capillary tube shall terminate at a ceiling sampling point specifically designed and approved.

4.12.10 ALARM SOUNDERS & XENON BEACONS

The Services Contractor shall supply and install sounders to ensure audibility levels throughout the development.

Generally sounders shall be provided in the form of ceiling mounted sounder bases and shall comply with BS EN 54 - 3; Xenon Beacons will comply with BS EN 54 - 23

Wall mounted alarm sounders where shown on the drawings are generally to be wall mounted at 2200mm from finished floor level to the centre line of the unit. With the exception of the plant room areas and roof voids, sounders are generally to be fixed directly to flush mounted BESA boxes. These shall be provided in areas in areas of high ambient noise.

Flashing beacons (red) shall be utilised in conjunction with audible alarms where high ambient noise levels are experienced or required for compliance with BS 8300: 2001 – Design of Buildings & Their Approaches, To Meet the Needs of Disabled People as shown on the drawings.

Flashing Beacons utilising Red LED's are to be installed in all circulation routes, WC's, Main Receptions and areas of high ambient noise i.e. Plant Rooms. These shall be stand-alone wall mounted beacons and shall not be combined with the smoke detector except in individual WC cubicles where these shall be combined with the smoke detector.

The flash rate of beacons shall be such as not to induce seizures in those vulnerable to photo sensitive epilepsy.

4.12.11 DÉTENTES (MAGNETIC DOOR HOLDERS)

The Services Contractor shall supply and install test & Commission all door détentes to corridor access doors as indicated on the drawings.

All détentes are to be of the type suitable for their particular application supplied by and installed by the Services Contractor.

Détentes are to be controlled by Power supply units generally to be installed within local switch cupboards.

Détentes provided to doors shall be switched independently of all areas allowing the doors to be isolated as required.

The Services Contractor shall liaise with the Principle Contractor with regard to positioning his connection to the doors.

Each détente or pair of détentes shall be provided with a test / close door facility switch.

A switch shall be provided to activate the closure of individual doors as required independently of the fire alarm system for test and operational reasons. It shall be red in colour, mounted at 1000mm AFL and 150mm in from the leading edge of the door in the head open position.

All switches are to be grid switch type with retractable switches employed, flush mounted and complete with white finish. Switches are to be labelled:

“Détente Test” utilising suitable permanent labels with 3mm high red lettering.

The Services Contractor shall ensure that where relay units are installed within power supply units they shall be of the suppressed and polarised type, installed in accordance with the manufacturer's requirements.

4.12.12 FIRE ALARM PANEL

The Analogue Addressable control panel shall be located within the ground floor reception area of each building. The panel will be designed to meet the requirements of BS EN-Part 2 & 4.

The fire detection & alarm system control panels shall operate and monitor all fire detection and Alarm functions.

The panels shall provide full alarm, fault and health monitoring of the Analogue, addressable detection loops and alarm circuits, as well as providing continuous status indication of the various fire detection zones.

The main panel shall be fully recessed of a neat attractive appearance.

Access to control panel functions shall be restricted, but system indication status shall be fully visible.

Separate volt free changeover rated at a suitable voltage shall be provided.

The panel shall house its power supply unit with associated batteries located within a separate enclosure of the same finish as the main panel.

The facility and interconnection wiring shall be provided on each panel to monitor fault and alarm conditions.

A print out facility is to be provided within the panel.

Fire Alarm repeater panels shall be identical in appearance to main panels and provide system status only.

4.12.13 COMMUNICATION WITH FIRE SERVICE

The Contractor shall provide all necessary equipment for connection of systems via monitored telephone line (BT Redcare or GSM) to transmit alarm signals automatically to the local authority fire service via a remote manned monitoring centre.

The Services Contractor shall provide details of all necessary rental costs for this facility, together with details of the system and remote manned centre proposed.

4.12.14 FIRE ALARM ZONES

The complete fire and detection system shall be zoned to the recommendations set out in BS 5839-1:2002+A2:2008 and the requirements of the Local Fire Authority.

Zones shall be arranged so that the indications of the fire alarm system can be rapidly related to the layout of the premises without confusion and without risk of misleading indications.

Detection zones and alarm zones should correspond where possible.

A mimic diagram shall be provided and wall mounted adjacent to the fire detection and alarm panel to indicate the area of each zone of the system.

4.12.15 COMMISSIONING

The commissioning shall be such that the manufacturer is prepared to give an unqualified guarantee to the operation of the system.

All visits to site by the Fire Alarm specialist to carry out the commissioning works and demonstrate the satisfactory operation of the system shall be incorporated

The overall responsibility for commissioning shall remain that of The Services Contractor shall programme all commissioning, provide personnel to assist the manufacturer, ensure that all tools, instructions and ancillary equipment (such as ladders and staging etc) are provided.

The Fire Alarm Specialist shall provide all equipment, wiring diagrams and to undertake all final testing / commissioning and connecting of the systems at the end of the project.

The system shall be fully Commissioned and Tested in accordance with the stipulations of BS 5839, Part 1 and upon completion of such tests the Fire Alarm Specialist shall issue a certificate stating compliance with BS 5839, Part 1, including all items listed in Appendix B of the said British Standard where applicable.

The Services Contractor shall ensure that all interfaces onto other systems and ancillary equipment are fully functional to meet stipulated requirements. Therefore commissioning and testing needs to be coordinated with these systems and their specialists. Coordination will be the responsibility of the Services Contractor.

Once the Services Contractor is satisfied that all of the defined systems are functioning correctly, the systems shall be offered for witness testing by the Employers Agent.

At least 7 working days written notice shall be given of the intended dates for witness testing.

Pre handover system checks by the System Specialist shall be undertaken prior to final handover of the system.

A representative of the Services Contractor must be present at all times during all witness testing of the Fire Detection & Alarm System by his appointed specialist.

A method statement shall be provided that gives clear concise steps as to how the Witness testing is to be undertaken.

The tests shall be carried out in accordance with BS 5839(2002). The Services Contractor shall include for attending to and rectifying any false alarms in order that a completely fault free system is provided upon handover.

The Fire Alarm Specialist shall allow to attend site for 1 No. half day to train Client representatives and end users on the operation of the Fire Detection & Alarm System. This shall include a Practical Demonstration of the system and the equipment.

The Fire Alarm Specialist shall instigate a system soak test in accordance with BS 5839 Part 1 2002 Section 35.2.6.

The soak test is to be carried out once the commissioning of the works have been Completed and the Client has taken possession of the site

4.12.16 AUDIBILITY TESTS

On completion of the works, the complete fire alarm system shall be proven to the satisfaction of the Employers Agent including the taking of fire alarm sounder levels in all areas, with all normal plant in operation.

The system Audibility Tests shall be tested in accordance with BS 5839 Part 1 and the results forwarded.

Details of the dates for the FINAL audibility tests shall be submitted at least 7 Working days prior to the testing to allow witnessing of the results.

Audibility Results shall be provided as a report within the O&M manuals and on "As Installed" Drawings.

4.12.17 DOCUMENTATION AND CERTIFICATION

In addition to full record drawings and maintenance information The Services Contractor shall complete and provide certificates of installation and commissioning together with a logbook, all as prescribed in British Standards.

The information provided must contain:-

- i) The required fire alarm system test certificate(s) to be issued by the specialist manufacturer, in the forms, as detailed in B.S.5839 and other relevant standards.
- ii) All audibility test results and presented in tabulated form.

- iii) Copies of all documentation including the above for comment inclusion in final documentation.
- iv) Maintenance/instruction manuals in the form of hard cover binder detailing the whole operation of the fire alarm systems, recommended regular testing and maintenance in accordance with the requirements of the specification.
- v) Fire alarm & Detection System record drawings in accordance with the requirements of the specification
- vi) Programming details for all devices incorporated on the system

4.13 EMERGENCY VOICE EVACUATION SYSTEM AND PUBLIC ADDRESS

Not required for this Project

4.14 MECHANICAL SERVICES WIRING

The Services Contractor shall allow for the supply, installation, commissioning and setting to work of all Electrical Services required to enable the Mechanical Services to function in the manner prescribed.

The Services Contractor shall fully liaise with the Principle Contractor to ascertain the requirements for electrical power supplies, control wiring etc. and shall include for all work necessary.

The Mechanical Services Works shall take the form of incorporating the heating and ventilation control panels located as indicated on the drawings.

Field wiring from these panels (both control and power) will be instigated by the Mechanical Services Contractor but the incoming supplies to the panels shall be provided by the Services Contractor (including final connection).

Final connections from isolators to Mechanical plant and equipment shall be by the Services Contractor.

In addition to the above the Services Contractor shall provide local power supplies, all containment system and control wiring to serve electrical equipment provided under The Mechanical Services works as follows:-

- a) Electric Heaters
- b) Water Heaters
- c) Shower Controls
- d) Extract Fans Locally Fed
- e) BMS Outstations
- f) Interface with Fire Detection and Alarm System
- g) Air Conditioning System
- h) Sensor operated taps
- i) Air handling unit lighting
- j)

The Services Contractor shall be responsible for the safekeeping of all items of free issue equipment.

All containment systems within plant rooms shall be Installed utilising galvanised steel conduit / trunking with dedicated wire ways for control cables as required.

4.15 EARTHING & EQUIPOTENTIAL BONDING SYSTEMS

A HV and LV earthing network is to be provided throughout the site for the transfer of electrical current to earth so that in the event of an earth fault, all earth fault currents are safely conducted to earth without danger to personnel or damage to equipment and facilitate operation of the electrical system protective devices such that all earth faults are cleared within the time scales specified in BS 7671.

In addition the requirement for the consumer, earthing requirements of the distribution network operator (DNO) supplying the building(s) / site incorporated are fully incorporated.

The entire Earthing Installation shall be provided to meet the requirements of:-

- Electricity at Work Regulations
- BS 7671 (IEE Wiring Regulations),
- BS 7430 Code of Practise for Earthing
- Energy Networks Association Technical Specification 41-24 "Guidelines for the Design, Installation, Testing & Maintenance of Main Earthing Systems in Sub Stations"

4.15.1 SOIL TESTS

The Services Contractor or is appointed Earthing specialist may undertake soil tests in accordance with BS 7430 and BS 1377 to establish soil electrical resistivity prior to commencement of the works in order to establish site ground conditions in the area of the proposed Earthing system.

This information shall be utilised and form the basis for the Earthing System design

Two copies of the Earthing Survey shall be provided by the Specialist and submitted to the Contract Administrator for approval.

The earthing survey document shall comprise:-

- i) Layout drawing indicating the position of the proposed earth electrode system
- ii) Location of Earth Soil Test and measured soil resistivity values at each location
- iii) Type and Specification for proposed Electrode System
- iv) Maximum Value of resistance to earth of each electrode System

4.15.2 HIGH VOLTAGE SYSTEM EARTHING

The system design and installation shall in addition to compliance with BS 7671 & 7430 respectively also meet the requirements of:-

- The Electricity Act 1989 (including amendments)
- The Electricity, Safety, Quality and Continuity Regulations 2002
- Electricity at Work Regulations 1989
-

The system shall be designed subsequent to completion of the Soil Tests as noted within 7.19.2 above.

The design shall ensure that the "Touch and Step Potential" are below 430V.

4.15.3 EARTHING CONDUCTORS

All earthing cables shall be single core cables having copper conductors enclosed within a green / yellow outer sheath of Low Smoke and fume (LSF) composition.

The location of all Earth bonding conductors whilst fully accessible shall be installed out of view to building occupants.

4.15.4 11KV SUBSTATION EARTHING

The HV earth system / exposed conductive parts in the substation shall be directly and permanently connected to an earth electrode system via the earth terminal on the LV switchgear and / or HV / LV transformer.

Adequately sized copper tape (at least 75mm x 6mm), or copper insulated cable (at least 95mm²) with PVC insulation shall be utilised

The earth resistance of the combined earths (HV exposed conductive parts plus LV neutral earth plus connections with earth associated with the cables connected to the substations via their sheaths) shall be 1.0 Ohm or less.

The metallic sheath and/or armouring of the HV cable shall be bonded to the LV earth system.

The neutral point of the transformer secondary winding shall be bonded to the neutral/earth bus bar in the LV distribution switch panel through a bolted link with the neutral/earth bus bar connected to the common earth bar within the LV distribution switchboard through a bolted link.

A Substation main earth bar 75mm x 6mm copper wall mounted in an accessible location on suitable insulators shall be provided mounted adjacent to the Main LV Switchboard.

The Earth bar shall have a copper disconnect link to enable routine testing to be undertaken

The earth bar and all outgoing Bonding Conductors shall be fully labelled / referenced to state their purpose, the label / reference shall also include the cable size and type.

All main equipotential bonding conductors including the main Switchboard termination shall be bonded to this earth bar.

Spare space shall be left on the earth bar for 20% future connections.

4.15.5 EARTH ELECTRODE SYSTEM

An earth Electrode system is to be provided for each 11kV package substation the earth electrode system being located in a suitable location adjacent to the respective substation

The Earth electrode system shall utilise copper conductor which interconnect a series of earth rods driven into the ground in an area agreed for the installation.

The rods are to be driven vertically into the ground until their tops are a minimum of 600mm below the surface.

Earth electrodes are to be spaced a minimum distance apart, equivalent to their buried length.

Prior to driving any electrodes into the ground, check the selected area with an electronic scanning device, for any buried services.

All earth connections are to be protected from corrosion by a suitable compound impregnated waterproof tape.

Where it is determined by test (See 17.9.2 above) that the ground has high soil resistivity such that the final resistance value of the earth electrode(s) cannot be guaranteed, additional earth electrodes shall be provided together with inter-connecting tape until the stipulated resistance over and above that specified is achieved.

The exact number of rods within array is to be determined by test by the installer to achieve the stipulated resistance to the mass of earth.

Earth electrodes arrays shall be connected using bronze purpose made clamps with compatible material high tensile bolts and 25mm x 6mm plain copper tape between electrodes.

Connections shall be made at the top of Electrodes to ensure that horizontal tape runs between electrodes are 750mm below finished ground level.

Earth electrodes are to be fitted with hardened steel tips and driving heads.

Ensure electrode is to be within 2000mm of the building foundations.

Earth rods are to be interconnected using suitably sized copper tape (Min size 25mm x 3mm).

The earth array shall be equally divided into two parts and connected to a proprietary testing links using insulated conductors, terminating at the substation earth bar to enable testing to be carried out on each half without loss of earthing facilities.

Earth connection cables buried below ground shall be PVC sheathed installed a minimum 0.6m below the ground, and sized in accordance with table 54.1 of BS 7671.

4.15.6 LV SYSTEM EARTHING

An LV earthing system to meet the requirements of BS 7671 shall be provided with separate Neutral and protective conductors throughout the installation.

Within each substation connect to the Main earth bar the following:-

- HV system exposed conductive parts, subject to achievement of combined earth resistance of 1ohm or less.
- Neutral of the Transformer

- Earth electrode system.
- Main LV distribution panel(s).
- Lightning protection system/structural steelwork.
- Cable tray/ladder Containment system(s).
- Any secondary earth bar(s).
- All building structural steelwork
- Mechanical plant including ductwork and pipework to meet wiring regulations

The size of the protective conductor shall be selected in accordance with BS7671

4.15.7 LIGHTNING PROTECTION

Lightning protection for the building will take the form of an air termination network tied into the structure and earthed at low level with rods driven directly into the ground.

The system will be in compliance with BS EN 62305.

The lightning protection system shall be bonded to the main building earth bar.

4.15.8 VOICE AND DATA FUNCTIONAL EARTHING

The earthing in respect of the voice systems shall be such that the separate earth cable serving the Main Server Room dedicated earth bar shall be a minimum cross sectional area of 25mm² or half the cross sectional area of the phase conductor serving the Main Server Room, whichever is greater, from the main earth bar in the Main LV switchroom.

The Main Server room earth bar shall be utilised to earth the PDU's and equipment racks and shall be bonded to the earth bar of the communications room distribution board earth bar by a earth cable of the same cross sectional area as the earth serving the earth bar.

The earth bar shall have a minimum of 8 pre drilled connection points and a disconnect / test link.

A 16mm² (minimum) bonding cable shall be connected from the building main earth bar to an earth bar within the hub room routed to follow the route of the electrical supply cables to the room and then following the sub main cable from the distribution board and installed in compliance with the BS 7671.

4.15.9 HIGH INTEGRITY EARTHING

The requirements of BS 7671 Section 607 in this regard shall be met with regards to the provision of the Underfloor Busbar Trunking Installation.

All socket outlets circuits are protected by 30mA RCD's, with the number of socket outlets on RCD protected circuits limited to reduce the risk of nuisance tripping due to equipment earth leakage current.

4.15.10 RAISED ACCESS FLOORS

All metallic parts of raised access floors shall be earth bonded to ensure they are electrically continuous fully in accordance with BS 7671.

This shall be undertaken by bonding raised floor pedestal legs every 4th Pedestal to form a grid, the cable shall be connected back to the main earth bar, refer to drawings for details

On completion of the raised floor earthing installation it shall be tested to ensure that the floor is electrically continuous and fully earth bonded.

4.15.11 CONDUCTORS

The cross-sectional area of all Earthing, bonding and protective conductors shall comply with the requirements of the BS 7671. Conductors for Earthing shall be copper.

Single core cables forming part of the Earthing system shall be of stranded copper, insulated to 450/750V standards with green/yellow LSF. These cables shall comply with BS6004, Table I

Main equipotential bonding conductors shall be provided fully in accordance with BS 7671. These shall bond the metalwork of incoming services, the lightning protection system, and the building steel framework, networks of piped and ducted services emanating from plant and plant rooms etc, and other items as required by BS 7671.

The main bonding conductors shall radiate from suitable points as determined by the design of the electrical installations, and in compliance with BS 7671.

4.15.12 EQUIPOTENTIAL BONDING

Services including gas mains, water mains, dry risers, etc. entering or leaving the building shall be effectively bonded to the main earthing terminal at their point of entry or exit. Connections shall be made to the services with purpose made earthing clamps to BS951. Cables to This effect shall be 16mm² LSF/Cu.

Metal pipes entering the building shall be bonded together at the point of entry. Connections shall be made using purpose made earthing clamps. A bonding conductor of 4mm² green/yellow PVC insulated stranded copper cable shall be installed to connect the pipework to the earthing terminal in the local distribution board.

Metal sinks, basins, etc., shall be bonded to the earth terminal of the nearest 13A socket outlet as shown on the drawings. The bonding conductor shall additionally be connected to any metallic pipes serving the sink or basin, with purpose made earthing clamps.

All cable tray, ladder, trunking etc. shall be bonded to the main earthing terminal using 16mm² LSF/Cu.

All cable tray, ladder, trunking, etc. shall be bonded at each end to the earthing terminal of the associated distribution board. Where cables supply distribution boards along the run of the cable tray, ladder, trunking etc., a bonding conductor shall be installed between the cable tray ladder, trunking, etc. and the earthing terminal of the distribution board. The cross sectional area of bonding conductors shall be not less than half that of the circuit protective conductor.

Where connections are made between sections of cable tray or trunking then the manufacturer's earth continuity link shall be installed across the joint

Where cable tray, ladders, trunking etc., cross building expansion joints a copper braid shall be installed to ensure electrical continuity.

Where cable support systems are not installed in an electrically continuous run; for example where the support system changes from ladder to tray, a bonding conductor shall be installed to ensure electrical continuity.

Unless stated otherwise, conductors used to ensure electrical continuity of cable support systems shall have a cross sectional area of not less than half that of the largest circuit protective conductor of the circuits supported.

The main support grid of any suspended ceilings shall be bonded to the earth terminal of adjacent luminaires. The bonding conductor shall be 2.5mm² green/yellow LSF insulated stranded copper cable and shall be connected to the support grid by means of a compression type cable lug, nut, bolt and lock washers. Sufficient bare metal shall be exposed on the ceiling grid to ensure satisfactory electrical continuity.

A minimum of one bonding connection shall be provided for each 20m² of ceiling, excluding any fortuitous bonds provided by luminaires or other electrical equipment.

The Services Contractor shall allow to bond across all non-conducting sections of ventilation ductwork utilising coiled 4mm² LSF/Cu copper cable.

4.15.13 COMMUNICATIONS ROOMS

The Communications room earth bar shall be utilised to earth the equipment racks undertaken by the equipment installer and shall be bonded to the earth bar of the communications room distribution board earth bar by a earth cable of the same cross sectional area as the earth serving the earth bar. The earth bar shall have a minimum of 8 pre drilled connection points.

All Communications Room dedicated Earth Requirements shall be bonded to this earth bar.

Connections to the earth bar shall be bolted with plain and spring washers using compression lugs.

Each cable connected to the earth bar shall be individually identified by means of an engraved disc permanently attached to the cable.

Adjacent to the earth bar the Services Contractor shall provide a typed encapsulated schedule giving details of each cable, including cross sectional area and destination.

The Services Contractor shall also provide the necessary warning notice adjacent to the earth bar required by BS 7671.

4.16 INDUCTION HEARING LOOP SYSTEM

Induction hearing loops and necessary loop amplifiers and microphones shall be supplied to cover Main reception desk and other areas as identified on the Room Data Sheets

All equipment will meet the requirements of BS EN 60118-4:1998 and [BS 7594:1993](#) and will be compatible with hearing aids incorporating 'T' switches.

The system comprising amplifiers, induction loops and all necessary connections, fixings and matching transformers shall be provided.

The performance of the loop system will be seriously affected by metallic components of the structure, due allowance will be made for any rectification measures considered necessary to ensure the systems satisfactory operation.

The loop wire shall be installed within a flush plastic conduit to the manufacturer's recommendations. No induction loop cabling or containment shall be visible on completion of the installation.

The number of joints within loop cables shall be kept to a minimum.

The loop amplifier should be located to protect against unauthorised access and installed outside the loop.

A free flow of air will be required across the amplifiers.

The equipment manufacturer / supplier shall test and commission the equipment on completion of the installation.

The Services contractor shall also provide all local 230V supplies for amplifiers.

4.17 SECURITY SYSTEMS

4.17.1 GENERAL

The Services Contractor shall employ a Security Specialist for CCTV, Access Control and Intruder Alarm Systems to design, supply, install, test, commission and demonstrate the Security Installations outlined in this section of the specification and drawings together with all associated interfaces.

The Specialist Security Contractor shall develop the Security System design and functional requirements indicated within this specification and install all components of the security system detailed below such that it functions as a complete system capable of operating from one database / platform to allow full Integration of the Systems.

The systems shall be fully compatible such that the complete development can be monitored and controlled from a Centralised Security room.

Cableways and power supplies shall be provided by the Services Contractor to the requirements and satisfaction of the Specialist. All cableways, ducts, etc. shall be completely separate from any other system of wiring.

Spatial Provision has been incorporated for equipment within the dedicated Electrical Cupboards; all equipment must be located within these cupboards.

The Specialist Contractor shall review of the allowances in order to ensure that sufficient space is available for the equipment to be installed, operated and maintained.

The design and installation shall be in accordance with the requirements of EN 50131, 50133 and PD 6662;2004, BS 5750, BS 4737, Electrical Contractors Association (Security Group) Code of Practices and BS 7671 (IEE Wiring Regulations) and must be able to meet the recommendations of the "Secure by Design" award scheme.

The equipment manufacturer will be accredited with BS EN 9001.

All systems should be capable of operating in the event of power failure for a period of 8 hours. Security systems shall be supported via the Diesel Driven Generator on power failure.

The details of each of the security system requirements are detailed in the following sections:-

4.17.2 ACCESS CONTROL

The security access control system shall provide control of personnel access points, pedestrian and vehicular access points to specified areas and according to defined user levels.

The Access Controller shall be capable of supporting up to 500 cards requiring access through the readers connected to the unit. All time zones and access levels assigned to the cardholder are to be retained and used at all times and including times if the controller is offline. Each card shall be programmed individually into groups which permit access into pre-determined and pre timed areas dependant on access rights of the cardholder, upon commissioning of the system. The system administrator shall have facility to change access rights at any time.

The system shall be configured for the following alarms to each door and controller to be relayed back to the monitoring station:-

- a) Doors Ajar
- b) Break Glass Activated
- c) Forced Entry
- d) Controller Failure

Proximity door access is to be provided to designated access doors to secure rooms and primary access routes together with staff entrance doors, car park exit barrier etc

Upon presentation of a card, the access grant decision shall be made within 0.3 seconds.

Vehicle Control Barrier

The Vehicular control barriers (provided and installed by others) will be provided with underground power supplies.

4.17.3 CLOSED CIRCUIT TELEVISION

The CCTV system has been designed to monitor the majority of the buildings perimeters, with a focus on covering all entrance/exit points to the buildings. The EMR & IES building will comprise of its own system, with the control equipment installed within each building, in a position to be confirmed.

The cameras will be fixed to the buildings exterior on brackets, with cables run internally. The MCC buildings No. 3&5 will connect into recording equipment for the EMR & IES building. Suitable cable routes and ducting will be required for the cables back to the EMR and RODEC building.

Each of the systems will comprise of a mixture of PTZ and static external dome cameras, controlled by a keyboard joystick controller with backlit LCD display. Each camera will have a minimum spec of 520TVL resolution, and day/night functionality. The cameras will connect to a 16 channel, H.264,D1,SVGA, DVD/USB backup, IE ready,2TB DVR and matrix outputting to 19" monitor.

The system will be designed and installed in accordance with BS EN50132-7 : 1996 and NACOSS codes of practice.

The EMR & IES building will comprise of its own system, with the control equipment installed within each building, in a position to be confirmed.

The cameras will be fixed to the buildings exterior on brackets, with cables run internally. The MCC buildings No. 3&5 will connect into recording equipment for the EMR & IES building. Suitable cable routes and ducting will be required for the cables back to the EMR and IES building.

Each of the systems will comprise of a mixture of PTZ and static external dome cameras, controlled by a keyboard joystick controller with backlit LCD display. Each camera will have a minimum spec of 520TVL resolution, and day/night functionality. The cameras will connect to a 16 channel, H.264,D1,SVGA, DVD/USB backup, IE ready,2TB DVR and matrix outputting to 19" monitor.

The system will be designed and installed in accordance with BS EN50132-7 : 1996 and NACOSS codes of practice.

The system shall comply fully with all applicable British Standards, NACOSS Codes of Practice, and Guidance Notes & Building Regulations applicable at the time of Tender.

The system shall achieve sufficient picture quality and detail to enable the 'identification' of a subject at the particular target surveillance areas.

The proposed system of hardware and software that is easy to customise, adjust, and control by the user without the need for specialist input.

The performance of the system is related to the image height of the Rotakin standard test target 1.6m high as a percentage of the image, based upon a person 1.6m tall, displayed at the monitor.

The level of surveillance where the image fills the monitor screen is described as 100%. Systems providing 'identification' of unknown persons achieve 120%, i.e. a person 1.6m tall shall be displayed approximately from top of head to knee height at the monitor.

Display

The outputs of the CCTV cameras shall be displayed on 19" LCD Flat Screen Monitors. Sufficient monitors are to be provided to enable a maximum of 8 No Cameras per monitor to be displayed simultaneously.

A Facility shall be provided to enable the operator to select multiple display windows of varying sizes on each screen, including as a minimum:

- Full screen
- windows, equal sizes
- 9 windows, equal sizes
- 16 windows, equal sizes
- windows of equal size +1 larger window

The system shall allow the user to easily set up and change the layout of display windows.

The windows shall be resized by click-and-drag operation, and any size and combination can be produced.

Image Capture

Images are to be recorded onto recorders located in secure areas as detailed be specialist designer

The total storage capacity of the recorders shall provide for 31 days continuous storage at 5 frames per second include spare capacity for 20% additional cameras after which the images will be overwritten

Recorded images are to be complete with authentication and encryption to removable recording media.

The outputs of the cameras are to be recorded onto a digital storage system
The recorders shall be sized and configured to record at 5 frames per second, with a minimum image size of 720 x 576 pixels (4 CIF) in RAID 5 configuration. Video compression to be MPEG-4 or H.264.

Full compliance with the Data Protection Act will be required, including date, time and frame stamping of all generated images, with a full audit trail via a time and date generator as an integral part of the surveillance system

Video and still images are recorded in response to movement detected by the camera, as well as manually by an operator.

The recorders shall include a built-in DVD Writer to provide one-time copying of video footage to standard DVD media.

Recording shall continue during other operations such as Playback, and Copying to DVD. The unit is to be fully networkable and supplied with remote viewing software.

All digital images must be instantly retrievable.

The control and monitoring equipment shall be located within the ground floor hub room within a 19" rack assembly with a lockable glass front door and ventilation fan tray, with a dedicated PC for control and playback facilities.

All video images will be archived on to hard disk.

Control Requirements

Manual and automatic control and viewing of all cameras within the scheme is to be provided as described in this specification.

The entire surveillance system is to be designed, installed, and commissioned to provide the specified resolutions and frame rates at full operating conditions, ensuring that the minimum network bandwidth is used without any reduction in the resolution and frame rate specified.

The following CCTV equipment is to be provided for the monitoring station

- LCD TFT high resolution colour spot monitors (number to be confirmed by appointed specialist)
- 1 No standard computer keyboard
- 1 No standard computer mouse
- 1 No contact-less joystick
- 1 No desk-mounted spot monitor recording button per spot monitor
- 1 No CD/DVD writer slot
-

The above equipment is to be supported from a maintained essential supply to all control, viewing, and recording equipment.

System Software Functions

The following software functions are to be provided as a minimum, to perform all central control functions simultaneously:-

- Live display of camera images
- Live display of camera image sequences (cycling)
- Instant replay of live images
- Control of PTZ cameras
- Retrieval and playback of recorded images

The software provided shall support the use of multiple screen monitor.

The software will provide a plug and play type hardware discovery service that automatically discovers devices as they are attached to the network.

The software shall allow the user to configure the performance parameters of each individual camera, notably separate frame rates for display, alarm, and recording, compression rates, activity detection grids layout and sensitivity, picture quality, and separate alarm, recording, and viewing resolutions.

The software to include a Microsoft Windows®-based graphical user interface.

This software shall allow any authorised user to configure system and equipment settings and add and modify user data.

Alarms

Upon trigger of an alarm condition or even the system shall in addition to generating an audible alarm at the monitoring point display the image or images on the specified event screen or screens, including pre and post event images.

The images shall automatically be stamped with the date time, camera and describe the alarm condition and record the details within the event log

The system shall record an alarm event at a frame rate of 5 images per second, including a user-definable pre event period of no less than 15 seconds, until the alarm is recognised and the recording is stopped by the operator.

System Alarms shall be generated by

- System signal loss
- Activation of camera anti-tamper software
- Video motion detection system
- intruder alarm system
- Access control system

Alarm prioritisation (management) shall be incorporated with a facility for user alarm prioritisation.

Provide a system to transmit notification of an alarm condition to a remote party via electronic mail, GSM, telephone line, and the computer network.

Operator Parameters

The system shall allow any operator to carry out the following activities, subject to password-based authorisation levels:

- Select any live camera image for display on any screen
- Retrieve any recorded surveillance data and display it on any screen
- Select any surveillance data to display simultaneously on more than one screen, or on all screens
- Adjust the speed of playback of recorded video, from single still image to at least double the full frame rate video
- Select forward and reverse directions of recorded video playback
- Select the configuration of any screen, i.e. the number of views to be displayed and the layout
- Control the direction and speed of the panning, tilting, and zooming functions of any movable camera through all ranges of speed and motion, without any visible time delay between the operation of the control device and the movement of the camera as viewed on the screen
- Set and adjust the pre-set positions and touring characteristics of each PTZ camera
- Adjust the bit rate of any data stream from any camera
- Activate an alarm condition relating to any camera
- Generate and edit text to be displayed with any camera view or alarm condition
- Manually record any surveillance data on the primary storage media
- Export part or all of the recorded surveillance data to any specified export medium
- Easily compile audit trails and event records and export these to any recording media
- Print any report, audit trail, event record, or image

The operator functions shall be carried out through the use of a standard QWERTY computer keyboards and mouse, as well as through a surveillance system joystick.

Cameras

All external cameras shall be either building mounted or on hinge down columns either roof or flange mounted.

No cables shall be visible at column locations

Cameras shall be high-resolution fixed colour / monochrome cameras (min 550TVL).

The external lighting levels will be adequate for the use of the CCTV System; the specialist shall review these levels and confirm suitability of illumination levels.

Each camera shall be housed within a vandal resistant purpose made weatherproof (IP65) enclosure, complete with integral heater / demisters with thermostat, sun shields as appropriate.

All external cameras shall be mounted at approximately 4 metres above finished floor level or 5m where column mounted, final camera mounting heights shall be as required by the security specialist and agreed with the Contract Administrator

In addition, an external fixed CCTV camera shall be located to provide coverage of the final staff entry / exit door area immediately outside, Images from these external camera shall be relayed and displayed onto ceiling mounted 17" Flat Screen LCD monitor positioned internally and visible internally from the final staff exit door.

Internal cameras shall be ceiling mounted high resolution fixed or colour cameras as denoted on the drawings. Each camera shall be housed within a vandal resistant enclosure, with a smoked mini-dome.

All CCTV cameras shall operate from regulated 12V DC charged power supplies located within riser cupboards and fed from essential distribution board(s).

All CCTV cameras shall be complete with varifocal lens to enable the engineer to select the exact view required on site during the commissioning period.

Camera Mountings

Camera mounting brackets are to be of the proprietary, welded steel alloy construction with stainless steel mounting hardware, and are to be designed to support the camera and all associated auxiliary equipment.

Outdoor camera mountings are to be weatherproof and corrosion-resistant. These mountings are to be able to withstand winds up to 160 km/h when fully loaded.

The camera mounting is to remain stable when the outdoor camera and support are subjected to gusty winds up to 100 km/h.

Indoor camera mountings are to be corrosion-resistant. These mountings are to be fastened to a wall, to a vertical support, or to an overhead member.

All cameras mounted on suspended ceilings are to be adequately supported from the soffit.

Pan/tilt Units

Pan and tilt units are to be provided to all movable cameras ensuring that maximum image stability is not compromised

The pan/tilt unit to be constructed using all metal gearing and hardened steel drive shafts to ensure reliability with permanently lubricated Bearings

Pan/tilt motors are to be sized for continuous duty operation at torques compatible with the total weight of cameras, lenses, and enclosures supplied.

Video Motion Detection (VMD)

Video motion detection (VMD) shall be provided in all cameras, the VMD detecting movements of persons or vehicles in its field of view.

Each camera shall be set up by to automatically record and display images generated as a result of VMD triggers, and to transmit an alarm signal via a local port and via the network.

Warning Notification

As part of the CCTV installation, The Services Contractor shall ensure that the following wall mounted signs are provided to the Client in order to comply with the Data Protection Act 1998. Regardless of size the following wording shall be used:-

"Images are being monitored for the purposes of Public Safety, Crime Prevention and Prosecution of Offenders.

This scheme is controlled by-
Tel: (Number to be provided by Client)"

- 2 No. 600 x 600mm Public Information Wall Signs
- 2 No. 300 x 300mm Public Information Wall Signs

The system will conform to the NACOSS Code of Practise for CCTV ref NCAP 20

4.17.4 INTRUDER ALARM SYSTEM TO EMR BUILDING

An Intruder Detection System shall be provided that will automatically transmit an alarm when an unauthorised person enters protected areas.

The system will transmit confirmed alarm notifications suitable for immediate Police response to on-site staff and a remote third party alarm-receiving centre when any person attempts to enter any protected space.

The system will incorporate Sequential Alarm Confirmation and comply with the requirements of DD243; 2004

The System shall fully comply with EN 50131 (Effective October 2005) in conjunction with PD 6662, 2004 for a grade 3 system with Notional Option C.

The system will provide full-confirmed full perimeter protection to provide trap zone protection. The System shall be capable of securing the perimeters of the separate Buildings and / or departments.

All perimeter doors shall be equipped with magnetic reed type contacts.

The integrated Intruder alarm system will ensure that areas/ zones can be set and unset by an authorised user to ensure the building is secure out of hours.

This is to be achieved by reed contacts protecting the perimeter doors. If any of these devices are activated when the system is set the alarm sounds and a signal is sent to the remote monitoring Centre to call out the nominated 1st key holder (through the Redcare line) for them to attend site. On a second alarm activation the Police will be called direct.

Due to the disparate nature of the building usage, the system shall incorporate remote keypads with integral proximity detectors, together with remote speakers, as shown on the drawings.

The system shall be so configured that each separate area may be set and unset independently of the remaining areas of the building. Setting and unsetting of the system(s) shall be by means of proximity cards. These proximity cards should be compatible for use with the access control system

All perimeter doors shall be equipped with magnetic reed type contacts.

The alarm system shall be controlled by a multi-circuit microprocessor based control unit suitably located. The control unit shall be capable of retaining a minimum log of 500 events and shall incorporate a digital communicator and modem.

The power supply for the control unit shall incorporate a rechargeable standby battery capable of supporting the system for a minimum period of 8 hours.

The system shall provide indication of an unauthorised entry into the building by

- Audible/visual means self-activating electronic sounders and strobe units within protective covers shall be installed to the front and rear of the building. Dummy sounders and strobe units shall be installed to the sides of the building.
- British Telecom Red CARE GSM — a Red CARE GSM signalling unit shall be provided adjacent to the control unit within the rear office area of the ground floor main entrance reception. Activation of the alarm system shall signal to an ACPO & NSI Approved alarm-receiving centre (ARC) via the BT telephone network.

The 12-month period shall commence from the date of Practical Completion and not from when the system first comes into operation.

4.17.5 AUDIO VIDEO INTERCOMS

No provisions made.

4.17.6 INSTALLATION, TESTING AND COMMISSIONING OF SECURITY SYSTEMS

The Services Contractor shall allow for demonstrating the systems to the Contractor until he is fully familiar with its operation

4.18 DISABLED WC ASSISTANCE ALARM

Disabled Person assistance alarm shall be provided by the Services Contractor to be installed to all disabled WC's throughout the building.

Power supplies shall be provided to meet the requirements of the Services Contractors System requirements.

The Disabled WC Assistance Alarm shall provide both audible and visible warning signals directly outside each disabled WC and to the main Control Panel located at the Main Reception Desk.

4.19 INDUCTION HEARING LOOP SYSTEM

Desk mounted Induction Hearing Loops are to be provided and installed to the Main Reception Desks (One per building)

All equipment will meet the requirements of BS EN 60118-4:1998 and BS 7594:1993 and will be compatible with hearing aids incorporating 'T' switches.

The system comprising amplifiers, induction loops and all necessary connections, fixings and matching transformers shall be provided.

The performance of the loop system will be seriously affected by metallic components of the structure, due allowance will be made for any rectification measures considered necessary to ensure the systems satisfactory operation.

The loop wire shall be installed within a flush plastic conduit to the manufacturer's recommendations. No induction loop cabling or containment shall be visible on completion of the installation.

The number of joints within loop cables shall be kept to a minimum.

The loop amplifier should be located to protect against unauthorised access and installed outside the loop.

A free flow of air will be required across the amplifiers.

The equipment manufacturer / supplier shall test and commission the equipment on completion of the installation.

The Services contractor shall also provide all local 230V supplies for amplifiers associated with this system

4.20 LIGHTNING PROTECTION SYSTEM & TRANSIENT SURGE VOLTAGE SUPPRESSION

4.20.1 LIGHTNING PROTECTION

The Services Contractor shall provide a lightning protection system to the building, fully in accordance with the latest edition of BS EN 62305 including all current amendments.

The Building's steel structure shall be used where possible.

The lightning protection system shall be installed to accord with the construction programme.

The Services Contractor shall employ an approved lightning protection specialist to instigate the work on his behalf as detailed within this specification and on the drawings.

A risk assessment shall be undertaken to determine the category of lightning protection system required

The lightning protection system shall be designed and shall be installed accordingly.

Conductors shall not run where exposed to view nor run surface on any part of the walls.

The Vertical rod or pinnacle type air terminations shall not be used.

The system has been designed utilising the metal decking roofing system indicated on Architects drawings together with supplementary roof mounted 25 x 3mm PVC sheathed aluminium tapes installed in a grid format.

The metallic roof decking shall be tested for electrical continuity prior to Installation of the Lightning Protection System.

The location of any strike plates shall be agreed in detail with the contract administrator and the services engineer.

All bonding required by BS EN 62305 shall be included and installed within the lightning protection scheme. Metalwork to be bonded in and on the structure shall include (but not limited to) all parts of the steel structure, metallic roof deck, rainwater gullies, louvers, handrails service flues and any metallic components penetrating the roof structure.

The Services Contractor specialist shall include for all bonds and straps required to ensure electrical continuity of the system.

Where practicable structural steel columns shall be utilised as down conductors to earth and shall connect to earth via earth rod/s approximately 2 metres from the building.

Where down tapes are utilised for down conductors for the lightning protection. These shall be concealed within the wall and column make up such that they are not visible or susceptible to vandalism.

A disconnect test joint shall be included within each earth electrode pit.

Earth Electrodes nominally 2400mm long x 16mm dia steel cored copper clad conductors shall be provided and installed.

On completion of the installation, earth electrodes shall be tested and if necessary additional earth rods installed in order to obtain a maximum acceptable reading of 10 ohms

Allowance shall be included for any additional rods that may be necessary in order to obtain an acceptable reading of 10 ohms.

Driving heads shall be fitted to all rods prior to driving.

Scanning for buried services shall be carried out prior to driving earth rods.

The earth pit housing shall be supplied by the Services Contractor and free issued to the Contractor for them to install.

Earth pit housings shall not be installed in pedestrian footways unless unavoidable. Where earth pits have to be installed in footways earth pits shall have lockable covers.

All Inspection Pits shall be labelled with a unique earth electrode reference number on completion of the works.

Due to the nature of this work close liaison with both the contractor and specialist is essential in order that phasing of the works is co-ordinated with the Principle Contractors programme.

The lightning protection system shall be bonded to the electrical installation main earth bar located within the main electrical switch room.

4.20.2 TRANSIENT VOLTAGE SURGE SUPPRESSION

Transient Voltage Surge Suppression (TVSS) units' rate at either 10/350µs of 8/20µs shall be provided and installed to the following items of equipment:

- Contained within the Main LV Switchboards, including Packaged Substations
- Distribution boards and panels serving externally mounted plant or electrical services leaving the building i.e. external lighting DB, Roof Mounted Plant.
- Incoming BT and Telecoms lines

4.21 VERTICAL TRANSPORTATION SYSTEMS

Not Applicable

4.22 DISABLED REFUGE CALL SYSTEM

No Provisions.

4.23 TELEVISION DISTRIBUTION SYSTEM

No Provisions

4.24 TESTING & COMMISSIONING

4.24.1 PRE COMMISSIONING

The complete system Pre - Commissioning of the Electrical Services installation(s) shall be carried out by the Services Contractor and / or his appointed Specialist Contractor(s) in accordance with the procedures specified within this specification, BS 7671, CIBSE Guidelines other relevant standards and specific plant and equipment commissioning manuals.

4.24.2 WITNESS TESTING

On satisfactory completion of the Pre Testing & Commissioning the systems shall be offered for witnessing by the Clients representatives who shall include for demonstrating all plant & systems to the Contract Administrator or his appointed Representatives and/ or nominees in its correct operation and use.

4.24.3 COMPLETION

Following the inspection and testing of the installation and the implementation of any Corrective action found necessary the Services Contractor shall issue a completion certificates and test results for the completed tested and commissioned systems.

APPENDIX I
IES WASTE TO ENERGY PLANT - OLBURY
TENDER SUBMISSION SCHEDULES

APPENDIX I

TENDER SUBMISSION SCHEDULES

CONTENTS**A1.0 Schedule of Tender Drawings****A2.0 Particulars of Services Contractors – Electrical Services****A3.0 Particulars of Services Contractors – Mechanical Services****A4.0 Information to be completed by the Electrical Services Contractor****A5.0 Information to be completed by the Mechanical Services Contractor**

A1.0 SCHEDULE OF TENDER DRAWINGS

Electrical	
Indicative HV single Line Schematic	30526(6S)001
Sub Station HV / LV Schematic – Rodecs Number 1	30526(6S)002
Sub Station HV / LV Schematic – Rodecs Number 2	30526(6S)003
Sub Station HV / LV Schematic – Rodecs Number 3	30526(6S)004
Sub Station HV / LV Schematic – Rodecs Number 4	30526(6S)005
Sub Station HV / LV Schematic – Gas Coolers	30526(6S)006
Sub Station HV / LV Schematic – Filter No.2	30526(6S)007
Sub Station HV / LV Schematic – Materials Handling	30526(6S)008
Sub Station HV / LV Schematic – EMR	30526(6S)009
Sub Station HV / LV Schematic – UPS	30526(6S)010
Sitewide Fire Alarm Schematic	30526(6S)011
External Services Sitewide Layout	30526(60)001
External Lighting & CCTV Layout	30526(60)002
Containment Layout Zone 1	30526(61)001
Containment Layout Zone 2	30526(61)002
Containment Layout Zone 3	30526(61)003
Containment Layout Zone 4	30526(61)004
Containment Layout MCC Room 3, MCC Room 5 & HV Switchrooms	30526(61)005
Containment Layout Process Floor Plan	30526(61)006
Containment Layout Process Floor Plan	30526(61)007
Small Power Layout Zone 1	30526(62)001
Small Power Layout Zone 2	30526(62)002
Small Power Layout Zone 3	30526(62)003
Small Power Layout Zone 4	30526(62)004
Small Power Layout MCC Room 3, MCC Room 5 & HV Switchrooms	30526(62)005
Small Power Layout Process Floor Plan	30526(62)006
Small Power Layout Process Floor Plan	30526(62)007
Lighting Layout Zone 1	30526(63)001
Lighting Layout Zone 2	30526(63)002
Lighting Layout Zone 3	30526(63)003
Lighting Layout Zone 4	30526(63)004
Lighting Layout Zone MCC Room 3, MCC Room 5 & HV Switchrooms	30526(63)005
Lighting Layout Zone Process Floor Plan	30526(63)006
Lighting Layout Zone Process Floor Plan	30526(63)007
Fire Alarm Layout Zone 1	30526(68)001
Fire Alarm Layout Zone 2	30526(68)002
Fire Alarm Layout Zone 3	30526(68)003
Fire Alarm Layout Zone 4	30526(68)004
Fire Alarm Layout Zone MCC Room 3, MCC Room 5 & HV Switchrooms	30526(68)005
Fire Alarm Layout Process Floor Plan	30526(68)006
Fire Alarm Layout Process Floor Plan	30526(68)007
Lightning Protection Layout	30526(69)001
Mechanical	
Cold Water Supply Schematic	30526(5S)MCWS

Natural Gas Schematic	30526(5S)Natural Gas
Environmental Layout - Zone 1	30526(50)001
Environmental Layout - Zone 2	30526(50)002
Ventilation Layout - Zone 1	30526(57)001
Ventilation Layout - Zone 2	30526(57)002

A2.0 PARTICULARS OF SERVICES CONTRACTORS – ELECTRICAL SERVICES

The Electrical Services Contractor's attention is drawn to the relevant Clause of the General Conditions of Contract in respect of the sub-letting of any part of this Contract.

Any part of the sub-contract in this Section to be sub-let to any other supplier than those nominated must be indicated below with the name and address of the proposed firm.

Description of Work	Name of Services Contractor

A3.0 PARTICULARS OF SERVICES CONTRACTORS – MECHANICAL SERVICES

The Mechanical Services Contractor's attention is drawn to the relevant Clause of the General Conditions of Contract in respect of the sub-letting of any part of this Contract.

Any part of the sub-contract in this Section to be sub-let to any other supplier than those nominated must be indicated below with the name and address of the proposed firm.

Description of Work	Name of Services Contractor

A4.0 INFORMATION TO BE COMPLETED BY THE SERVICES CONTRACTOR**Manufacturer of the Materials:**

Tenderers are required to enter below the Manufacturer of the materials on which their Tender is based in different to supplies identified within this specification. The range and catalogue number or other information by which the material may be identified.

Material	Manufacturer	Details

A5.0 INFORMATION TO BE COMPLETED BY THE MECHANICAL SERVICES CONTRACTOR

Manufacturer of the Materials:

Tenderers are required to enter below the Manufacturer of the materials on which their Tender is based if different to supplies identified within this specification. The range and catalogue number or other information by which the material may be identified.

Material	Manufacturer	Details

APPENDIX II
TENDER SUMMARY

APPENDIX II**TENDER SUMMARY****CONTENTS**

B1, 0 Tender Summary – Electrical Services

B2.0 Tender Summary - Mechanical Services

B3.0 Provisional Sums

B4.0 Schedule of Day work Rates

APPENDIX B1.0

TENDER SUMMARY

IES WASTE TO ENERGY PLANT

ELECTRICAL SERVICES

I / We hereby offer to execute and complete the design supply and installation of the above contract works in accordance with the specification, Drawings and Conditions pertaining to the Contract and the Employers Information and Good Working Practice for the following sums of money:-

No	SERVICE	ELEMENT	£
	<u>General</u>		
1.0	Preliminaries / Preambles.		£
1.1	Allowance for Compliance with CDM 2007 Regulations.		£
1.2	Testing and Commissioning.		£
1.3	Operation and Maintenance Manuals.		£
	Total of items 1.0 to 1.3 inclusive		£
2.0	<u>Electrical Services</u>		
2.1	LV Sub Mains Distribution		£
2.2	General Lighting	Removal of Existing Installation	£
		New Installations	£
		Modifications To Existing Installation	£
2.3	Emergency Lighting	Removal of Existing Installation	£
		New Installations	£
		Self-Test System	£
2.4	Small Power	Removal of Existing Installation	£
		New Installations	£
2.5	Voice & Data Systems	New Telephone Installations	£
		Removal of Existing Data Installation	£
		New Data Installations	£
2.6	Fire detection and Alarm System	Specialist Services Contractor Works	£
			£
No	SERVICE	ELEMENT	
2.7	Emergency Voice Evacuation and	Specialist Services Contractor Works	£

	Public Address System	£
2.8	Mechanical Services Power Supplies	£
2.9	Earthing and Equipotential Bonding	£
2.10	Security Systems	
	CCTV - Specialist Services Contractor Works	£
	Access Control - Specialist Services Contractor Works	£
2.11	Induction Hearing Loop Systems	£
2.12	Vertical Transportation Systems	£
2.13	Assistance Alarms	£
2.14	Television Distribution System	£
2.15	Staff Location & Paging System	£
2.16	Pulsed Clock System	£
2.17	Footfall Counting System	£
	Total of items 2.1 to 2.17 inclusive	£
	TOTAL	£
3.0	Miscellaneous	
3.1	Any other items not listed above (please state)	
	Total for item 3.1	£
	Contract Sum	£

Signed	.....	Name (Print)	.....
Position	.....	Date	.....
Company	.....	Telephone Number	.....
Address	.....	Facsimile Number	.....
	.....	E Mail	.....
		
		

APPENDIX B2.0

TENDER SUMMARY

IES WASTE TO ENERGY PLANT

MECHANICAL SERVICES

I / We hereby offer to execute and complete the supply and installation of the above contract works in accordance with the specification, Drawings and Conditions pertaining to the Contract and the Employers Information and Good Working Practice for the following sums of money:-

No	SERVICE	ELEMENT	£
	<u>General</u>		
1.0	Preliminaries / Preambles.		£
1.1	Allowance for Compliance with CDM 2007 Regulations.		£
1.2	Testing and Commissioning.		£
1.3	Operation and Maintenance Manuals.		£
1.4	Working drawings		
	Total of items 1.0 to 1.4 inclusive		£
2.0	<u>Mechanical Services</u>		
2.1	Public Health Services (series 52 drawings)	Removal & Modification	£
2.2	Natural Gas Services (series 54 drawings)	Removal	£
2.3	LTHW & Chilled Water Services (series 56 drawings)	Removal, Modification & Extension	£
2.4	DX Systems (series 56 drawings)	Provision of New Systems	£
2.5	Ventilation Services (series 57 drawings)	Modification & Extension	£
2.6	Sprinkler Systems (series 59 drawings)	Modification	£

No	SERVICE	ELEMENT	£
2.7	Building Energy Management System (BEMS)	Modifications, extension & up-grades	£
2.8	Thermal Insulation	Provision of New & Making Good	£
	Total of items 2.1 to 2.8 inclusive		£
	Total of items 1.0 to 1.4 (c/f)		£
	Mechanical Services Sub Total		£
3.0	Miscellaneous		£
3.1	Any other items not listed above (please state)		£
	Total Contract Sum to B of Q		£

Signed	.....	Name (Print)	.....
Position	.....	Date	.....
Company	.....	Telephone Number	.....
Address	.....	Facsimile Number	.....
	.....	E Mail	.....
		
		

APPENDIX B3.0**IES WASTE TO ENERGY PLANT****PROVISIONAL SUMS**

(Refer to Main Contract Works Documentation for details)

Item	Provisional Sum £
1) Substation Earthing	
2)	

APPENDIX B 4.0

TENDER SUMMARY**IES WASTE TO ENERGY PLANT****SCHEDULE OF DAYWORK RATES**

Any Work agreed and Instructed to be carried out as day work will be paid for at the following rates and such payment will only be for the net time worked on the Site.

The work will be undertaken at net cost plus the following percentage to cover overheads & Profit, supervision, establishment charges and other payments made under the Working Rule Agreement or any Regulation, Bye-law or Act of Parliament.

Materials%
Labour%
Fares and allowances%
On Site Plant%
Plant bought specifically to site%
Specialist sub-contractor works%

We the undersign confirm that the costs, rates and percentage additions given above are fixed until the end of the 12 months defects liability period.

Name (Print)

Signed

**For and on behalf
of:**

Date:

APPENDIX III

IES WASTE TO ENERGY PLANT OLBURY

WORKMANSHIP & MATERIALS SPECIFICATIONS

(SEE SEPERATE DOCUMENTS)

C1.0 ELECTRICAL SERVICES

C2.0 MECHANICAL SERVICES