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**The Horniman
Museum & Gardens
Aquarium Chiller
Replacement
Construction & MEP
Services Specification
Revision T1**

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Association for Consultancy and Engineering Member Firm

Issue	Date	Reason for Issue	By	Approved
00	Feb 2018	MEP Services Specification	SM	NCM
01	April 2018	MEP Services Specification	NCM/LG	CJM
T1	June 2018	MEP Services Specification	NCM	CJM

Project Management

10/04/2018 - 16:31

00-05-10 Project definition

101 The Project

- **Project reference:** 302807
- **Project title:** Horniman Museum & Gardens Aquarium Chillers
- **Project description:** A new chilled water system including controls and electrics in a new external plant enclosure to serve Aquarium & Comms. room

110 Project documents

- **Document type:**
Briefing document and Specification.
- **Title:** Construction, Mechanical, Electrical, & Public Health (MEP) Service Specification.
- **Status:** Tender.
- **Format:** Hard copy and Electronic.
- **Provision:** Provided.

00-05-15 Works terminology

110 Terminology

- **Meaning:** Terms, derived terms and synonyms used are as defined in this section or in the appropriate referenced document.

210 Description terminology

- **Attendance:** Provision of temporary works and facilities to a third party. If not detailed in the contract, to be as described in RICS NRM coverage rule 10.4.
- **Building Manual:** A document containing information of use to subsequent building owners, occupiers and users about the requirements and procedures for effective operation, maintenance, decommissioning and demolition of the building.
- **Construction Work:** Permanent work together with temporary work.
- **Contractor:** The party who undertakes to perform the services, supply goods or carry out work defined in a contract. Includes Main Contractor, Contractor, Prime Contractor, Supplier, Service provider, Builder, Subcontractor, etc. as the context dictates, which may be defined terms in certain standard contract forms. The contractor is responsible for ensuring all persons and employees are suitably skilled and instructed to complete the tasks.
- **Contractor's choice:** Selection delegated to the Contractor, but liability to remain with the specifier.
- **Contractor's design:** Design to be carried out or completed by the Contractor, supported by appropriate contractual arrangements, to correspond with specified requirements.
- **Cost:** The amount paid or given by one party to another in exchange for goods, work or services.
- **Designer:** A person carrying out design on a project.
- **Deviation:** Difference between a specified dimension or position and the actual dimension or position.
- **Employer:** The party to the Contract for whom the goods, work or services are provided. Includes Client (in consultancy contracts and CDM Regulations), the Employer, Building owner or Purchaser (in construction contracts), the Developer (in development agreements and funding agreements), or the 'Main' contractor in contractor/ subcontractor agreements - which may be defined terms in certain standard contract forms. The contractor is responsible for ensuring all persons and employees are suitably skilled and instructed to complete the tasks.
- **Estimate:** An approximate evaluation of either time or cost of part or the whole of a project.
- **Execute:** To complete a task fully and put into effect. To fix, apply, install or lay products securely, accurately, plumb and in alignment.
- **Fastener:** Device for mechanically attaching something to something else.
- **Manufacturer and Product reference:** Manufacturer - the body under whose name the particular product, component or system is marketed.
Product reference - the proprietary brand name and/ or reference by which the particular product, component or system is identified.

References are as specified in the manufacturer's technical literature current on the date specified.

- **Manufacturer's standard:** Where used in conjunction with a specified proprietary product, accessories to be those recommended by the product manufacturer.
- **Permanent Work:** Work to be constructed and completed in accordance with the Contract.
- **Price:** An indication of the amount required to be paid by one party to another in exchange for goods, work or services.
- **Product:** Material, both manufactured and naturally occurring, goods and accessories for permanent incorporation into the Works.
- **Requirements:** A description in outline or detailed form of the development, or a part of it, which one party requires another to design and/or build.
- **Schedule of rates:** The subdivision of product and execution prices by a pre-determined unit basis.
- **Schedule of Work:** The subdivision of work items by a pre-determined classification. Can form the basis of a pricing document where Bills of Quantities are not used.
- **Schematic:** A drawing of a system showing components, products, systems and their interconnections.
- **Site equipment:** The Contractor's apparatus, appliances, machinery, vehicles or things of whatsoever nature required in or about the construction for the execution and completion of the Works and the remedying of defects.
Includes Appliances, vehicles, consumables, tools, temporary work, scaffolding, cabins and other site facilities.
Excludes: Temporary work, Employer's products and equipment or anything intended to form or forming part of the permanent Works.
- **Specification:** Written description of requirements.
- **System:** Products, components, equipment, accessories, controls, supports and ancillary items, including installation, necessary for that section of the work to function.
- **Temporary work:** Incidental work to be undertaken during construction but not intended to form part of the completed work.

310 Activity terminology

- **Advise:** See 'Communicate'.
- **Agree:** See 'Communicate'.
- **Approve:** Record conformance of work to specified criteria by giving formal or official sanction.
- **Communicate:** Includes advise, inform, agree, confirm, notify, seek or obtain information, consent or instructions, or make arrangements.
- **Confirm:** See 'Communicate'.
- **Ease:** Adjust moving parts of designated products, systems or work to achieve free movement and good fit in open and closed positions.
- **Fix:** Receive, unload, handle, store, protect, place and fasten in position; dispose of waste and surplus packaging; to include labour, materials and site equipment for that purpose.

- **Give notice:** Communicate in writing to the person administering the Contract at the address listed therein.
 - **Inform:** See 'Communicate'.
 - **Keep for recycling:** As 'keep for use' but relates to a naturally occurring material rather than a manufactured product.
 - **Keep for reuse:** Do not damage designated products, systems or work. Clean off bedding and jointing materials. Stack neatly, adequately protect and store until required by the Employer or Purchaser, or for use in the Works as instructed.
 - **Make good:** Execute local remedial work to designated work. Make secure, sound and neat.
-
- **Match existing:** Provide products and work of the same appearance and features as the original, excluding ageing and weathering. Make joints between existing and new work as inconspicuous as possible.
 - **Notify:** See 'Communicate'.
 - **Quote:** Use 'Estimate'.
 - **Recycle:** Collect, sort, process and convert discarded or recovered components into raw materials for use in the creation of new products.
 - **Refix:** Fix previously removed products.
 - **Remove:** Disconnect, dismantle as necessary and take out the designated products or work, together with associated accessories, fixings, supports, linings and bedding materials. Dispose of unwanted materials.
Removal of a system includes this work.
 - **Remediate:** Action or measures taken to lessen, clean-up, remove or mitigate the existence of hazardous materials existing on a property; in accordance with standards, specifications or requirements as may be required by statutes, rules, regulations or specification.
 - **Repair:** Execute remedial work to designated products. Make secure, sound and neat. Excludes redecoration and replacement.
 - **Replace:** Supply and fix new products matching those removed. Execute work to match the original new state of that removed.
 - **Reuse:** Recover components to be fixed or used in the project or other buildings without the requirement for recycling.
 - **Submit:** Deliver an item in a specified format to a specified person within a specified timeframe.
 - **Submit proposals:** Submit information in response to specified requirements.
 - **Supply and fix:** Supply of products, components or systems to be fixed, together with their fixing.

00-05-20 Project participants

110 Project participants

- **Company:** Harley Haddow Consulting Engineers.
 - **Name:** Chris McLaren
 - **Address:** Vox Studio V305, 1-45 Durham Street, Vauxhall, London, SE11 5 JH
 - **Telephone number:** 0203 7355060
 - **Email address:** chris.mclaren@harleyhaddow.com
- **Title:** MEP Consulting Engineers

00-05-70 Project location

110 Project location

- **Details:** The Horniman Museum & Gardens.
- **Address:**
 - **Street:** 100 London Road
 - **City:** Forest Hill, London
 - **Post code:** SE23 3PQ

130 Existing buildings on, or adjacent to the site

- **Details:** The exiting chiller enclosure against the existing Aquarium section of the Museum.

150 Surrounding land and building uses

- **Surrounding land uses or activities:** Museum & Gardens

170 Access

- **Details:** Through the park, existing building and at rear of site. Access routes and permits to work to be agreed with the CA.
- **Limitations:** Walkway with chiller plant enclosure. Access restricted and the site should be visited to ensure a full understanding of the access/construction issues. Any issues created that could have been avoided by visiting the site shall not be valid reasons for delay or additional costs

00-10-70 Works Contract Content

135 The Contract work

- **Details:** The Contractor shall be responsible for the design, procurement, supply and construction of the enclosure building (as a CDP item) including the concrete plinth, painting wood treatment, DPM, locks, flashings etc. in fact everything required to give a complete building (refer to enclosure performance specification, design parameters and contract enclosure building drawings). The contractor shall employ a suitable professional Architect to carry out the design work. Note: Planning permission has been obtained for the design of the enclosure building as currently proposed. Therefore the contractors proposed enclosure building design shall closely follow the outline planning drawings in all ways to avoid the need to amend or resubmit the planning application. The contractor shall be responsible for adhering to any planning restrictions required under the planning permission. The contractor shall be responsible for obtaining a completion certificate at the end of the works from the local authority.
- The contractor shall also be responsible for the supply, procurement, installation, testing and commissioning of the mechanical, electrical, and public health (MEP) installations. They shall be responsible for completing and co-ordinating the outline design indicated on the MEP contract drawings.

The contractor shall be responsible for demolishing the existing enclosure, shutting down and draining the existing chilled water system, cutting back the existing chilled water pipework to suit the new installation, temporary works to maintain the chilled water system in operation during the works, disconnection and removal of the redundant chiller, removal of redundant supports brackets, supports etc., disposal of the demolition material, disposal of the removed pipework, insulation, brackets, supports etc. disposal of the existing cooling fluid. All disposals shall be via an approved and certified disposal company.

The temporary chiller pipework to allow the existing chiller to run during the works shall be arranged so that the pipework is run to avoid blocking the final chilled water installation and has suitable valves to allow the final chilled water installation to be connected to the existing system in the building and the new pipework within the building enclosure without having to shut down the chilled water for an extended period.

The contractor shall be responsible for protecting the remaining existing chiller, controls and electrical systems ensuring that they are protected from physical damage water ingress and condensation etc. while the demolition and new construction/installation takes place. A temporary electrical/controls arrangement shall be required.

Any shut down of the chilled water due to temporary pipework alterations, power or control alterations, demolitions or construction shall be limited to a short period (hours). The exact

period will depend on external temperatures etc. and shall be determined with the Employer at the time of the shutdown.

The Contractors will be bound to the conditions set out within the contract preliminaries, those stated within the contract documentation stated above and this specification.

The contract shall be on a lump sum basis and accordingly shall not be subject to re-measurement.

The contract price shall include everything necessary for all design, design development to allow a fully integrated installation on site including (but not restricted to); co-ordination, installation, supervision, services, operations, materials, consumables, labour and plant necessary for and incidental to the proper construction, completion, testing, commissioning and adjustment of the Works to the satisfaction of the CA and in accordance with the conditions of contract, the specifications and the drawings.

The tender drawings primarily describe the "design intent" of the Works, the working principles of the systems, general arrangements, principles of services co-ordination and the intended methods of installation. The Contractor shall be fully responsible for the complete development and co-ordination of the design intent to installation on site.

The drawings are accordingly part diagrammatic with runs of piping, ducts, cable, containment and the like being shown to small scale and not necessarily indicating exact installation positions.

TENDER MEP BIM MODEL (If provided as part of this Tender) & DRAWING DEFINITION;

TECHNICAL DESIGN DRAWING/MODEL

The BIM model (if provided) and 2D CAD drawings, which forms part of this tender shall be provided to the standards set out in BSRIA BG6/2014 Pro-forma 4A. The model/drawings shall indicate the detailed MEP design, with locations of main plant items, pipes, ducts and cables using generic objects in positions that are feasible for the contractor and sub-contractor to price and install without major re-routing. The drawings/model will not indicate the precise position of the services/plant, but it shall be feasible to install the services within the general routes indicated. It will be possible for the contractor and sub-contractor to produce co-ordinated working drawings and/or installation drawings without major re-routing of the services.

The drawings shall also provide sufficient information:

- o Allow the completion of the Enclosure and MEP services design from the design intent drawings.
- o To facilitate the preparation of an estimate and tender

- o To enable all other participants to appreciate the inter-relation of the works with other disciplines
- o When read in conjunction with the architectural and structural engineering drawings to enable the preparation of the final or supplementary builder's work information, co-ordination, installation and shop drawings incorporating manufacturing drawings and final details of specified or selected plant and equipment.

The drawings indicate structure, equipment, pipework, ductwork, cable tray routes and trunking, in sufficient detail to show how all the building and engineering services can generally be accommodated and coordinated with each other. These drawings are provided for information purposes only. The installer shall be responsible for all detailed co-ordination of the building and the building services.

The drawings will not necessarily show dimensions required to construct the works nor will they accurately locate every item of equipment or plant ancillary which does not influence the visual impact of the completed works. The decision of the CA as to what has a visual impact shall be, shall be final.

Confirm mounting heights with the CA once the design is progressed. All elevation and setting out drawings will be provided by the Contractor.

Co-ordination drawings do not detail the building fabric or structure whether new or existing nor are they based on survey drawings or installation drawings of any other party or consultant.

Obtain all information required to produce the co-ordination and installation drawings or requirements at no cost.

Where it is necessary to survey an existing building or existing structure or services within that building to prepare coordinated installation and shop drawings undertake responsibility for obtaining that information. The cost of obtaining that information must be included in the contract price.

Plant and equipment is shown based upon the manufacturers' catalogue information and is subject to verification or revision when manufacturers' drawings are available.

Interpret the design intent of the tender drawings and reflect same in the co-ordination and installation drawings subject to the comments of the CA. Where differences occur between the tender and the co-ordination and installation drawings these differences shall be deemed to be included in the contract price for the Works and no additional cost shall be allowed due to any variation in layout, arrangement or detail unless the deviation is specifically covered by an CA Instruction before the production of the drawings.

The Contractor shall be responsible for handing over a complete coordinated installation that is commissioned and snag free, with a complete set of approved operation and maintenance manuals.

The Contractor shall supply, install and satisfactorily test and commission the said services, and to provide full documentation comprising operating, maintenance instructions and record information and building log book to facilitate the successful management, operation and running of the new MEP Engineering Services all as set out herein and shown on the tender/contract drawings and Revit model.

All works executed under this contract shall be carried out in strict accordance with BS7671 17th Edition and any subsequent amendments, current Building Regulations, Planning requirements and to the complete satisfaction of the Architect /Engineer.

All plant, equipment and materials shall be sourced from local suppliers and manufacturers, where possible, without compromising quality, service or maintainability of the final installation. All materials must meet the relevant standards for each item as identified in the project and contract documentation.

All plant equipment and materials shall be ethically sourced preferably from EU countries with particular care taken regarding obtaining the same products and services from other commercial markets.

The Contractor must obtain written approval from the Contract Administrator (CA) before deviating from the preferred manufacturers specified herein or other sections of the specification or contract documentation.

The tender drawings and specification for the Construction and MEP services comprise full details of the construction, systems to be installed, tested and commissioned comprising of but not limited to:-

Construction of the enclosure building, structure, roofing, flashings, doors, locks, supports, foundations, water proofing, painting, insulation, vapour barriers, all accessories etc shall be carried out to the requirements of the construction drawings to provide a complete enclosure building.

Heating, Ventilation, Chilled water, Cold Water Services, Drainage, General Power, Lighting, Fire Alarm/ Voice Evacuation, Intruder Alarm, CCTV, accessible call systems, voice/data, wiring to mechanical services, external lighting.

The electrical contractor shall allow for all new circuits as shown on the distribution schematic supplied in conjunction with this document and allow for all accessory boxes and terminations they require.

The electrical contractor is responsible for coordinating with the mechanical contractor to ensure all power supplies are captured for the project. The electrical contractor shall request a detailed schedule of required supplies at tender for inclusion in the electrical tender submission.

The electrical contractor is responsible for coordinating with all sub-contractors or specialist sub-contractors to ensure all power supplies are captured for the project. The electrical contractor shall request a detailed schedule of required supplies at tender for inclusion in the electrical tender submission.

The Contractor shall be deemed to have carefully examined this specification, tender documents and tender drawings. Any inconsistencies within the tender documents, specification and drawing shall be clarified with the CA during the tender period and confirmed in writing.

Where quotations have been sought and incorporated into this specification it shall be the responsibility of the Contractor to check that the quantities correspond with the specification and drawings. Subsequent claims on the basis of inconsistencies within the tender documentation will not be accepted.

300 Provisional sum for defined work

- **Details:** Refer to Contract preliminaries

310 Provisional sum for undefined work

- **Details:** Refer to Contract preliminaries

320 Prime Cost sum

- **Details:** Refer to Contract preliminaries

00-20-70 Works contract

CONTRACT

- **The Contract:** Refer to contract preliminaries for contract details.
- **Requirement:** Allow for the obligations, liabilities and services described.
 - **Date for Commencement:** Refer to the contract preliminaries.
 - **Date for Completion:** Refer to the contract preliminaries.
 - **Amendments to clauses:** Refer to the contract preliminaries.
 - **Additional clauses:** Refer to the contract preliminaries.

00-30-70 Works Contract Procurement

110 Compliance with Tender rules

- **Compliance:** Tendering Contractors must price specification, drawings and equipment as specified within the tender documentation. Any proposed alternatives must form a cost saving option. With full justification and technical details to be passed to the Engineer for appraisal. Failure to comply will result in Tenders being rejected.
- **Costs:** No liability is accepted for costs incurred in the preparation of a Tender.

120 Preliminary Enquiry

- **Details:** The Tenderer shall acknowledge receipt of the tender documentation and confirm that they are able to submit a tender in accordance with the instructions to tender within 2 working days from receipt.

135 Instructions

- **Execution: Exclusions**

If the Tenderer cannot tender for any part(s) of the work defined in the tender documentation written notification must be made to the office of issue of the tender documents, stating the relevant part(s) and the reasons for their inability to tender.

Acceptance of instructions

The submission of a tender will denote the tenderer's acceptance of an undertaking to comply with all the clauses contained in the tender documentation.

Liability to tenderers

The Employer will not be responsible for or pay any expenses or losses which may be incurred by any Tenderer in the preparation of his tender, neither does he undertake to accept the lowest or any tender.

Checking Documents

The Tenderer is required to check the tender documentation for obvious errors and missing pages. Should any such errors or omissions be discovered he must inform the office issuing the documents at once in writing in order that a correction may be issued and all Tenderers advised before the date for submission of the tender.

Unqualified Tenders

Other than as part of an alternative offer as described elsewhere, no account will be taken of any qualification or standard or special conditions that a Tenderer may impose on his tender and any tender which contains such additional conditions may be rejected by the Employer.

Named Suppliers

In certain cases, manufacturers of equipment are mentioned in the Specification. The tender shall be based on all named manufacturers. Nevertheless, the Contractor will be held responsible for ensuring that the equipment will give the performance specified.

Other "equal and approved" shall mean by approval of the Client/Lead designers and alternatives shall only be considered prior to submission of Tender, when they have been submitted and approved in writing.

Alternative equipment, specialists or methods of carrying out the works in addition to those described in the tender documents may be submitted. Alternative offers shall be indicated on the appropriate document and include:

- Details of the alternative equipment, specialist or method proposed.
- Full technical data for each such alternative together with details of any consequential amendments to the design and/or other parts of the works. Demonstrate compliance with any stated British (or other equivalent recognised International) Standards.
- A detailed breakdown of any omissions or additions to the basic tender sum indicated on the appropriate document.
- The impact of all proposed alternative equipment or materials on Section 6 compliance including:
 - The CO2 Target Emissions Rate.
 - The final 'as constructed' CO2 Buildings Emissions Rate.

The Contractor must confirm equivalence in quality, operation and space requirements to those items which have been specified by name. Demonstrate the proposed alternative is fully equivalent to the specified item and identify any constructional, cost, programme, maintenance or other differences.

The Contractor must include for all necessary measures to ensure alternative manufacturer's equipment and the total installation is equivalent to that specified.

The Tenderer shall include the costs necessary for re-sizing and reselection of associated equipment (including pipework, ductwork and cable sizes) resulting from the proposed alternative together with all resulting design and coordination.

Alternative offers will only be considered if accompanied by a compliant tender. Additional costs resulting from non-compliance with the above will not be accepted. All alternatives must be declared during the tender process. No alternatives will be accepted following agreement of the Tender proposals.

For full instruction to alternatives please refer to "Works Contract Verifications".

Privacy of information

All details contained in these tender documents shall be treated as private and confidential.

Accuracy of quantities

Attention is drawn to the clause headed "tender drawings" of the General Conditions, as relates to the function of the drawings issued as part of the tender documents. The tenderer is required

to supplement the information contained on the drawings in such a manner as he shall consider appropriate and as normal custom and practice in order that the quantified schedule of rates produced by him and forming the basis of his tender, shall constitute an accurate and comprehensive representation of the various items which together form the contract works. No claim for additional monies, or for extension of time, will be allowed due to any failure on the part of the tenderer to recognise the diagrammatic and preliminary nature of the drawings and to make due allowance in his tender accordingly.

Interpretation of the specification

Should the tenderer be in doubt about the precise meaning of any item or figure for any reason whatsoever, he must inform the office of issue of the tender documents in writing in order that the correct meaning may be given no more than 7 working days before the date for submission of tenders.

Any clarification of the meaning or intent shall be issued in writing only and no other means of communication shall be valid. All Tenderers will be notified of any such explanation.

No liability will be admitted, nor claim allowed, in respect of errors in a tender due to mistakes that should have been rectified in the manner described above.

Schedule of rates

Prior to the acceptance of any tender the Tenderer shall prepare and submit at no extra cost a quantified schedule of rates showing how the tender sum has been calculated. The schedule of rates shall be fully priced to agree with the tender sum. Each item is to be priced to include the cost of the item, fixing, overheads and profit.

A schedule of rates must be submitted with the tender.

Further information

Subsequent to the submission of a detailed schedule of rates and prior to the award of the Contract, the Tenderer may be called upon to provide further information used in the pricing of their tender that may reasonably be required to enable a proper assessment to be made thereof.

Such information may include the inspection of the manufacturers' quotations, labour and material prime costs and verification of percentage additions covering overheads, profit, fixed price allowance and the like.

In the event of a lump sum or sums being inserted the Tenderer will be required to provide a detailed breakdown of the amount so included.

Programme

The Tenderer shall submit with their tender a programme or a summary thereof indicating the sequence and timing of the principal parts of the works including periods for planning, design, procurement, installation and commissioning.

Operating procedure statements

The following operating procedure statements must be submitted with the Tender in addition to those stated elsewhere:

- Management procedures to be adopted for the project
- Commissioning and testing management
- Managing and resourcing of design duties and responsibilities including design capability
- Quality control management and procedures
- Statement describing any significant and unavoidable risks associated with executing the works

Tender pricing document

The Tenderer shall complete all sections of the tender pricing document in full. Items identified on the tender summary shall not have their cost element included within other items. Items described in the pricing document are abbreviated for the purpose of the schedule. The Tenderer is to make full allowance for all works associated with the installation of a particular element.

Items entered in the pricing document shall be deemed to include all costs involved in carrying out the Works, but the Tenderer where required must identify separately the cost of all items specifically described under preliminaries.

Provisional items will be adjusted at the final agreed rates when information is issued in respect of these items.

Procurement of materials

The Tenderer shall allow for the procurement of materials and equipment from suppliers at such time, and in such a manner as may be necessary to allow for the completion of the Works in accordance with the contract programme.

The Tenderer shall clearly state in the tender return any foreseen difficulties with delivery periods for the selected equipment.

No additional costs resulting from non-compliance will be accepted.

Alternatives

Tenderers may submit alternative equipment or methods of carrying out the works in addition to those described in the tender documents. Alternative offers shall include the salient features of the equipment or method proposed together with a detailed breakdown of any omissions or additions to the basic tender sum and all shall be indicated on the appropriate document.

Full technical data for each such alternative must be submitted together with details of any consequential amendments to the design and/or other parts of the works. Alternatives that involve significant changes to other work may not be considered.

Where an alternative manufacturer's equipment is offered the Tenderer shall include for all necessary measures to make the equipment and the total installation equivalent to that specified.

The Tenderer shall include the necessary resizing and reselection of associated equipment (including systems controls, pipework, ductwork and cable sizes) resulting from the proposed alternative together with all necessary design and coordination.

Additional costs resulting from non-compliance with the above will not be accepted.

Alternative offers will only be considered if accompanied by a compliant tender and a significant benefit/cost saving to the project.

All alternatives must be declared during the tender process. No alternatives will be accepted following agreement of the Tender proposals.

For full instruction to alternatives please refer to "Works Contract Verifications".

Privacy of information

All details contained in these tender documents shall be treated as private and confidential.

Accuracy of quantities

Attention is drawn to the clause headed "tender drawings" of the General Conditions, as relates to the function of the drawings issued as part of the tender documents.

The tenderer is required to supplement the information contained on the drawings in such a manner as he shall consider appropriate and as normal custom and practice in order that the quantified schedule of rates produced by him and forming the basis of his tender, shall constitute an accurate and comprehensive representation of the various items which together form the contract works.

No claim for additional monies, or for extension of time, will be allowed due to any failure on the part of the tenderer to recognise the diagrammatic and preliminary nature of the drawings and to make due allowance in his tender accordingly.

Interpretation of the specification

Should the tenderer be in doubt about the precise meaning of any item or figure for any reason whatsoever, he must inform the office of issue of the tender documents in writing in order that the correct meaning may be given no more than 7 working days before the date for submission of tenders.

Any clarification of the meaning or intent shall be issued in writing only and no other means of communication shall be valid. All Tenderers will be notified of any such explanation.

No liability will be admitted, nor claim allowed, in respect of errors in a tender due to mistakes that should have been rectified in the manner described above.

Schedule of rates

Prior to the acceptance of any tender the Tenderer shall prepare and submit at no extra cost a quantified schedule of rates showing how the tender sum has been calculated.

The schedule of rates shall be fully priced to agree with the tender sum. Each item is to be priced to include the cost of the item, fixing, overheads and profit.

A schedule of rates must be submitted with the tender.

Further information

Subsequent to the submission of a detailed schedule of rates and prior to the award of the Contract, the Tenderer may be called upon to provide further information used in the pricing of their tender that may reasonably be required to enable a proper assessment to be made thereof.

Such information may include the inspection of the manufacturers' quotations, labour and material prime costs and verification of percentage additions covering overheads, profit, fixed price allowance and the like.

In the event of a lump sum or sums being inserted the Tenderer will be required to provide a detailed breakdown of the amount so included.

Programme

The Tenderer shall submit with their tender a programme or a summary thereof indicating the sequence and timing of the principal parts of the works including periods for planning, design, procurement, installation and commissioning.

Operating procedure statements

The following operating procedure statements must be submitted with the Tender in addition to those stated elsewhere:

- o Management procedures to be adopted for the project
- o Commissioning and testing management
- o Managing and resourcing of design duties and responsibilities including design capability
- o Quality control management and procedures
- o Statement describing any significant and unavoidable risks associated with executing the works

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The Tenderer shall complete all sections of the tender pricing document in full. Items identified on the tender summary shall not have their cost element included within other items. Items described in the pricing document are abbreviated for the purpose of the schedule. The Tenderer is to make full allowance for all works associated with the installation of a particular element.

Items entered in the pricing document shall be deemed to include all costs involved in carrying out the Works, but the Tenderer where required must identify separately the cost of all items specifically described under preliminaries.

Provisional items will be adjusted at the final agreed rates when information is issued in respect of these items.

Procurement of materials

The Tenderer shall allow for the procurement of materials and equipment from suppliers at such time, and in such a manner as may be necessary to allow for the completion of the Works in accordance with the contract programme.

The Tenderer shall clearly state in the tender return any foreseen difficulties with delivery periods for the selected equipment.

No additional costs resulting from non-compliance will be accepted.

150 Tender Programme

- **Details:** Refer to Contract Preliminaries for details.

165 Tender acceptance

- **Tender acceptance period:** Refer to Contract Preliminaries for details.

170 The Tender documents

- **The Tender documents:** As stated within the project Preliminaries.
- **Number of hardcopy documents provided:** 1 No. Any additional copies are at the expense of the contractor.

180 Tender queries

- **Notification requirements:** Refer the contract preliminaries

190 Tender instructions

- **Qualifications:** No alterations or erasures to the text of any part of the tender documentation shall be permitted.
Any tender containing such alterations or erasures may be rejected.
- **Confidentiality:** Do not reveal details of parts of the Tender or supporting documents (except for the necessary purposes of preparing that Tender) without the Employer's express written permission.

210 Pricing

- **Pricing:** Price and extend each item individually as instructed. Do not group items together.
- **Currency:** Pounds sterling.

220 Site visit

- **Nature of the site:** On receipt of the tender documentation the tenderer is advised to inspect the site and any existing installations relevant to the works and to study any relevant existing record drawings.

Ascertain before Tendering, including access thereto and local conditions and restrictions likely to affect the execution of the Work.

No claims will be allowed after submission of a tender for lack of information or other reasons which could have been resolved by such a visit to the site. Arrangements for the visit must be made through the office issuing the tender documents and with prior agreement.

- **Arrangements for visit:** Via Contact detailed with the contract documentation.

230 Return of Tender

- **Return of Tender:**
 - **Destination:** As detailed within the contract Preliminaries.
- **Inability to tender:** Advise immediately if the work as defined in the Tender documents cannot be tendered.
Define those parts, stating reasons for the inability to tender.

320 Error resolution

- **Arithmetical errors:** Tender price will prevail. An opportunity will be given to confirm the Tender or withdraw.
- **Technical errors:** The Tender is deemed to meet or exceed the requirements of the Tender documents. Amendment of the Tender to reflect this will not constitute a variation and no claim for additional costs will be accepted.
- **Corrections:** An endorsement will be added to the priced documents indicating that rates or prices (excluding preliminaries, contingencies, Prime cost and Provisional sums) inserted therein will be adjusted in the same proportion as the corrected total differs from that stated incorrectly.

340 Post-Tender negotiations

- **Negotiations:** Will be required.

410 Notification to Tenderers

- **Notification method:** Via the CA..

00-40-70 Works Contract Establishment

ACCESS

110 Access to the site

- **Details:** Refer to Contract Preliminaries.
- **Limitations:** Refer to Contract Preliminaries.

150 Storage, accommodation, mechanical plant, temporary works and services

- **Position:** Refer to Contract Preliminaries.
- **Maintenance:** Alter, adapt and move as necessary. Remove when no longer required and make good.

GENERAL INFORMATION

195 Environmental targets

- **BREEAM targets:**
 - **CO2 or energy arising from site activities:** Refer to Contract Documents.
 - **CO2 or energy arising from transport to and from site:** Refer to Contract Documents.
 - **Water consumption arising from site activities:** Refer to Contract Documents.
 - **Air (dust) pollution arising from the site:** Refer to Contract Documents.
 - **Water (ground and surface) pollution occurring on the site:** Refer to Contract Documents.
 - **Site timber:** Refer to Contract Documents.
- **Monitoring:** Check progress against each target as the work proceeds.

220 Constructing Better Health Scheme

- **Membership:** Register and provide evidence of registration
- **Address:** Constructing Better Health, B&CE Building, Manor Royal
Crawley, West Sussex
RH10 9QP
Tel: 0845 873 7726
Email: info@cbhscheme.co.uk
Website: www.cbhscheme.co.uk
- **Submittal date:** With Tender

PROGRAMME

280 Start of work on site

- **Notice:** Before the proposed date for start of work on site give minimum notice of two weeks.

HEALTH AND SAFETY INFORMATION

310 Health and Safety statement

- **Content:** The Tenderer shall submit a statement with the tender describing any significant and unavoidable risks that they consider might arise as a result of executing the works.

The Tenderer shall also submit with the tender (for the attention of the CDM Coordinator and/or the Principal Contractor) measures considered necessary to safeguard the operatives and of any person who may be affected by the contract works.

The Tenderer shall also include with the tender (bound as a separate document for onward issue to the CDM Coordinator):

- A copy of the company's health and safety policy document including risk assessment procedures
- Accident records for the last five years
- Details of any Health and Safety Executive enforcement action
- Details of staff responsible for health and safety on this project with details of their qualifications and duties
- **Submittal date:** Within one week of request.

330 Health and safety hazards

- **Potential hazards to be considered:** Refer to the Design Team Risk register and risk assessments.
- **Limitations:** The nature and condition of the site and/ or building cannot be fully ascertained before it is opened up.
- **Information:** The accuracy and sufficiency of this information is not guaranteed by the Employer or the Employer's representative. Ascertain if additional information is required to ensure the safety of all persons and the Works.
- **Site staff:** Draw to the attention of personnel working on the site the nature of possible contamination and the need to take appropriate precautionary measures.

340 Preconstruction information

- **Availability:** Integral with the project specification, including but not restricted to the following:
Description of project.
Client's consideration and management requirements.
Environmental restrictions and on-site risks.
Significant design and construction hazards.
The Health and Safety File.

350 Execution hazards

- **Common hazards:** Not listed. Control by good management and site practice.
- **Significant hazards:** Refer to the project Risk Register or individual risk assessments.

- **Hazard:** Refer to the project Risk Register or individual risk assessments.
- **Precautions assumed:** Works carried out by a competent contractor in line with HSE and CDM requirements.

360 Product hazards

- **Hazardous substances:** Site personnel levels must not exceed occupational exposure standards and maximum exposure limits stated in the current version of HSE document EH40: [Guidance Notes: Environmental Hygiene \(EH\): Workplace exposure limits. Containing the list of workplace exposure limits for use with the Control of Substances Hazardous to Health Regulations 2002 \(as amended\)](#).
- **Common hazards:** Not listed. Control by good management and site practice.
- **Significant hazards:** Refer to the Design Team Risk register and risk assessments.

MANAGEMENT AND STAFF

400 Management and staff – Contract minimum requirement

- **Details:** Allow for compliance with contract obligations.

The Tenderer shall submit with their tender a line management diagram starting at the site supervisors and rising through the management levels. Relevant names and addresses shall be shown on the diagram.

The Tenderer shall set out details of their management team and the commitment to the project.

The Tenderer shall submit with their tender the curriculum vitae and references for each of the key personnel that will be used on the project. Curricula vitae, qualifications, recent project experience and definition of the person's role in the contract shall be clearly stated.

Details shall be provided for both the site and office based teams

- **Cost significant items:** Project Specific management and staff.
Visiting management and staff.
Extraordinary support costs.
Staff travel.

410 Management and Staff – Full Time Services Co-ordinator

- **Dedicated staff role:** The **contractor** shall allow for the employment of a suitably qualified and experienced engineering Services Co-ordinator who will ensure compliance with the contract drawings, specification and programme.

The Services Co-ordinator must be a qualified Electrical or Mechanical Services Engineer and have at least ten years working experience in Building Services Installations including on-site

installations works, and he must be able to communicate at all levels from Site Operatives to Consultant.

The service co-ordinator shall be employed (full-time) during the mechanical and electrical works.

The service Co-ordinator must be fully competent in both mechanical and electrical installations.

The Services Co-ordinator shall provide at least the following duties:-

- o Carry out regular inspections to ensure compliance with the Contract Specification & good workmanship and shall provide programmes of works to rectify any defects or items of noncompliance.

- o Prepare defects lists for all Engineering Services Works and shall ensure any & all defects are addressed quickly and to the required standard.

- o Attend the project Pre-Start Meeting providing a programme of anticipated critical path inspections to be carried out. Notwithstanding the aforementioned these inspections shall be undertaken at regular intervals, not exceeding one working week.

- o Identify areas of non-compliance or defects as the works progress to ensure a quality installation is provided within the projects programme.

- o All installations offered up for inspection must be substantially complete. The Design Consultants will not prepare extensive defects lists. If significant defects exist the Contractor will be asked to correct defects and re-offer the systems for inspection when defects are substantially complete. All M&E installations shall be snagged and signed off by the Services Coordinator prior to them being offered to the design team for inspection.

- o Co-ordinate and progress timeously the various items of builders work relative to Mechanical, Electrical and other Specialist Services installations, particularly the properly dimensioned positions of all holes to be cut or provided. This shall involve the procurement of Sub-Contractors Builders work Drawings detailing all services builders work requirements for approval by the Architect/Engineer.

- o Co-ordinate the execution of all Services Installations and ensure that information is timeously exchanged with the various Services Sub-Contractors and Direct Works Contractors to maintain progress in accordance with the programme and to ensure all installations are commissioned at the proper time and to the full satisfaction of the Architect / Engineer.

- o Ensure that each Engineering Service Sub-Contractor is provided with all relevant Contract Drawings to ensure that the services are set out to take into account building configuration, adjacent services and any particular Architectural requirements.
- o Identify and report any conflict in the positioning between Engineering Services or with the structure.
- o Ensure that services work carried out in common voids are carried out in a correctly sequenced manner to ensure compliance with programme, phasing and design requirements.
- o Check the services ceiling/floor voids, specifically to ascertain if structural tolerances have been exceeded, which may reduce services voids accordingly, and in such instances to take on-site dimensions and advise the Design Team of proposed corrective action to maintain the original floor/ceiling heights.
- o Timeously advise the Design Team of future access requirements to switches, void detectors, drain points, air points and other manual devices.
- o Monitor the progress of all Engineering Services Sub-Contractors Production / Working Drawings. The Co-ordinator shall ensure that suitable procedures are in place to ensure these Production Drawings are co-ordinated. Prior to information being forwarded for approval the Services Coordinator should satisfy himself that suitable information is provided, this information has been properly co-ordinated and this information is issued timeously.
- o Renew the subcontractor's RFI's/TQ's and action accordingly. Any non relevant or site co-ordination type query should be dealt with by the Services Coordinator with suitable correspondence issued to the Design Team confirming action.
- o Convene Services Sub-Contractors Meetings and review the progress of all Sub-Trades and identify critical action items. The meetings should be recorded with minutes issued to the design team timeously.
- o Procure from the Commissioning specialist a logic diagram and full commissioning method statement at an early stage to ensure that sufficient time is made available for commissioning the systems prior to Practical Completion.
- o Provide a schedule of dates and time of all tests, commissioning, etc to be witnessed by the Employer's Agent.
- o Be responsible for ensuring record As-Built Drawings and the Operating and Maintenance Manuals are produced timeously and of a suitable standard for comment.

o Ensure that the Operating and Maintenance Manuals for each discipline follow the same general format and together provide a "site specific" set of documents.

440 Temporary Accommodation - use and location

- **Restrictions:**
 - **Positioning:** Refer to the contract preliminaries
 - **Timing:** Refer to the contract preliminaries

TEMPORARY SERVICES

500 Temporary Services – contract minimum requirement

- **Details:** Allow for compliance with Contract obligations.
- **Cost significant items:** Temporary water supply.
Temporary electric supply.
Temporary telecommunication systems.
Temporary drainage.

510 Water

- **Supply:** Refer to the contract preliminaries for confirmation of site power requirements
- **Metering:** If applicable the the meter shall be installed by the the Contractor and charged to the Contractor.
- **Continuity:** No liability will be accepted for the consequences of failure or restriction in supply.

540 Lighting and power

- **Supply:** Refer to the contract preliminaries for confirmation of site power requirements
- **Metering:** If applicable the meter shall be installed by the Contractor and charged to the Contractor.
- **Continuity:** No liability will be accepted for the consequences of failure or restriction in supply.

590 Meter readings

- **Charges for service supplies:** Where to be apportioned ensure that:
Meter readings are taken by relevant authority at possession and/ or completion as appropriate.
Copies of readings are supplied to interested parties.

00-50-70 Works Contract Management

GENERALLY

SUPERVISION, COOPERATION AND COORDINATION

130 Supervision

- **Requirement:** The whole of the contract work and any significant parts must be under the close control of competent trade supervisors to ensure maintenance of satisfactory quality, progress and coordination.
- **Evidence:** Submit, including details of the person proposed; their relevant skills, training and knowledge; practical experience; qualifications; membership or registration with professional bodies; employment history; work related assessments and management structure.
- **Submittal date:** Two weeks before start on site.
- **Replacement of supervisory personnel:** Give maximum possible notice before changing supervisory personnel.

PROGRESS

170 Contractor's progress report

- **General:** Ensure the Works programme is maintained up to date and redraft, without delay, in any circumstance arise that affect the progress of the Works and submit to the CA.

Provide progress reports to the CA every 2 weeks in addition to any other information required under the contract conditions.

Record progress of the Works weekly on a copy of the programme.

Maintain a set of the latest drawings, which shall form the basis for the record drawings, marked up as the works progresses. These shall be available for inspection by the CA at any time.

If at any time the execution of the Works falls behind the contract programme formulate corrective measures and notify the CA of these intended measures prior to their being adopted.

- **Requirement:** The report must include the following.
- **Content:**
 - Date of order and delivery of all major plant and equipment.
 - Materials and equipment on site or installed.
 - Site labour employed.
 - Activity breakdown indicating target percent progress and actual percent progress for each activity monitored against the contract programme.
 - Latest schedule of information required indicating required / received dates and highlighting critical path items.
 - Status of utility services with connection dates for each service.

- Latest progress indicated on a copy of the programme. The programme shall include a base line activity bar for each activity and a separate progress bar to each activity bar
- Any proposed alteration to the programme. Alterations shall be identified clearly prior to the activities being undertaken and shall be in accordance with the contract.
- Copies of snagging/defects lists verifying that inspections are being undertaken.
- **Progress statement:** Detailing matters materially affecting the regular progress of the Works including suppliers' progress reports.
 - **Information:** Requirements for further drawings or details or instructions to fulfil obligations under the Conditions of Contract.

OPERATION

200 Employer's representatives inspections

- **Access:** Provide at reasonable times.
- **Inspections:** Agree dates and times several days in advance, to enable affected parties to be present.
- **Safety:** Submit details in advance of safety provisions and procedures (including those relating to materials, which may be deleterious), which will require compliance of the Employer and Employer's representatives when visiting the site.
- **Provide:** Protective clothing and/ or equipment site for the Employer, the Employer's representatives and other visitors to the site.

210 Removal or replacement of existing work

- **Extent and location:** Agree before commencement.
- **Execution:** Carry out in ways that minimize the extent of work.

230 Measurement

- **Covered work:** Give notice before covering work required to be measured or inspected for quality

290 Occupied premises

- **Extent:** Existing buildings will be occupied and/ or used during the Contract.
- **Details:** The buildings around the site will be occupied during the contract.
- **Works:** Carry out without undue inconvenience and nuisance and without danger to occupants and users.
- **Overtime:** If compliance with this clause requires certain operations to be carried out during overtime, and such overtime is not required for any other reason, the extra cost will be paid to the Contractor, provided that such overtime is authorized in advance.

300 Access control

- **Authorized persons:** Submit a list of the names of persons requiring access together with other related information reasonably required.
- **Return of equipment:** On request or on completion of the work to which it relates.

310 Occupier's rules and regulations

- **Occupier's rules and regulations:** Comply

PROTECTION FROM

410 Fuel, lubricants and hydraulic fluids

- **Restrictions:**
 - **Storing, handling and refuelling:** On hard standing or other approved areas. Keep away from watercourses, drains, soil, planting and grassed areas.
 - **Vehicles and equipment:** Prevent leakage or spillage. If it occurs, inform immediately and take emergency action.

430 Nuisance

- **Duty:** Prevent nuisance from smoke, dust, rubbish, vermin and other causes.
- **Surface water:** Prevent hazardous build-up on site, in excavations and to surrounding areas and roads.

440 Asbestos containing materials

- **Requirement:** Report immediately suspected materials discovered during execution of the Works. Do not disturb and agree methods for safe removal or encapsulation.

445 Antiquities

- **Requirement:** Report immediately fossils, antiquities and other objects of interest or value discovered during execution of the Works.
- **Preservation:** Keep objects in the exact position and condition in which they were found.

450 Fire prevention

- **Requirement:** Prevent personal injury or death, and damage to the Works or other property from fire.
- **Standard:** Comply with 'Fire prevention on construction sites' - the joint code of practice on the protection from fire of construction sites and buildings undergoing renovation.

460 Smoking on site

- **Smoking on site:** Not permitted.

480 Moisture

- **Wetness or dampness:** Prevent, where this may cause damage to the Works.
- **Drying out:** Control humidity and the application of heat to prevent:
 - Blistering and failure of adhesion.
 - Damage due to trapped moisture.
 - Excessive movement.

500 Infected timber and contaminated materials

- **Removal:** Where instructed to remove material affected by fungal and/or insect attack from the building, minimize the risk of infecting other parts of the building.
- **Testing:** Carry out and keep records of appropriate tests to demonstrate that hazards presented by concentrations of airborne particles, toxins and other micro-organisms are within acceptable levels.

510 Waste

- **Includes:** Rubbish, debris, spoil, containers and surplus material.
- **Requirement:** Keep the site and Works clean and tidy. Remove rubbish, dirt and residues before closing voids and cavities in the construction.
- **Waste:** Remove frequently and dispose off site in a safe and competent manner as approved and directed by the Waste Regulation Authority.
- **Recyclable material:** Sort and dispose at a Materials Recycling Facility approved by the Waste Regulation Authority.
- **Documentation:** Retain waste transfer documentation on site.

520 Electromagnetic interference

- **Duty:** Prevent excessive electromagnetic disturbance to apparatus outside the site.

540 Power actuated fixing systems

- **Use:** Not permitted.

550 Invasive species

- **General:** Prevent the introduction or spread of species (e.g. plants or animals) that may adversely affect the site and the Works economically, environmentally or ecologically.
- **Requirement:** Report immediately suspected invasive species discovered during execution of the Works. Do not disturb and agree methods for safe eradication or encapsulation.

PROTECTION OF

630 Existing features

- **Protection:** Prevent damage to existing buildings, fences, gates, walls, roads, paved areas and other site features, which are to remain in position during execution of the Works.

640 Existing work

- **Protection:** Prevent damage to existing work, structures or other property during the execution of the Works.
- **Removal:** Minimum amount necessary.
- **Replacement work:** To match existing.

690 Protection of subcontract work

- **Protection:** Check regularly.

METHOD AND SEQUENCE

750 Existing structures

- **Duty:** Check proposed methods of work for effects on adjacent structures inside and outside the site boundary.
- **Supports:**
 - **Standards:** In accordance with [BS 5975](#) and [BS EN 12812](#).
 - **Requirements:** Provide and maintain incidental shoring, strutting, needling and other supports as may be necessary to preserve stability of existing structures on the site or adjoining, which may be endangered or affected by the Works.
Do not remove until new work is strong enough to support existing structure.
Prevent overstressing of completed work when removing supports.
- **Adjacent structures:** Monitor and immediately report excessive movement.

760 Materials for recycling or reuse

- **Duty:** Sort and prevent damage to stated products or materials, clean off bedding and jointing materials and other contaminants.
- **Storage:** Stack neatly and protect until required by the Employer or for use in the Works as instructed.

780 Use or disposal of materials

- **Specific limitations:** Refer to Contract Documents.

790 Working hours

- **Specific limitations:** Refer to Contract Documents.

00-60-70 Works Contract Verification

STANDARDS OF PRODUCTS AND EXECUTIONS

110 Substitute products

- **Details:** All tender prices MUST include all manufacturers/equipment manufacturers / systems types / specialists as detailed within the specification, schedules and drawings .

Failure to comply with this will result in the Tender being rejected. If the contractor wishes to propose products of different manufacturer to those specified, the contractor must submit a cost saving proposal together with reasons for each proposed substitution, full technical details for appraisal and programme advantages.

Substitutions which have not been notified at tender stage may not be considered. If no options are given or the contractor fails to confirm manufacturers at the time of the tender return, it shall be deemed that the contractor is in full compliance with the tender documentation and manufacturers / specialist contained within.

- **Compliance:** In certain cases, manufacturers of equipment are mentioned in the Specification. The tender shall be based on all named manufacturers. Nevertheless, the Contractor will be held responsible for ensuring that the equipment will give the performance specified.

Other "equal and approved" shall mean by approval of the Client/Lead designers and alternatives shall only be considered prior to submission of Tender, when they have been submitted and approved in writing.

Alternative manufacturers, equipment, specialists or methods of carrying out the works in addition to those described in the tender documents may be submitted. Alternative offers shall be indicated on the appropriate document and include:

- Details of the alternative equipment, specialist or method proposed.
- Full technical data for each such alternative together with details of any consequential amendments to the design and/or other parts of the works. Demonstrate compliance with any stated British (or other equivalent recognised International) Standards.
- A detailed breakdown of any omissions or additions to the basic tender sum indicated on the appropriate document.

The Contractor must confirm equivalence in quality, life expectancy, operation and space requirements to those items which have been specified by name. Demonstrate the proposed alternative is fully equivalent to the specified item and identify any constructional, cost, programme, maintenance or other differences. The Contractor must include for all necessary measures to ensure alternative manufacturer's equipment and the total installation is equivalent to that specified. The Tenderer shall include the costs necessary for re-sizing and

reselection of associated equipment (including pipework, ductwork and cable sizes) resulting from the proposed alternative together with all resulting design and coordination. Alternative offers will only be considered if accompanied by a compliant tender. Additional costs resulting from non-compliance with the above will not be accepted.

All alternatives must be declared during the tender process. No alternatives will be accepted following agreement of the Tender proposals.

120 Substitution of products

- **Products:** If an alternative product to that specified is proposed, obtain approval before ordering the product.
- **Reasons:** Submit reasons and relevant information for the proposed substitution.
- **Information to be submitted:**
 - Company details
 - Manufacturer and product reference.
 - Full technical data and performance characteristics
 - Certification attained & relevant standards.
 - Details of any implications or consequential amendments to the design and/or construction / installation of other parts of the Works
 - Availability.
 - Performance.
 - Compatibility of accessories.
 - Proposed revisions to drawings and specification.
 - Compatibility with adjacent work.
 - A complete and precise statement of the effects on cost. Relevant cost savings will be deemed to have allowed for all consequential costs associated with amendments of other parts of the Works.
 - Identify additional costs arising from necessary changes to the details of the installation, including changes to the design and drawings, as well as any associated ancillary equipment
 - Effects on construction, programme, maintenance, cost in use or other differences
 - Copy of warranty or guarantee.
- **Alterations to adjacent work:** If needed, advise scope, nature and cost.
- **Manufacturers' guarantees:** If substitution is accepted, submit before ordering products.

DOCUMENTS AND INFORMATION

150 Currency of documents

- **Currency:** References to published documents are to the editions, including amendments and revisions, current on the date of the Invitation to Tender.

160 Incomplete documentation

- **Products and executions:** Where and to the extent that products or executions are not fully documented, they are to be as follows.
- **Requirements:**

- **Standard:** Of a kind and quality appropriate to the nature and character of that part of the Works where they will be used.
- **Suitability:** Suitable for the purposes stated or reasonably to be inferred from the project documents.
- **Contract documents:** Omissions or errors in description and/ or quantity shall not vitiate the Contract nor release the Contractor from obligations or liabilities under the Contract.

210 Record drawings and information

- **Record drawings:**
 - **Drawings scope:** As the construction period progresses the design team will not update drawings to reflect changes which arise. All design/client changes will be covered via a CA/Architects/Engineers instruction and sketch "part Plan". It is the contractor's responsibility to maintain a set of up to date "working" drawings which included all changes arising throughout the contract.

Record drawings

Drawing showing the building and services installations as installed at the date of practical completion. The main features of the record drawings are:

Provide a record of the locations of all the building, systems and components installed including pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components.

Use a scale not less than that of the installation drawings.

Have marked on the drawings the positions of access points for operating and maintenance purposes.

The drawings should not be dimensioned unless the inclusion of a dimension is considered necessary for location.

The location, including level if buried of public service connections provided within the contract, no matter who installed them, together with the points of origin and termination, size and materials of pipes, line pressure, flow and other relevant information.

The location, including level if buried of public service connections provided within the contract, no matter who installed them, together with the points of origin and termination, size and materials of cables, and cable ducts other relevant information.

Location and depth of all buried services

Schematic drawings of each system indicating principal items of equipment, zoning, means of isolation, etc in sufficient detail to understand the system operation and the inter-connections between various systems.

The layout, location and extent of all piped services showing pipe sizes, together with all valves for regulation, isolation and other purposes, drain cocks, test points, gauges, flow or pressure switches and other instruments.

The layout, location and extent of all cables, including sizes, together with all accessories locations, for each system: power, lighting, data, security, fire, communications, etc.

Location, identify, size and details of all equipment and controls equipment served by, or associated with, each of the various services.

The layout, location and extent of all air ducts, including those formed in builder's work or otherwise outside the contract, showing dampers and other equipment, acoustic silencers, grilles, diffusers, other air terminals, balancing dampers, access panels, fire dampers, turning vanes, hand holes, test holes, gauges and instruments. Each duct and terminal shall be marked with its size and air quantity flowing. Each terminal unit or grille shall have its duty clearly shown as recorded from the commissioning results.

The location and identity of each room including space housing plant, machinery or apparatus.

Detailed general arrangements of all boiler houses, machinery spaces, air handling plant rooms, tank rooms, electrical switch-room and other plant or apparatus, including the location, identity, manufacturer, size and rating of each item.

Detailed general arrangements of all electrical distribution rooms/ cupboards, including the location, identity, manufacturer, size and rating of each item.

All necessary sections, elevations, isometrics and schematics of the each system.

Control and wiring diagrams shall be provided incorporating details of each instrument and equipment item and written description of the sequence of operation of each system. All diagrams shall include full details of internal panel wiring and connections to field mounted items.

Layout, location and extent of electrical switchgear, distribution boards cables and termination points.

Detailed general arrangements of all switch-rooms, riser cupboards, service trenches, transformer chambers, generator rooms and other plant or apparatus, including the location, identity, manufacturer, size and rating of each apparatus

Details to show inter-connections between the works and equipment or systems provided by others to which wiring and connections are carried out as part of the works

Detailed wiring drawings and diagrams for all systems showing origin, route, cable containment size, type and number of conductors, length termination size and identification, and measured conductor and earth continuity resistance of each circuit. Indicate if cable/conduit is surface mounted, concealed in wall chase, in floor screed, cast in-situ, in false floor, above ceiling void, etc.

Logic flow diagrams for each individual control or monitoring specification and for each engineering system to illustrate the logical basis of the software design.

Record drawings of the complete Works shall be provided at practical completion.

Record drawings of the final "as installed" layouts shall be issued in draft form to the CA for examination 4 weeks prior to the testing and commissioning period to allow checking for accuracy.

Record drawings will be prepared on the current Autocad format as agreed with the CA prior to production of the drawings.

All drawings shall be suitably layered, with different services on each layer. A detailed list of layers, external references or equivalent (if used) and list of files shall be provided with the discs. If the drawings were produced from CAD drawings provided by the CA, the same layering system shall be used.

The drawings shall be produced in full size metric units.

Once approved the complete set of record drawings shall be revised as necessary to incorporate testing and commissioning data where applicable, and the final set(s) of record drawings and computer discs shall be handed over at practical completion. Issue at practical completion the complete approved package of record drawings in the following numbers:

CAD disk(s) 2no sets of complete record drawings

'white' prints 2no sets of complete record drawings

Each CD shall be labelled and CD jewel cases shall be labelled identifying project title, issue date and index of contents.

Valve charts, electrical distribution charts in panels and the like, shall be issued for examination at agreed dates to allow adequate time for manufacture and installation prior to practical completion.

Where portions of the work are to be concealed, draft copies of record drawings shall be supplied to the CA before the work is concealed in order to facilitate checking and examination.

The record documents shall be correlated so that the terminology and the numerical and/or other references used therein are consistent with and similar to those used in the physical identification of component parts of the Works.

Each record drawing shall show the following information:

- The name of the contract and, where appropriate, the zone or floor designation.
- Description of drawing, drawing reference and scale.
- Name and address of the contractor and the consulting engineer.

The completed drawings shall be signed as record drawings.

Each record drawing shall be endorsed with the words 'Record Drawing' in the bottom right hand corner adjacent to the title block.

Mark up 'as installed' details weekly and before any work is hidden from view.

Failure to undertake the above procedure for the preparation of record drawings and leaving the production of such drawings too late in the construction/commissioning period will result in practical completion not being granted by the CA.

Plant and switch room drawings, schedules and schematics;

Provide good quality plant and switch room drawings, schedules, schematics and instructions and hang in the respective plant room or any other appropriate location or where directed by the CA.

Protect surfaces of such information by pressure lamination and hang using suitable fixings and provide backboards if necessary.

A sample shall be submitted for approval prior to commencing production.

Provide information as stated elsewhere and include:

- All information required under statutory or other regulations

- Location of all incoming service isolating and metering facilities
- Emergency operating procedures including details for emergency call out service
- First aid instructions for treatment of persons after electrical shock
- Schematic drawings of installations showing identification and duties of equipment
- Controls schematics

Prior to being fixed, plant and switch room drawings, schedules, schematics and instructions shall be submitted for review by the CA. The review procedure shall be as for record drawings as stated elsewhere and all items shall be fixed prior to practical completion.

- **Drawings format: The Contractor is to maintain a full set of up to date paper and electronic "Working" drawings that should be no more than 1 week out of date.**

All information shall be provided in editable electronic format on request. The drawings should be available at any organised site inspection.

- **Record specification:**

- **Specification format:** Be advised that great importance will be placed upon quality, accuracy, clarity and completeness of the record documents and upon these being made available promptly.

Practical completion will not be granted unless an approved copy of the record documentation has been prepared, and is available for handover to the Employer.

Comply with the requirements of the CDM Regulations in providing the appropriate input to the health and safety file for the Works.

Comply with the requirements of the Building Regulations in providing all necessary documentation and information.

Provide record documentation, as detailed elsewhere, to include but not limited to:

- Record drawings and schedules.
- Plant room and switch room drawings, schedules and schematics.
- Operating and maintenance manuals.
- Blank maintenance logs.
- Building log book information.

Ensure record documents clearly record the arrangements of the various sections of the Works as actually installed and identify and locate all component parts.

The record documents shall set out the extent to which maintenance and servicing is required and how, in detail, it should be executed. Sufficient, readily accessible and proper information shall be provided to enable spares and replacements to be ordered.

Correlate record documents so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.

Demonstrate as required throughout the execution of the contract works that complete and accurate records are being maintained and that the record documents are being progressively compiled as the work on site proceeds.

All information shall be provided in editable electronic format.

- **Submittal date:** Two weeks after request and at least 1month before project completion or phased hand-over

220 Technical information

- **Retain:** Available on site for reference by supervisory personnel.
- **Information:** Manufacturer's current information and relevant British Standards, relating to products to be used in the Works.

230 Compliance

- **Compliance:** Retain on site evidence that the proprietary product specified has been supplied.
- **Submit:** Evidence of compliance with performance specifications, including test reports indicating properties tested, pass or fail criteria, test methods and procedures, test results, identity of testing agency, test dates and times, identities of witnesses and analysis of results.

PRODUCTS AND EXECUTION

240 Workmanship skills

- **Operatives:** Appropriately skilled and experienced for the type and quality of work.
- **Registration:** With Construction Skills Certification Scheme.
- **Evidence:** Operatives must produce evidence of skills and qualifications when requested.

250 Quality of products

- **Generally:** New.
- **Supply:** Each product from the same source or manufacturer.
- **Quantity:** Whole quantity of each product required to complete the Works of a consistent kind, size, quality and overall appearance.
- **Submittal date:** Evidence of source of supply when requested.
- **Recycling:** Proposals for recycled products may be considered.

260 Quality of execution

- **Generally:** Fix, apply, install or lay products securely, accurately, plumb, neatly and in alignment.
- **Colour batching:** Do not use different colour batches where they can be seen together.
- **Dimensions:** Check on-site.
- **Finished work:** Not defective, damaged, disfigured, dirty, faulty, or out of tolerance.
- **Appearance:** Adjust joints open to view so they are even and regular.

270 Inspections

- **Standard:** Inspection, or other action, of products or executions must not be taken as approval unless confirmed in writing including the following:
 - Date of inspection.
 - Part of the work inspected.
 - Respects or characteristics which are approved.
 - Extent and purpose of the approval.
 - Associated conditions.

Inspection before concealment

Whenever work requiring inspection or testing is subsequently to be concealed, 7 days notice shall be given to the CA so that inspections may be made or tests witnessed before concealment.

Failure to give due notice may necessitate the uncovering of the work and reinstating it at no extra cost or claim or extension to the programme or allowance for delay.

Record drawings of any services to be concealed shall be issued to the CA at the time notice is given.

Inspections Generally

Prior to commencement of the works submit schedules indicating those parts of the contract works for which inspections and tests are required to substantiate conformity with the specification.

Should any alternative item be proposed that does not carry appropriate certification, ensure independent testing is carried out at no expense to the contract works to confirm compliance.

Provide method statements supported by risk assessments detailing the procedures for carrying out all on site tests.

Agree in advance with all parties procedures for inspections and tests including periods of notice.

Where a test indicates non-compliance with the specification submit immediately details of the non-compliance and details for corrective action.

Maintain records of all specified inspections and tests performed including third party and works testing and maintain copies of all records on site for inspection.

290 Manufacturer's recommendations and instructions

- **General:** Comply with manufacturer's printed recommendations and instructions current on the date of the Invitation to Tender.
- **Submit:** Details of changes to recommendations or instructions.
- **Execution:** Use ancillary products and accessories supplied or recommended by main product manufacturer.
- **Products:** Comply with limitations, recommendations and requirements of relevant valid certificates.

SAMPLES AND APPROVALS

340 Approval of products

- **Programme:** Undertake or arrange submissions, samples, inspections and tests to suit the Works programme.
- **Approval:** Relates to a sample of the product and not to the product as used in the Works. Do not confirm orders or use the product until approval of the sample has been obtained.
- **Retain:** Complying sample in good, clean condition on site. Remove when no longer required.

350 Approval of execution

- **Programme:** Undertake or arrange submissions, samples, inspections and tests to suit the Works programme.
- **Approval:** Relates to the stated characteristics of the sample. (If approval of the finished work as a whole is required this is specified separately). Do not conceal, or proceed with affected work until compliance with requirements is confirmed.
- **Retain:** Complying sample in good, clean condition on site. Remove when no longer required.

ACCURACY AND SETTING OUT GENERALLY

380 Setting out

- **General:** Submit details of methods and equipment to be used in setting out the Works.

Ensure all items of plant and equipment can be installed in the available space and that there is adequate access to install plant to its final position in a safe manner.

Install the Works so as to be accessible for safe operation, maintenance, repair and future replacement. Deviations from the drawings to achieve this shall be agreed with the CA and written approval obtained before installation work commences. Final position and size of access doors shall be agreed with the CA.

Ensure uniform, neat and symmetrical arrangements of wall, floor and ceiling mounted equipment.

Agree with the CA all necessary horizontal and vertical alignment before installation work commences.

Amend any errors arising from inaccurate setting out or lack of site co-ordination at no additional expense to the contract.

- **Levels and dimensions:** Check and record the results on a copy of drawings. Notify discrepancies and obtain instructions before proceeding.
- **Completion of setting out:** Give notice before commencing construction.

400 Critical dimensions

- **Critical dimensions:** Set out and construct the Works in accordance with the critical dimensions and tolerances stated.

410 Setting out records

- **Record drawings:** Include details of grid lines, setting-out stations, benchmarks and profiles. Retain on site throughout the Contract and hand over on completion.

SERVICES GENERALLY

430 Services regulations

- **Services:** The complete services installation and components shall, unless stated otherwise, comply with the appropriate British Standard (BS and/or BS EN)) or Code of Practice (CP) and where no BS or CP is applicable the Agreement Certificate for the particular item.

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

All product and materials shall have product conformity certification (e.g. BSI Kitemark, BSI Safety Mark or CARES scheme) or product approval (eg British Board or Agreement Certificate)

All products must have the recognised 'CE' mark attached.

Certificates of compliance with British Standards, BSI Certification Schemes, and/or other Quality Assurance Schemes, shall be provided to the CA when requested.

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

In the absence of specific design, performance or installation standards being stated seek the instructions of the CA prior to commencement of the Works and with adequate time so as not to cause delay.

Comply with all statutory obligations where applicable, including, but not limited to, the following:

- British Standard Specification (BS) and European Standards (BS EN).
- British Standard Code of Practice (BSCP).
- CIBSE Guides to Current Practice and Technical Memoranda
- Institution of Engineering and Technology Regulations (IET) (BS 7671).
- Institute of Plumbing and Heating Design Guide (IPHE).
- Water Supply (Water Fittings) Regulations
- Water Byelaws
- The Building Regulations
- Loss Prevention Council (LPC)
- Building Research Station (BRE) digest recommendations
- Building Services Research and Information Association (BSRIA) recommendations and guides
- Local Bye-Laws and/or Regulations.
- Manufacturer's instructions and recommendations for installation/testing
- Government (formerly PSA) specifications
- Health and Safety at Work Act
- CDM Regulations
- Health Technical Memoranda (HTMs)
- Health Building Notes (HBNs)
- Radio communications Agency

When new editions are published during the construction, the instructions of the CA shall be sought regarding any modifications or changes necessary.

References to BSI documents shall be to the versions and amendments listed in the British Standards Catalogue and in subsequent issues of BSI News up to one month prior to the tender issue date.

Reference to a British Standard shall mean all parts or sub-sections of that standard unless stated otherwise.

The tender shall be based on the Regulations current one month prior to the issue date of tenders.

440 Water regulations and byelaws notification

- **Requirements:** Notify Water Undertaker of work carried out to or which affects new or existing services. Submit required plans, diagrams and details.
- **Consent:** Allow adequate time to receive Undertaker's consent before starting work. Inform immediately if consent is withheld or is granted subject to significant conditions.

450 Water regulations and byelaws Contractor's certificate

- **Content:**
 - **Installation:** Describe the new installation and/ or the work carried out to an existing installation, including the address.
- **Statement:** Confirm that the installation complies with the relevant Water Regulations or Bylaws.
 - **Inspection:** Provide the Contractor's name and address, the name and signature of the individual responsible for checking compliance and the date on which the installation was checked.
- **Submit:** Certificate on completion of the work, include a copy to the Water Undertaker.

460 Electrical installation certificate

- **Certification:** The original certificate is to be lodged in the Building Manual at the completion of relevant electrical work.

470 Gas, oil and solid fuel appliance installation certificate

- **Content:**
 - **Installation:** Describe the new installation and/ or the work carried out to an existing installation including the address.
 - **Safety:** Include special recommendations or instructions for the safe use and operation of appliances and flues.
- **Statement:** Confirm that the installation complies with the appropriate safety, installation and use regulations.
 - **Inspection:** Provide the Contractor's name and address, the date on which the installation was checked and the name, qualifications and signature of the competent person responsible for checking compliance.
- **Submit:** Before the completion date stated in the contract.
- **Certificate location:** Building Manual and Health and Safety File.

480 Mechanical and electrical services

- **Final tests and commissioning:** Carry out so that services are in full working order at completion of the Works.

- **Confirmation:** Provide a Building Regulations notice, signed by a suitably qualified person, to Building Control that systems have been commissioned in accordance with approved procedures.
- **Records:** A copy to be lodged in the Building Manual.

500 Continuity of thermal insulation

- **Record and report:** Confirm that work to new, renovated or upgraded thermal elements has been carried out to conform to the Specification.
 - **Content:** Address of premises, the Contractor's name and address, the name, qualification and signature of a competent person responsible for checking compliance and the date on which the installation was checked.
- **Submit:** Before completion of the Works.
- **Copy:** Include in the Building Manual.

QUALITY CONTROL

535 A General Requirements

- **Quality:** Prepare a method statement to indicate fully the quality control programme for the Works and indicate clearly the role of the CA in that programme.

The objective of the quality control programme shall be:

- Full compliance with the ISO 9001 standards and procedures
- Full compliance with the specification in regard to materials and workmanship
- Establishment of standards that will be acceptable to the CA by means of a sample installations prior to full scale erection of all major elements and trades required
- Submission to the CA for agreement of any samples of proposed manufacturer's items to be utilised in the Works prior to ordering
- Establishment of method statements defining quality standards

The quality control system will be subject to audit at any time during the duration of the contract.

The CA shall issue a quality control instruction where the installation fails to meet the standard required in the specification.

Where the installation fails to meet the required standard submit written proposals for compliance.

The quality control system shall include a suitable methodology and recording procedure which shall enable the personnel responsible for any work to be identified.

540 Proposals for rectification of non-compliant products and executions

- **Non-compliant items:**
 - **Opening up, inspection, testing, making good, adjustment of the Contract Sum, or removal and re-execution:** Submit proposals
 - **Submittal date:** So soon as possible after discovery of items which are or appear to be non-compliant.
- **Acceptability:** Such proposals may be unacceptable and contrary instructions may be issued.

550 Measures to establish acceptability

- **General:** Wherever inspection or testing shows that the work, materials or goods are not in accordance with the Contract and measures (e.g. testing, opening up, experimental making good) are taken to help in establishing whether or not the work is acceptable, such measures will be at the expense of the Contractor and will not be considered as grounds for revision of the completion date.

DAYWORK

600 Daywork charges schedule

- **Schedules:** Provide, priced and extended.
- **Details:** Where authority is given for work to be executed on a daywork basis, original vouchers giving the fullest particulars of hours worked, names of craftsmen and labourers, description of work executed and materials and plant used, must be forwarded to the CA through the contract procedures not later than the end of the week following that in which the work has been executed.

The daywork sheets shall be numbered in sequence, and all sheets are to be signed by the agent/foreman responsible and site representative of the CA. Such signatures are only to be taken as certifying that the time, materials and plant are correct, and shall not be held to justify a claim that the work shall be so charged or that it cannot be measured and priced according to the terms of the contract.

The value of work accepted by the CA to be paid on a daywork basis shall be calculated in the manner and in accordance with the rates quoted in the daywork Schedule.

- **Submittal date:** Not later than the end of the week following that in which the work has been executed

630 Daywork vouchers

- **Notice:** Give reasonable notice to person countersigning daywork vouchers before starting work to be recorded.
- **Information requirements:**
 - **Details:** Include a full description of the work undertaken time spent on individual tasks.
 - **Reference:** To the instruction under which the work is authorized.

- **Signature:** Sign by Contractor's person in charge as evidence that the operatives' names, the time spent by each, the plant and materials shown are correct.
- **Submittal date:** Not later than the end of the week following that in which the work has been executed

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USE OF DOCUMENTS

140 Dimensions

- **Dimensions:**

Use a laser levelling system to install all building and building services installations wherever possible and co-ordinate the measurements with all other trades and disciplines to prevent any clashes.

Obtain all dimensions and levels on site for the actual setting out of the works. Ensure these dimensions are available before proceeding with the Works.

Do not take dimensions from drawings by scaling. Where dimensions are indicated on the drawings check these on site, as appropriate, to ensure construction and manufacturing tolerances can be accommodated.

As the development advances measure on site all works by others that may foreseeable affect the Works. These dimensions shall be incorporated into the drawings or marked up on revised drawings if already issued.

No extra cost or claim will be allowed for any errors arising from inaccurate setting out or failure to check actual site dimensions. Reimbursement will be sought for any abortive expenditure.

Any comments, discrepancies or divergences that will / may affect the Works shall be brought to the attention of the CA in adequate time to avoid delay or abortive expenditure.

Setting out

Ensure all items of plant and equipment can be installed in the available space and that there is adequate access to install plant to its final position in a safe manner.

Install the Works so as to be accessible for safe operation, maintenance, repair and future replacement. Deviations from the drawings to achieve this shall be agreed with the CA and written approval obtained before installation work commences. Final position and size of access doors shall be agreed with the CA.

Ensure uniform, neat and symmetrical arrangements of wall, floor and ceiling mounted equipment. Agree with the CA all necessary horizontal and vertical alignment before installation work commences.

Amend any errors arising from inaccurate setting out or lack of site co-ordination at no additional expense to the contract.

Site modifications

Site modifications to plant, equipment or assemblies shall not be undertaken without approval from the CA.

Authorised site modifications shall be in accordance with manufactures' recommendations and requirements and comply with any type test certificate obtained for the arrangement of components.

Terminal locations

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

Agree with the CA the room terminals that are subject to final positioning on site.

Allow for the movement of all such terminals up to a radius of 2.0 m from the positions shown on the drawings.

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

DOCUMENTS PROVIDED BY CONTRACTOR

230 Additional copies of drawings and schedules

- **Additional copies:** In addition to those listed in the Contract Preliminaries the following will be provided in accordance with a programme to be agreed with the Subcontractor.
- **Details:** Coordination drawings showing the relationship to the structure and each other of piped supply, mechanical heating, mechanical ventilation, electrical supply and communications systems.

DOCUMENTS PROVIDED BY SUBCONTRACTORS

280 Schedule of Rates

- **Content:** Include items and materials included in the tender, together with their rates, extended and totalled. Separately price Preliminaries. Totals must agree with the Subcontract Sum and subtotals must agree with the priced breakdown of the tender.

A quantified schedule of rates shall be prepared and submitted subsequent to tender and accepted by the CA shall only constitute part of the contract in the following respects:

- The descriptions of the works and the rates and prices contained therein shall be used for the purpose of adjusting variations
- The quantities contained therein shall be used to facilitate the preparation and the checking of interim applications for payment
- The provisional and prime cost sums contained therein shall be subject to adjustment in accordance with the rules and procedures contained in the contract conditions.

Failure to provide sufficient information to satisfy the CA of the accuracy of the schedule of rates shall entitle the CA to impose a schedule of rates for the Works. All costs associated with the preparation and issue of this schedule of rates shall be at the installer's cost.

- **Rates:** Contractor's cash discount is included.
- **Fully priced copy - submittal date:** With the tender.
- **Errors in quantification:** Correction will not lead to adjustment of the Subcontract Sum.

380 Method statements

- **Method statements:** Supply to the Principal Contractor, any method statements, he or the client may request. Comply with all CDM procedures required by the CDM Coordinator and the Principal Contractor.

Provide method statements supported by risk assessments detailing the procedures for carrying out all on site tests.

Produce comprehensive commissioning method statements including procedures, logic diagrams and risk assessments for the pre-commissioning checks, setting to work, commissioning, system proving and environmental testing of the Works.

Produce flushing, chemical cleaning and water treatment method statements, logic diagrams and programme for integration into the building contractor's construction, commissioning and finishes programmes.

- **Submittal date:** 2 weeks prior to work element covered by Method Statement.

420 Design documents

- **Scope:**
 - **Design drawings:** The tender drawings primarily describe the design intent of the Works, the working principles of the building, systems, general arrangements, principles of services co-ordination and the intended methods of installation.

The drawings are accordingly part diagrammatic with runs of piping, ducts, cable, containment and the like being shown to small scale and not necessarily indicating exact installation positions.

The drawings indicate equipment, pipework, ductwork, cable tray routes and trunking, in sufficient detail to show how all the engineering services can generally be accommodated and coordinated with each other, the architecture and the structure. These drawings are provided for information purposes only. The installer shall be responsible for co ordination of building services.

The Design Team shall produce the following information (except Contractor Design Items in which these requirements fall to the contractor);

Technical design drawing

A drawing showing the extent of the building and services installations. The main features of technical design drawings are:

- Plan layouts to a scale of at least 1:100.
- The drawings shall show the extent and type of services terminals visible within the space
- Approximate locations of horizontal and vertical service runs shall be shown
- Plant and distribution system sizes, particularly those affecting spatial allocation, while acknowledging that these may need some adjustment and refinement in the preparation of the detailed design drawings and equipment schedules
- Pipework and electrical containment should be represented by single line layouts. Ductwork should be represented by either double or single line layouts as required to demonstrate that the routes indicated are feasible.
- Symbols and line conventions in accordance with industry recognised standards for symbols and other graphic conventions.

Detailed design drawing

A drawing showing the intended locations of building, plant items and service routes in such detail as to indicate the design. The main features of detailed design drawings are:

- Plan layouts to a scale of at least 1:100.
- Plant areas to a scale of at least 1:50 and accompanied by cross sections.
- The drawing will not indicate the precise position of services, but it should be feasible to install the services within the general routes indicated. It should be possible to produce co ordinated working drawings or installation drawings without major re routing of the services.
- Pipework and cable containment represented by single line layouts.
- Ductwork represented by either double or single line layouts as required to demonstrate the routes indicated are feasible.
- Symbols and line conventions in accordance with industry recognised standards for symbols and other graphic conventions.
- The drawing should indicate the space available for major service routing in both horizontal and vertical planes.

The contractor shall be expected to produce the following information;

Co ordinated working drawing

- A drawing showing the inter relationship of two or more engineering services and their relation to the structure and building fabric. The main features of co ordinated working drawings are:
 - Plan layouts to a scale of at least 1:50, accompanied by cross sections to a scale of at least 1:20 for all congested areas.
 - The drawing should make allowances for installation working space and space to facilitate commissioning and maintenance.
 - The drawing should be spatially co ordinated i.e. there should be no physical clashes between the system components when installed.
 - Critical dimensions, datum levels and invert levels should be provided together with dimensions in areas where tolerances are minimal.
 - Spaces shown on the drawing should make allowance for the service at its widest point eg spaces between pipe and duct runs. Allowances for insulation, standard fitting dimensions and joint widths should be included on the drawing
 - Make allowance for those plant items specified by the designer and identified in the design specification.
 - The drawing should indicate positions of main fixing points and supports where they have significance to the structural design.
 - The drawing should demonstrate a feasible sequence of installation of the services.
 - The drawing should be supported with individual services drawings for clarity.
 - Plant room layouts to a scale of at least 1:20, accompanied by cross sections and elevations to a scale of at least 1:20.

Installation drawing

A drawing based on the detailed design drawing or co ordinated working drawing with the primary purpose of defining that information needed by the tradesmen on site to install the works. The main features of installation drawings are:

- Plan layouts to a scale of at least 1:50, accompanied by cross sections to a scale of at least 1:20 for all congested areas.
- A spatially co ordinated drawing, i.e. no physical clashes between the system components when installed at the scaled off positions shown on the drawing.
- Make allowance for inclusion of all supports and fixings necessary to install the works.
- Make allowance for the service at its widest point for spaces between pipe and duct runs.
- Allow for insulation, standard fitting dimensions and joint widths on the drawing.
- Make allowance for installation details provided from shop drawings.
- Make allowance for installation working space; space to facilitate commissioning and space to allow on going operation and maintenance in accordance with the relevant health and safety requirements.

- Make allowance for plant and equipment including those that are chosen as alternatives to the designer's specified option.
- Provide dimensions where the positioning of services is considered to be important enough not to leave to the tradesmen on site
- Plant room layouts to a scale of at least 1:20, accompanied by cross sections and elevations to a scale of at least 1:20.

Installation wiring diagram

Drawing showing the interconnection of electric components, panels etc in accordance with the design and incorporating the details provided on manufacturer's drawings.

The information shall indicate maximum electrical loading for each supply cable; cable termination facilities; and cable identification and all terminal numbers.

Manufacturer's drawing

Drawing provided by a manufacturer, fabricator or supplier for a particular project, and which is unique to that project and indicates a project specific representation of the product, components or plant items to be supplied. Examples include: control and switchgear panels and associated internal wiring, pre-fabricated plant customised specialist systems and equipment etc.

Manufacturer's certified drawing

Drawing provided by a manufacturer or supplier to indicate details of the product, components or plant items and which the manufacturer or supplier guarantees the supplied equipment will comply with.

Record drawing

Drawing showing the building and services installations as installed at the date of practical completion. The main features of the record drawings are:

- Provide a record of the locations of all the systems and components installed including power, lighting, fire, data, data, communications systems, components, and associated containment.
- Use a scale not less than that of the installation drawings.
- Have marked on the drawings the positions of access points for operating and maintenance purposes.
- The drawings should not be dimensioned unless the inclusion of a dimension is considered necessary for location.
- The location, including level if buried of public service connections provided within the contract, no matter who installed them, together with the points of origin and termination, size and materials of cables and cable ducts and other relevant information.
- Location and depth of all buried services

- Schematic drawings of each system indicating principal items of equipment, zoning, means of isolation, etc. in sufficient detail to understand the system operation and the inter-connections between various systems
- The layout, location and extent of all electrical and specialist services showing cable sizes, together with all accessories for isolation and other purposes.
- Location, identify, size and details of all equipment and controls equipment served by, or associated with, each of the various services.
- The layout, location and extent of all accessories, including those formed in builder's work or otherwise outside the contract, showing fire and acoustic treatments to services passing through barriers.
- The location and identity of each room including space housing electrical equipment.
- Detailed general arrangements of all electrical rooms, cupboards, and electrical switch-rooms illustrating the manufacturer's details, sizes and ratings of each item.
- All necessary sections, elevations, isometrics and schematics of the electrical spaces.
- Control and wiring diagrams shall be provided incorporating details of each system and equipment item and written description of the sequence of operation of each system. All diagrams shall include full details of internal panel wiring and connections to field mounted items.
- Layout, location and extent of electrical switchgear, distribution boards cables and termination points.
- Detailed general arrangements of all switch-rooms, riser cupboards, service trenches, transformer chambers, generator rooms and other plant or apparatus, including the location, identity, manufacturer, size and rating of each apparatus
- Details to show inter-connections between the works and equipment or systems provided by others to which wiring and connections are carried out as part of the works
- Detailed wiring drawings and diagrams for all systems showing origin, route, cable containment size, type and number of conductors, length termination size and identification, and measured conductor and earth continuity resistance of each circuit. Indicate if cable/conduit is surface mounted, concealed in wall chase, in floor screed, cast in-situ, in false floor, above ceiling void, etc.
- Logic flow diagrams for each individual control or monitoring specification and for each engineering system to illustrate the logical basis of the software design

Builder's work drawing and information

Drawings and/or schedules, appropriate to the stage of design development showing the requirements for architectural and/or structural provisions and those necessary to facilitate the engineering services and allow their integration into the project. Such information includes the position and sizes of all access covers, panels and doors required in the building structure and fabric for proper safe access for and to plant for installation, maintenance, inspection and future replacement.

Design stage

A drawing and/or schedule to show the provisions required to accommodate the engineering services that significantly affect the design of the building structure, fabric and external works. The information also indicates the work to be carried out by building trades eg. plant bases, major openings and major structures for plant and equipment.

This will be appropriate to the stage of design development and maybe based on preliminary, non-manufacturer specific plant selection.

Installation stage

Drawings to show requirements for building works necessary to facilitate the installation of the engineering services and as described elsewhere.

Controls logic diagrams

Diagrams, drawings and/or schematic details of all control components and instruments showing the layout with each item uniquely identified together with a description of the controls operation and details of the associated interlocking.

Switchgear, starter and control instrumentation panel drawings

Drawings that show the construction and internal wiring diagrams of the starters, panels and/or other devices.

- **Technical information:** All calculations produced as part of the contractor's design responsibilities must be co-ordinated and presented in a logical format that can be easily understood.

All calculations shall be prepared to a recognised and agreed format and must be indexed.

The use of computer programs in the preparation of designs shall be carefully controlled. All software programs shall be verified and their use agreed with the CA prior to commencement of design tasks. Where unverified software is used its use must be declared and the initial outputs justified by full and complete hand calculations.

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

Submittals shall clearly state the methodology, formulae, design criteria, assumptions and all design margins used in the calculations.

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

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

Each set of calculations shall further require the approval of a Chartered Engineer to verify that the design is in accordance with the specification and design intent.

Allow at least 21 working days from date of receipt by the engineer for examination of the calculations and submittals.

Incomplete submittals will not be examined until fully re-submitted, as they will be considered inadequate and misleading.

The costs for the preparation of all necessary calculation shall be included in the tender return.

- **Submittal Review:** The CA will examine the submittals for compliance, in principle, with the design intent.

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

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

The drawings, calculations and submittals shall be issued progressively as agreed in advance with the CA to facilitate examination.

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

Each package shall contain all drawings, design calculations, support information, manufacturer's literature, etc. necessary to facilitate an independent review. All documents (excluding drawings) submitted for examination must be adequately bound.

All documents shall be clearly identified with a 'status' during the course of the project.

The following categories shall be used:

- Preliminary Submittal presented for informal comment as appropriate. Any comment, or lack of comment, is not to be construed or implied as giving approval.
- Information Submittal presented for information only and no comments required
- For Review To be reviewed and examined by the CA

- Construction For construction purposes

Revised items on drawings shall be indicated by 'clouds' around the changes and annotated with a revision number/letter.

All drawings shall require the approval of the installer's design manager to verify that the drawing has been developed from an approved design and that the information does not conflict with the requirements of other design disciplines.

All documentation submitted shall be accompanied by a certificate indicating that it has been checked and approved by the installer's design manager.

Only drawings that have been reviewed, and incorporate the comments by the CA may be progressed to 'Construction' status. Should it become necessary to revise the drawing its status must be changed to 'For Review' and be re-submitted.

On receipt and examination of any submittal the following conditions shall apply:

A Reviewed. Fabrication, manufacture or construction may proceed

B Reviewed. Fabrication, manufacture or construction may proceed subject to incorporation of comments indicated. If compliance with the comments cannot be achieved amend and re-submit.

C Rejected with or without comments. In this case the submittal does not comply and is to be re-submitted after correction.

Where drawings and submittals are reviewed subject to comments indicated, these comments shall be incorporated immediately and re-submitted to the CA prior to issue for construction.

Where drawings are revised and updated during construction these shall be issued to the CA for examination of the revision only, the revision being clearly marked.

Builder's work information and installation drawings shall not be reviewed in detail but shall be examined by the CA for general suitability.

Record drawings are to be prepared as the Works progress and shall be examined in the same manner as stated above unless stated otherwise.

Allow 10 working days from receipt by the Architect/CA/Engineer for review and comment on any of the above.

- **Submittal date:** At least 4 weeks prior to work section commencing on site.

430 Proposed manufacturers/ suppliers

- **Scope:** List details of products, equipment and plant.
- **Content:** The tender drawings have been prepared based on the current catalogue information of the equipment specified elsewhere.

Revisions or modifications of the physical characteristics of the equipment sometimes occur between the published catalogue information and the final information issued on the manufacturing drawings. When such revisions or modification arise incorporate these and their effects on other parts of Works onto the installation drawings and where necessary the final builder's work information.

Review the manufacturer's references at the earliest opportunity and bring any anomalies to the attention of the CA in writing.

No extra cost or claim or extension to the programme or delay will be allowed for such modifications to the drawings or the Works as a result of such manufacturing changes.

The CA shall review all drawings and manufacturers details prior to any orders being placed.

The final details including all technical aspects and calculations where applicable shall be submitted in a clear, definable and easily read format with the specified technical details, notes and performance data clearly shown in the English language. Where drawings are to be examined the manufacturer's details (shown on the drawings) must have been previously reviewed or only partial approval/comment will be granted.

Submit a separate compliance statement for each item of plant or equipment identifying all technical details and performance characteristics and that required to be achieved as specified.

All reviews of submittals will be carried out in the offices of the engineer and include for all costs and make all necessary arrangements for reviews of submittals to be undertaken in this manner.

All meetings in this respect shall be held in the offices of the engineer. Agree with the CA where samples of materials offered for review are to be sent.

The drawings, calculations and submittals shall be issued progressively as agreed in advance with the CA for review.

Each package shall contain all drawings, design calculations, support information, method statements, manufacturer's literature, builder's work information, etc necessary to facilitate an independent review. All documents (excluding drawings) submitted for review must be adequately bound.

All correspondence related to the examination and review procedure shall be directed through the office of the CA.

Allow **10 working days** from the date of receipt by the engineer for review or comment or otherwise on all submittals.

The number of copies and format of information to be provided shall be as follows:

- 1No. Electronic Copy.
- 1No. Paper Copy.

The review period shall not commence until all the information stated above has been submitted.

- **Submittal date:** Within one week of request

460 Health and safety statement

- **Content:** Comply with the requirements of all relevant health and safety legislation and regulations including the Construction (Design & Management) Regulations (CDM) 2015.

Comply with the requirements of the project health and safety pre construction information.

Allow for providing all necessary general health, safety and welfare facilities unless it has been specifically agreed that certain facilities will be provided by others.

Appoint a "competent person" on the site to manage health and safety during construction.

Where the design of any elements of the works is undertaken, cooperate with and provide information to the CDM Coordinator in accordance with the designer's duties under the CDM Regulations.

Ensure, so far as is reasonably practicable, that all persons employed on, or visiting, the site are adequately informed, instructed, trained, supervised and equipped such that they are able to carry out their duties without risk to safety or health.

Take all necessary steps to ensure that only authorised persons are allowed into any construction area.

Ascertain the sufficiency and accuracy of information provided by, or on behalf of, the Employer and advise where any additional information or clarification is required.

Health and safety information provided in the tender documentation or within the pre-construction information is limited to highlighting significant risks to health and safety identified

during the design and is not intended to identify all health and safety risks with which a competent contractor should be familiar.

Provide relevant information about the works that might affect the health and safety of any person.

The Principal Contractor shall provide all required information to allow the development of the construction health and safety plan in accordance with the requirements of the CDM Regulations prior to the commencement of works on site.

Develop the construction health and safety plan in accordance with the requirements of the CDM Regulations prior to the commencement of works on site.

Review, and revise as necessary, the construction health and safety plan in line with any information received from sub-contractors or any changes in the requirements of the project. Any changes shall be promptly advised to all relevant sub-contractors, the Principle Designer and CA as appropriate.

The development of the health and safety plan shall not be limited to those particular risks identified pre construction but shall include consideration of all reasonably foreseeable risks. The development of the health & safety plan shall include the arrangements for the management of the construction works and for monitoring compliance by all persons with the requirements of relevant statutory provisions.

The health and safety plan must be adequately developed, as far as is reasonably practicable allowing for any phasing of works, etc., in sufficient time to allow it to be submitted to the Principle designer and/or CDM Coordinator for comment prior to the commencement of any works on site. In the case of phased works the plan relating to the work content of any phase must be adequately developed and submitted for approval prior to the commencement of any work within that phase of the project.

Supply to the Principle designer any method statements, they or the Employer may request. Comply with all CDM procedures required by the Principle designer.

Ensure that all sub-contractors complete appropriate assessments of the risks to health and safety in respect of their works as required under applicable statutory legislation, including the latest.

Management of Health and Safety at Work Regulations and the Control of Substances Hazardous to Health Regulations and other relevant health and safety regulations.

Ensure, so far as is reasonably practicable, that all sub-contractors, employees and self employed persons under your control who are at work on the construction of the project comply with the requirements of the construction health and safety plan.

Prepare all necessary information for the production of a health and safety file for the works in accordance with the requirements of the CDM Regulations and in the format defined by, or agreed with, the CDM Coordinator, Principle designer and/or Employer. Ensure and coordinate the provision of information for the health and safety file by all sub-contractors, specialists and suppliers. Provide the health and safety file information in adequate time to allow this to be coordinated and handed over to the Employer at practical completion of the works, unless otherwise agreed.

Comply with latest edition of the Control of Substances Hazardous to Health Regulations. Undertake COSHH assessments for all activities and substances provided or used on site to assess their potential health hazards. Copies of all relevant COSHH assessments must be issued to the operatives concerned and strictly monitored. Particular attention must be given to the use of glues and sealant.

Labour saving lifting devices shall be used wherever possible and materials sized to allow easy manual lifting.

Consider the future replacement of plant and equipment and ensure no item of plant or equipment is installed in such a manner that it cannot be routinely and regularly maintained in a safe manner.

Ensure that all sub-contractors are issued with copies of the pre construction health and safety information including details of all identified significant hazards and relevant information prior to the submission of their tenders and that they price for compliance.

Describe any significant and unavoidable hazards which may arise as a result of carrying out the work and the measures proposed to safeguard the health and safety of operatives and of any person who may be affected by the work.

- **Submit:** Prior to works commencing

480 Health and safety file information

- **Information:** Provide as required by CDM Coordinator/Principle designer.

650 Sub subcontractors

- **List:** Details of portions of contract works to be sublet and names and addresses of proposed sub subcontractors.
- **Submittal date:** With the tender.

INFORMATION

740 Proposed instructions

- **Estimates:** If a proposed instruction requests an estimate of cost, submit without delay and in any case within seven days.

750 Design and production information

- **General:** Complete the mechanical, electrical, and public health designs and detailing of parts of the Works as specified and shown on the outline tender drawings The building shall be designed as CDP item following the drawings and performance specification.
- **Provide:**
 - **Production information:** Based on the drawings, specification and other information.
- **Liaison:** Ensure coordination of the work with related building elements and services.
 - **Additional information:** Request as necessary and provide information in time to meet the programme.
- **Submission to Contractor:** Until confirmed that resubmission is not required, resubmit for further checking and comment, and incorporate necessary amendments.
- **Design and production information:** Submit two copies, one can be returned with comments. Ensure that necessary amendments are made without delay.
- **Subcontractor's changes:** Support request for substitution or variation to requirements with relevant information.
- **Contractor's amendments:** If considered to involve a variation to the requirements, which has not already been acknowledged as a variation, notify without delay (maximum period 7 days), and do not proceed until instructed. Claims for extra cost, if made after it has been carried out, may not be allowed.

780 Drawn and other information

- **Subcontractors design documents:** Drawings as described earlier within this specification.
Sizes and scales required.
Schedules of all mechanical equipment
Specification for all mechanical equipment
Calculations for all mechanical services / systems as detailed earlier within this specification.
Names of manufacturers and suppliers, including certification of components and assemblies.
- **Format:** Electronic and paper copy
- **Builder's work information:** Take responsibility the design and for confirming and amplifying such information.

800 Insurance

- **Documentary evidence:** Under the terms and conditions of the contract certain policies of insurance are required to be secured. Details, policies and receipts for the insurances required by the Conditions of Contract.

Examine these policies and obtain such supplementary cover as shall be necessary to ensure that the Works and the materials, plant, tools and equipment brought onto the site for the purpose of the execution of the Works shall be protected for their full value against the risks defined in the contract conditions.

The risk of injury to third parties and damage to third party property arising from the execution of the contract shall be insured up to the limit defined in the said conditions.

- **Submittal date:** Before starting work on site.

810 Professional indemnity insurance

- **Requirement:** Provide and maintain PI insurance in respect of Contractor Designed Work.
 - **Level of cover:** As required within the Contract Preliminaries.
 - **Period of insurance for these purposes:** As required within the Contract Preliminaries.
- **Amount of indemnity required:** As required within the Contract Preliminaries.
- **Sub-limits of cover:**
 - **Pollution and contamination claims:**
 - Level of indemnity:** An annual aggregate amount.
 - Limit of cover:** As required within the Contract Preliminaries.
- **Expiry of required period of CDP Professional Indemnity Insurance:** As required within the Contract Preliminaries.
- **Documentary evidence:** Details and/ or policies and receipts for the insurances required.
- **Submittal date:** Before starting work on site.

820 Insurance claims

- **Notice:** If an event occurs which may give rise to a claim or proceeding in respect of loss or damage to the Works or injury or damage to persons or property arising out of the Works, immediately give notice to the Employer, the CA administering the contract on behalf of the Employer and the Insurers.
- **Failure to notify:** Indemnify the Employer against loss, which may be caused by failure to give such notice.

840 Ownership of products

- **Ownership:** At the time of each valuation, supply details of those products not incorporated into the Works which are subject to reservation of title inconsistent with passing of property as required by the Conditions of Contract, together with their respective values.
- **Evidence:** When requested, provide evidence of freedom of reservation of title.

850 Products stored off site

- **Evidence of title:** Submit reasonable proof that the property in such items is vested in the Contractor.

- **Supplier:** For products purchased from a supplier include a copy of the contract of sale and a written statement from the supplier that conditions of the sale relating to the passing of property have been fulfilled and the products are not subject to encumbrance or charge.

880 Defects in existing work report

- **Undocumented defects:** When discovered, immediately give notice. Do not proceed with affected related work until response has been received.
- **Documented remedial work:** Do not execute work which may hinder access to defective products or executions, or be rendered abortive by the remedial work.

900 Commissioning programme

- **Submittal date:** Prepare comprehensive programmes for the pre-commissioning checks, setting to work, testing, commissioning, system proving and environmental testing of the contract works. Submit programme within 4 weeks of contract appointment.

Review and update the commissioning programme at agreed intervals and if necessary revise and amend the programme to suit the progress of the contract works. Due account shall be taken of any phasing requirements.

- **Format:** Electronic and Hard Copy.
- **Commissioning manager:** Employ an independent company who specialises in testing and commissioning of building services to undertake all commissioning and testing activities associated with the contract works and as specified elsewhere.

The commissioning specialist shall be a member of The Commissioning Specialists Association (CSA).

Submit with the tender details of the independent company to be employed.

910 A Commissioning & testing

- **Requirements:** Where used in the specification the following definitions shall apply:
 - Commissioning - the advancement of an installation from the stage of static completion to working order to the specified requirements.
 - Testing - the measurement and recording of specified quantifiable characteristics of an installation or parts thereof. This includes off site testing.
 - Setting to work - the process of setting a static system in motion
 - Regulation - the process of adjusting the rates of fluid flow in a distribution system to achieve specified values
 - Environmental testing - the measurement and recording of internal environmental conditions
 - System proving - the measuring, recording, evaluating and reporting on the seasonal performance of the systems against their design values

- System demonstration - demonstrating the capability of the installation to achieve and maintain the specified performance criteria
- Fine-tuning - the adjustment of the system where usage and system proving has shown such a need. This may include the re-assessment of design values and control set points to achieve the required system performance.

Notify the CA in writing when the Works or parts thereof are ready for testing and commissioning.

Provide all necessary facilities to enable tests to be witnessed and inspections carried out including all necessary instruments and recorders to monitor systems during commissioning system proving and environmental testing.

Appoint a "competent person" to supervise the whole of the testing, commissioning, system proving, system demonstration and instruction of the employer's staff.

Co-ordinate the activities of all specialised personnel, including manufacturer's representatives, together with providing any attendance required.

Indicate on drawings where access is required into ceiling voids, service risers etc and ensure these points are not closed up until the commissioning and testing is complete.

The CA will examine, subsequent to setting to work and regulation of the Works the results of the commissioning and the documentary records thereof.

The object of the witnessing stage is to enable the CA to establish a level of confidence in the commissioning results being presented. The extent and proportion of results to be witnessed by the CA will be at the discretion of the CA.

The CA will only witness test proceedings, confirm recorded results and determine if the specified requirements have been satisfied.

Should the tests fail to demonstrate that the plant and equipment are properly installed and functioning correctly, the cause of the failure shall be investigated. Should the failure be due to incorrect or faulty work then without delay, carry out such remedial measures and adjustments as may be necessary and repeat the commissioning and testing procedure to the satisfaction of the CA.

Ensure all requirements such as cleanliness, protection from harmful external and internal elements are provided prior to commencement of commissioning

Where it is not possible at the particular time of commissioning and testing for full load conditions to be obtained or simulated, undertake to repeat such operations of full load or a simulation thereof at a time when this can be achieved.

The Works shall be fully tested, commissioned and be fully operational prior to witnessing and inspection by the CA.

Where portions of the work are required to be commissioned and tested separately, then upon final completion, demonstrate to the CA that all the several portions are capable of proper simultaneous operation in accordance with the requirements of the specification.

In cases where the construction programme is such that the commissioning, testing, balancing, adjustment, needs to be undertaken in an area of the building taken over and occupied by the

Employer, then take all necessary precautions against and be responsible for any damage caused whilst working in such areas for that purpose.

All certification documents shall be submitted to the CA for examination before any system is offered for final acceptance.

Provide a written statement to the CA confirming that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.

Undertake the following:

- Test, commission, regulate and set to work the Works
- Prepare comprehensive programmes, commissioning plans, schedules and method statements and procedures supported by risk assessments for the pre-commissioning checks, setting to work, commissioning, system proving and environmental testing of the Works
- Develop and complete the initial commissioning plan and submit to the CA
- Comply with the requirements of the Building Regulations for the inspection and commissioning of the building services systems. Prepare all necessary submittals including commissioning plans and reports. Obtain all compliance approvals from the building control bodies.
- Provide all specialist personnel including manufacturer's representatives and coordinate their activities, together with providing any attendance required.
- Provide and submit standard proforma for the various requirements for commissioning records and certification for agreement with the CA prior to commencement of the works
- Monitor progress against the program of works and provide weekly reports detailing progress of testing and commissioning activities
- Maintain a diary/log of significant commissioning and testing activities
- Measure and reconcile noise levels at agreed locations to verify compliance with design criteria

- Submit to the CA all certification documents prior to any system being offered for final acceptance
- Confirm in writing to the CA that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.
- Ensure all certification is attained and witnessed as necessary for inclusion in the record documentation
- Provide and submit a report for every test, demonstration, balance or commissioning activity witnessed, together with an engineering appraisal on the performance, either on or off-site
- As necessary co-ordinate and liaise with the Employer's representative
- Maintain on site at all times full records of all testing, commissioning and performance testing
- Prepare a written report on the operational and performance testing
- A final commissioning report detailing the results of the commissioning and commenting on the performance of systems

Performance testing, system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the CA.

Submit to the CA written reports signed by a "competent person" to confirm that:

- Prior installation - all system designs can be commissioned
- Post installation - installations complete and ready for commissioning
- System cleanliness - specified cleanliness has been achieved
- Pre-commissioning checks - completion of pre-commissioning checks
- Commissioning and testing - demonstrate compliance with specified requirements and confirm that each installation has been correctly tested and commissioned and achieving the specified performance
- All necessary checks and witnessing by the Local Authority, Government offices, Statutory Authorities etc have been undertaken

During the 12 months after practical completion and in consultation with the CA undertake to:

- Assess the need for fine tuning of the installations
- Ensure the requirements for fine tuning are incorporated in the commissioning specification
- Ensure that fine tuning activities are programmed, planned in advance and agreed with the CA and employer prior to commencement
- Arrange that the relevant parties are retained and appointed to provide input to fine tuning activities
- Ensure that fine tuning activities are planned with regard to the health and safety of occupants and such that any disturbance to them is minimised
- Provide a mechanism by which the employer can provide feedback on the performance of the building both before and after fine tuning
- Attended meetings as requested by the CA to deal with issues arising from fine-tuning of the Works.

Costs for fine-tuning and adjustment of the Works during the 12 months after practical completion shall be included in the contract price.

Allow for 6 of visits during the 12 months after practical completion and provide rates for additional visits.

- **Inspections and Tests:** Prior to commencement of the works submit schedules indicating those parts of the contract works for which inspections and tests are required to substantiate conformity with the specification.

Should any alternative item be proposed that does not carry appropriate certification, ensure independent testing is carried out at no expense to the contract works to confirm compliance.

Provide method statements supported by risk assessments detailing the procedures for carrying out all on site tests.

Agree in advance with all parties procedures for inspections and tests including periods of notice.

Where a test indicates non-compliance with the specification submit immediately details of the non-compliance and details for corrective action.

Maintain records of all specified inspections and tests performed including third party and works testing and maintain copies of all records on site for inspection.

- **Static Testing:** Progressive static testing shall include the following tests, but other tests may be required and witnessed:
 - Insulation resistance
 - Earth fault loop impedance
 - Earth continuity
 - Soil Resistivity
 - Pressure testing of hydraulic systems
 - Air leakage testing of ductwork systems

The CA shall be given the opportunity to witness all static tests. Advance notice of 5 working days shall be given to the CA.

- **Fuel for Testing:** Fuel for testing and operating the Works will be provided by the Client.

920 Maintenance instruction and guarantees

- **Components and equipment:** Obtain or retain copies, register with manufacturer and hand over when requested before completion of the Works.

00-80-70 Works Contract Completion

230 The Building Log Book

- **Content:** The Contractor shall be responsible for compiling the building log book.

Prepare and submit to the party responsible for compiling the building log book all necessary information for inclusion in the document to meet the requirements of the Building Regulations and in accordance with CIBSE TM31 Building Log Books - A guide and templates for preparing building log books.

Clearly, there are direct links between the building log book and the operating and maintenance manual, record drawings etc. The building log book information is an additional requirement to the responsibilities for the production of record documentation as stated elsewhere.

Practical Completion will not be granted if the required information is not issued.

- **Preparation:** By Contractor.
- **Latest date for submission;** Before practical completion

235 System Demonstrations

- **Requirements:** Subsequent to the completion of all testing and commissioning to the satisfaction of the CA, when directed by the CA operate the plant and demonstrate that the overall systems function correctly in accordance with the requirements of the specification.

Full running and operation for a period of at least 1 week shall be considered reasonable for this demonstration and this period shall be allowed in the programme.

During this period be responsible for the recording of results and the operation and maintenance of the plant. If appropriate, use this time to instruct the Employer's staff in the operation and maintenance of the systems.

Provide an operational report of the demonstration and print out of the conditions maintained within the space for the required demonstration period.

- **Staff Training:** At a time to be agreed with the CA and prior to practical completion instruct the Employer's staff in the use, correct operation and general maintenance of the Works and be satisfied that such staffs are competent to take over the installation on completion.

Include adequate periods to instruct the Employer's staff in the operating and maintenance of the Works. Submit to the CA for approval a detailed training programme and method statement for the training of the Employer's staff.

During such periods of instruction undertake and be responsible for the correct operation and maintenance of the installations.

Employ the services of relevant specialists and suppliers necessary for this purpose and provide each person with a comprehensive set of teaching notes and diagrams.

All the associated training equipment required by the trainer(s) to enable the training to be demonstrated effectively shall be provided.

For all instruction periods maintain training records which shall be submitted to the CA on completion. All attendee names shall be recorded and signatures obtained from all attendees confirming they have understood the training given. A schedule of names shall be provided within the operating and maintenance documentation.

All health and safety issues relating to the Works shall be brought to the attention of all attendees.

All attendees shall be provided with the appropriate Personal Protective Equipment (PPE).

'Formal' presentations shall be carried out over 'half day' periods.

As an indication, the training for operating staff should include, but not be limited to:

- Building Maintenance requirements
- Building services system scope (demonstrated with the aid of schematics and/or other drawings/visual aids). To include an overview of the purpose and normal operating functions of the Works and explaining the philosophy and method of control used.
- Demonstration and training (by controls Specialist) of the building control system.
- An electronic projector style 'walk through' of the operation and maintenance manuals, highlighting important areas of health and safety together with all other items of importance.
- Highlighting, demonstrating and providing delegate experience in all maintenance procedures identified in the O&M Manuals.
- Physical tour(s) of inspection of the Works illustrating aspects covered in the 'classroom' and the location of essential isolating points of all incoming services.
- Explaining and illustrating all operator alarms, their possible causes and actions required.
- Explaining all known and typical fault scenarios which are capable of being recognised and/ or rectified by the operators.
- Identifying and demonstrating all safety equipment and interlocks including all interlocks with other suppliers' systems /equipment.
- Identifying the noise levels in the various areas and highlighting the need for any protection required.
- Specifying and illustrating any hazards associated with the Works and the methods employed to deal with them.

- Providing instruction on the correct operation of plant items and the safe limits of their operation.
- Explaining the mode of operation and sequence of events resulting from both power failure and fire alarm conditions.
- Demonstrating any alarms and explaining their meaning and possible causes.
- Highlighting any associated hazardous maintenance materials which may require special disposal considerations.
- Highlighting the signs, cause and effect of known/ possible breakdown or fault conditions.
- Indicate and demonstrate (where practicable) arrangements made for access and removal of specific items of equipment or key large or heavy subassemblies / components.
- Demonstration of the safe day to day running and maintenance of all systems, plant and equipment.
- Providing sufficient expertise to address delegate questions.

The training for the operation of the controls, monitoring or BMS installations shall include as a minimum:

- Initial training at the works of the controls supplier including hands on experience of equipment and software similar to the installation.
- Instruction on the procedures for testing and routine inspection of sensors and actuators to enable the operator to assess the nature of faults and extent of remedial action required.
- The provision of all appropriate reference and training manuals.
- Complete initial instruction prior to commissioning of the installed system.
- Site instruction on the installed system.

Together with the controls and commissioning specialists, be available for an agreed period as agreed with the CA to assist the Employer's personnel in the operation of the various systems following practical completion and occupation of the buildings.

All costs associated with the instruction of the Employer's staff and required attendance following practical completion shall be included in the contract price. •

245 Operation & Maintenance Manuals

- **Test Certificates:** Ensure test certificates include:
 - Project title
 - Contractor's name
 - Specific location of the item in the Works, including plant identification, system etc
 - Details of the plant / equipment, including manufacturers' reference number
 - Date, time and duration of inspection / test
 - Weather conditions during the test, where applicable
 - Details of the test / inspection
 - Instruments used, serial numbers, and calibration dates, where applicable

- Number and type of deficiencies found, where applicable
- Any corrective action taken, where applicable
- Itemised readings for all tests, where applicable
- Name and signature of those inspecting / witnessing test / testing
- Other relevant particulars.

Test certificates must be issued in duplicate to the CA within 10 working days of the test. Maintain records of all specified inspections and tests performed including third party and copies of works test certificates on site.

- **Record Documentation:** Be advised that great importance will be placed upon quality, accuracy, clarity and completeness of the record documents and upon these being made available promptly.

Practical completion will not be granted unless an approved copy of the record documentation has been prepared, and is available for handover to the Employer.

Comply with the requirements of the CDM Regulations in providing the appropriate input to the health and safety file for the Works.

Comply with the requirements of the Building Regulations in providing all necessary documentation and information.

Provide record documentation, as detailed elsewhere, to include but not limited to:

- Record drawings and schedules.
- Plant room and switch room drawings, schedules and schematics.
- Operating and maintenance manuals.
- Blank maintenance logs.
- Building log book information.

Ensure record documents clearly record the arrangements of the various sections of the Works as actually installed and identify and locate all component parts.

The record documents shall set out the extent to which maintenance and servicing is required and how, in detail, it should be executed. Sufficient, readily accessible and proper information shall be provided to enable spares and replacements to be ordered.

Correlate record documents so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.

Demonstrate as required throughout the execution of the contract works that complete and accurate records are being maintained and that the record documents are being progressively compiled as the work on site proceeds.

- **Operating and maintenance manuals:** Either carry the works out in house or employ an independent company who specialises in the preparation of operation and maintenance manuals to provide the manuals in accordance with the requirements of this specification.

If a decision is taken to use a specialist, submit details of the proposed specialist to the CA for approval prior to commencement of the Works. If manuals are produced in house are not to the required standard or quality the CA will have the option to ask for the manuals to be produced by an outside specialist

4 weeks before the contract completion date provide a draft copy of the operating and maintenance manual to the CA for comment.

Retain a copy of all the delivered record documentation for at least one year after practical completion. If requested by the Employer or CA during this period, provide additional copies subject to a charge.

Undertake the following activities with respect to the preparation of the operation and maintenance manual:

- Liaison with the Planning Supervisor and any other parties associated with the production of the Health and Safety File, to ensure that the required information is complete and that the method of presentation and terms used are consistent.
- Liaison with designated members of the design team to obtain all information necessary to convey a thorough understanding of the design intent and operating principles of the installations.
- Liaison with designated contractors and specialist subcontractors to obtain all necessary details of the installed systems and equipment to enable safe and proper operation and maintenance.
- Liaison with specialist equipment suppliers as necessary to ensure that clear operating and maintenance instructions are included in the Manual.
- Preparation of additional written, diagrammatic and/ or pictorial information as necessary for the operation and maintenance of the engineering services installations;
- Re-drafting and restructuring information provided by others as necessary so as to ensure consistency with other parts of the manual and other sections of the Health and Safety File.
- Submitting periodic reports to the CA on the progress of the preparation of operation and maintenance manuals.
- Collating all the information into a co-ordinated, indexed and cross-referenced document.
- Providing all stationery, printed material and binders required for the production of the draft and final editions of the operation and maintenance manuals.

The manual supplier shall be responsible for the correction of any errors or omissions in the manual.

General requirements:

- All documentation shall be in English as spoken and written in the United Kingdom.
- All units of measurement shall be metric, conforming to the SI system.
- The text of descriptive sections shall be concise and complete avoiding possible ambiguity or misunderstanding. All information shall be pertinent to the specific installations. Irrelevant material or material of a general nature shall not be acceptable. Where generic standard clauses are used as the basis for certain parts of the manual, they shall be edited to ensure that all text is relevant to the Works.
- Jargon shall be avoided. All new terms shall be defined when first introduced. Abbreviations shall only be used if they have been defined or their meaning is clear from the text.
- The imperative mode shall be used for instructions regarding operation, maintenance, disassembly etc.
- Illustrations, drawings and diagrams incorporated into the manual shall be easily read in conjunction with the relevant text.

All aspects of the manual shall comply with relevant requirements of the CDM Regulations for the provision of information for the Health and Safety File.

Where appropriate, the maintenance procedures and frequencies detailed in the manual shall be in accordance with details provided by the manufacturer for specific items of equipment.

Where specific requirements are not pertinent, the procedures and frequencies shall be as recommended in HVCA Standard Maintenance Specifications for Services in Buildings.

Care shall be exercised to ensure that maintenance procedures and frequencies described in manufacturers' printed details are accurately reflected in the text of the manual.

The manual supplier shall identify, from the CA, the intended maintenance strategy for the Works and the level of technical competence and user ability of the personnel likely to be employed. The manual shall be written in a style to suit the abilities of all users. Where necessary, prepare separate sections to suit the following levels of competence:

- Non-technical - e.g. building manager or caretaker requiring simple directions for basic operations.
- General technical - with broad-based maintenance skills required for routine maintenance, inspections etc. and detailed analysis of system operation.
- Specialist - in individual fields and with respect to particular items of equipment.

The manual shall have an alphabetical index or indexes. The indexing and cross-referencing in other parts of the manual shall be arranged to provide easy access to required information.

Content and layout

The manual shall be arranged as follows unless an alternative format and contents are agreed with the CA prior to issue of the draft document:

Outline of contents;

- Front cover and fly sheet
- General details to be shown on all volumes
- Document titles - Buildings and Operating and Maintenance Manual
- Employer name and logo
- Premises name
- Services referred to in the manual
- Volume reference where the manual runs to more than one volume
- Description of contents (e.g. General Information and Design Details)
- Spine details to be shown on all volumes
- Services referred to in the manual
- Volume reference where the manual runs to more than one volume
- Description of contents (e.g. General Information and Design Details)

Title pages;

- Premises name and address (authenticated postal address, phone, fax, e-mail etc)
- Services referred to in the manual
- Full name and address of the Employer
- Date of completion and date of handover of the services to the Employer
- Date of issue
- The author's reference number of the manual
- Name and address of the author of the manual

Contents and index;

- Contents list for the whole manual. To comprise a master list of main headings of each section for each volume of the manual, for cross reference. (Copies of this master contents list to be included in the master contents list for the Health and Safety File)
- Detailed contents for the particular volume. To include a structured contents list showing main headings and details of contents of each section in that volume, with paragraph numbers and page numbers.
- Detailed contents for each section. To be located at the front of each section of the manual, giving a detailed, structured list of the contents of the respective section.
- Index comprising a comprehensive alphabetical index for all sections of the manual

Section 1 General information and introductory overview;

- Full name, address, telephone and facsimile numbers, website address and email address of the design team and all installing contractors, sub-contractors and specialists for the Works

- Full name, address, telephone and facsimile numbers, website address and email address of all public utilities and local authorities

- Any limitations on the use of the manual

Record of amendments to manual schedule (including space for future records)

- Description of how to use the manual

- List of all supplementary documents

- Distribution list and locations of all copies of the manual

- Scope including a brief description of which systems and details are included in the manual

Section 2 Contractual and legal information;

- Details of ownership, leases etc defining areas of responsibility for operation and maintenance

- Construction / handover dates including installation start date(s), practical completion date and end of defects liability date

- Details and copies of all manufacturers' guarantees or warranties together with maintenance agreements offered by sub-contractors or manufacturers. Include expiry dates.

- Insurance inspection reports. Documents pertinent to Employer's / User's liability

- Local and public authority consents. To include permissions required for access, alterations etc

- Safety and fire certificates. Certificates confirming that the premises and installed systems may be safely utilised. These shall include examination certificates by competent persons for pressure systems etc., together with written schemes of examination for pressure systems.

- Software licence information.

Section 3 Health and safety;

- Features or characteristics that may produce a hazard. Flammable, toxic or otherwise deleterious substances necessary for the operation of systems; restricted access; pressure systems etc.

- Known hazards against which protection can be provided

- Mandatory requirements relating to safety. To include details of all systems and equipment requiring periodic inspection/ examination/ testing to comply with relevant regulations, approved codes of practice etc.

- Relevant safety precautions. To include procedures to minimise the risk of damage or injury from recognised hazards. Requirements for special manual procedures, permits to work etc.

- Details of recommended first aid equipment to be maintained on the premises.

Section 4 Emergency information;

- Contact information for:

- Utility supplier emergency services (gas, water, electricity)

- Provider of emergency call out service

- Installer's emergency staff

- Security/fire systems

- Location of first aid equipment

- Emergency control locations

- Water main stopcock(s)
- Gas shut -offs
- Electricity isolation points
- Specific systems/plant

Section 5 Description of services and design intent;

- A schedule of the floor areas of each of the building zones categorised by environmental servicing type
- Description of the whole building and intended use
- Design philosophy including all design criteria
- A full description of each of the installed systems and items of equipment. To include as a minimum a written explanation of the following:
 - Scope
 - Intended purpose
 - Plant and distribution locations; divisions of main zones; etc., cross-referenced to schematics
 - Function
 - General design parameters
 - Installed capacities
 - System capacities (based on commissioning results)
 - Restrictions of the systems
 - Planned operational efficiency and most economic mode of operation
 - Expected service life
 - Manufacturers information concerning correct operation

Section 6 Equipment schedules;

- System by system schedules of all plant, equipment, valves, distribution boards etc stating as minimum:
 - Component type
 - Unique asset number
 - System
 - Location
 - Number off
 - Duty and size
 - Performance figures
 - Manufacturer and supplier
 - Manufacturer's model and/or reference number
 - Manufacturer's serial number and nameplate details
 - Original order number for the particular plant/equipment item
 - Each item of plant/equipment must have a unique asset number cross-referenced to the record drawings and schedules.

Section 7 Systems operation;

- Descriptions of the operational and control strategies to include:
- Control and operating strategy for each system
- Outline of general operating mode including summer and winter operation
- Start-up and shut down procedures. Description of procedures for whole system and individual items of plant, from fully off to fully operational, including interlocks etc.
- Interlocks and inter-dependencies between plant and systems.
- Procedures for emergency shut down and operating procedures for standby plant.
- Means of making safe potentially dangerous plant
- Precautions necessary to overcome known hazards when operating each system, bringing into operation all standby equipment included in each system
- Instructions on fault finding and emergency in case of plant malfunction or equipment failure control sequences for all systems installed
- Details of all software provided and procedures for updating and/or modifying software operating systems and control programs
- Instructions for the creation of control procedure routines and graphic diagrams where applicable.

Section 8 Energy management;

- Energy management strategy to enable energy consumption to be monitored and controlled.
- Metering philosophy. To include a schedule of the building's energy supply meters and sub-meters, indicating for each meter, the fuel type, its location, identification and description, and instructions on their use.
- Carbon emissions and the comparable performance benchmarks / target figures for energy consumption and energy costs. (Design assessments to be in accordance with Building Regulations)
- The measured air permeability of the building
- Forms for recording plant running hours, energy consumption and energy costs.

Section 9 Maintenance;

- Maintenance instructions for each item of plant, co-ordinated from manufacturer's details and recognised industry guidelines including frequency and recommended routine maintenance activities guidance on the nature of deterioration and defects look for dismantling and re-assembly adjustment , calibration and testing special tools needed for maintenance (cross referenced to the particular item) test equipment and auxiliary services
- Reference to spare parts / replacements
- Programme / frequencies for planned preventive maintenance.
- Comprehensive schedules identifying:
 - routine periodic checks on plant / system status and condition.
 - periodic verification of accuracy of controls, instruments etc.
 - routine visual and physical checks, measurements and certification of continuing fitness for purpose and safety.

- routine checks / changes to plant / system components / settings to compensate for wear, operational requirements, experience in use etc so as to ensure continuing optimum performance.

Recommended frequencies and procedures for routine lubrication of moving parts, including generic specification for lubricants.

- Procedures for fault finding and identifying causes of abnormal operation of plant / equipment.

Section 10 Spares and tools;

- Schedule of types of replaceable assemblies, components etc particular to specific plant.
- Schedule of specialist tools / equipment particular for specific plant and necessary for undertaking work at height etc.
- Separate parts lists shall be provided for each item detailed in the equipment schedule.
- Schedule of normal consumable items
- Recommended stocking levels
- Schedule of personal protective equipment necessary for operation / maintenance activities / tasks

Section 11 Drawings;

- A schedule of all engineering services record drawings for the Works. The information to include drawing title, number, source, revision, date, system detail, file/storage location. The schedule to include space to record future modifications and dates.
- An A3 size reduced copy of all record drawings together with an index.
- An A3 size reduced copy of all plantroom and switchroom drawings, schematics and schedules
- Legend for all colour-coded services
- Schematic drawings of each system, indicating principal items of plant, equipment, valves, etc.
- A schedule of all manufacturers' drawings for the Works. The information to include drawing title, number, source, revision, date, system detail, file/storage location. Schedule to include space to record future modifications and dates.

Section 12 Testing and commissioning data;

- Copy of report(s) confirming that the Works were satisfactorily commissioned signed by a competent person(s)
 - Copies of all test certificates, records, commissioning and performance test records for the Works. All certification shall be signed and witnessed.
 - Method statements for the testing and commissioning procedures undertaken including description of equipment used.
 - Copies of calibration certificates for all test equipment.
- Schedules of all fixed and variable equipment settings established during commissioning.

Section 13 Manufacturers' data;

- Schedule of all manufacturers and suppliers indicating company name, address, telephone and facsimile numbers, email address(es), website address and equipment unique asset number. (Sorted in company order alphabetically)
- Product (manufacturer's) data/ literature for all items of equipment and plant installed. The information to be project specific and include detail drawings, electric circuit details and operating and maintenance instructions.

Section 14 Materials and substances;

- Register of harmful substances. Details of any materials that could be hazardous to health, used in connection with or otherwise relevant to operational or maintenance activities.
- COSHH details
- Register of recyclable materials
- Methods for safe disposal or destruction of any parts, materials or components. Provide a data sheet for each material known to constitute a potential hazard, with detailed procedures for its safe, authorized disposal.

Section 15 Modification information;

- Details of allowances made by plant manufacturer or system designer for modifications
- Provide space in manual to record future modifications.

The manual shall conform to the following minimum standards:

- The covers shall be substantial, of adequate size, distinctive and of sufficient strength to protect the contents for the life of the installation. The method of binding shall give a permanent anchorage along the left-hand side whilst allowing the text to be flat without damage to the spine.
- The manuals shall be prepared on an approved typeface on top quality A4 suitable for direct insertion into the manuals
- The front cover and where appropriate the spine, shall have the information clearly displayed in permanent lettering.
- Dividers between sections shall be stepped, overlapping printed card. The divider shall be labelled to identify the section of the manual that it proceeds.
- All pages comprising the manual shall be subsequently numbered according to each section (i.e. section 1 pages numbered 1/1, 1/2,etc., section pages numbered 2 2/1, 2/2etc.).

Checking of drafts

A draft copy of the operating and maintenance instruction manuals contained in a temporary loose leaf binder(s) shall be issued to the CA for examination prior to the testing and commissioning.

The draft copy of the manual shall conform to the required format and contain all the information identified in this specification with the exception of any information not available at that time (such as commissioning results).

Draft versions of the manual shall clearly display the word "DRAFT".

Final documentation

Once approved a draft copy shall be handed over prior to instructing the employer's staff in the operation and use of the services installations. This copy shall contain all testing and commissioning data and test results, actual control set points and the like in draft form.

Prior to practical completion provide the following copies of the final manual which shall include all testing and commissioning results and final plant duties and control settings, etc. in a typed form.

- The number of paper format copies shall be three number.
- The number of copies in electronic format on CD shall be three number.

All CD's and other electronic forms of delivery media associated with the manual shall be clearly labelled with:

- A heading stating "O&M manual" and disc number if more than one disc
- Details of the premises and systems covered
- The issue number of the manual and date of release

Copyright

The Employer shall have sole copyright to all documents produced specifically for the manual. The Employer shall be entitled to produce copies of all parts of the manual for his own use.

If the Employer transfers ownership or responsibility of the installations he shall be entitled to transfer his copyright of documents included in the manual.

250 Handover

- **Requirements:** This section details the requirements and procedures for completion and handover.

As a pre-requisite to Practical Completion in respect of the contract works or part thereof, demonstrate to the satisfaction of the CA that:

- All the contract works are complete. With the exception of minor snags or limited defects as agreed with the CA that could be reasonably completed within an agreed programme without causing disruption to the Employer's use of the building or part thereof.
- All spares, keys, tools and other consumables as stated elsewhere have been supplied and handed over to the Employer.
- The instruction of the Employer's staff in the use and correct operation of the installation has been completed satisfactorily. In particular, safety devices and controls demonstration.

- All commissioning and testing completed including the issue of a final commissioning reports signed by an approved competent person
- A complete demonstration of the contract works including fully functional operational controls tests undertaken in the presence and to the satisfaction of the CA.
- All necessary certification by the Employer's insurers has been completed.
- All approved record documentation including record drawings, operation and maintenance manuals, etc is approved and issued
- All information required for the health and safety file is issued to the satisfaction of the Planning Supervisor.
- All necessary Statutory Authority approvals have been undertaken and written confirmation established
- Completion and issue of building log book information in accordance with Building Regulations.

Should adequate record documentation not be available Practical Completion will not be granted.

- **Spare parts:** One month before practical completion submit to the CA a schedule of spare parts as stated in the specification and make recommendations of any others that the employer should obtain for the maintenance of the installations included in the Works.

The schedule shall be priced in detail and include the following information for each item:

- Manufacturer's current price (including packaging and delivery to site)
- Quantity to be provided
- Manufacturer's reference for the item
- Referencing to the plant and equipment installed

Identify the items that are additional to those specified and included in the contract price. Submit to the CA a quotation, priced in detail, for the additional items.

Two weeks prior to practical completion provide all specified spare parts and the additional items if so instructed by the CA.

For each spare part provided include for and undertake to:

- Check that each spare part is suitable for the replacement of the corresponding part supplied with the plant and equipment installed
- Reference to the plant and equipment information in the operating and maintenance manual so purpose is clear
- Label and reference in accordance with the schedule of spare parts
- Paint, grease and pack as necessary to prevent deterioration during storage

All spares shall be contained where practicable in protective containers.

- **Tools:** One month before practical completion submit to the CA a schedule of tools and portable instruments as stated in the specification and make recommendations of any others that the employer should obtain for the maintenance of the installations included in the Works.

The schedule shall be priced in detail and include the following information for each item:

- Manufacturer's current price (including packaging and delivery to site)
- Quantity to be provided
- Manufacturer's reference for the item
- Referencing to the plant and equipment installed
- Purpose

Identify the items that are additional to those specified and included in the contract price. Submit to the CA a quotation, priced in detail, for the additional items.

Two weeks prior to practical completion provide all specified tools, keys and portable instruments and the additional items if so instructed by the CA.

Include for and undertake to:

- Check that each item is suitable for the intended application
- Label and reference each item identifying purpose and the plant or equipment
- Paint, grease and pack as necessary to prevent deterioration during storage

All tools, keys and portable instruments shall be secured and contained in lockable cabinets that will be located as agreed with the CA

Where a schedule is not provided, the contractor shall make allowance for the provision of 2 sets of all keys and/or specialist tools required for the testing and on-going maintenance of each system within the contract.

Outline Specification

10/04/2018 - 16:31

Outline Specification

60-45-10 Chilled water systems

110 Chilled water system

The Contractor shall procure, supply, install, test & commission a chilled water system with a new air cooled chiller system in a new external plant enclosure which serves the existing Aquarium plate heat exchangers and comms room fan coil unit.

The Mechanical Contractor shall isolate, drain down and strip out the older of the existing chillers, pipework, ductwork, attenuator, & associated supplies and dispose of equipment off site in accordance with health and safety regulations and via a certified disposal company. This shall include any cooling fluid which must be captured and not allowed to run to drain or into the environment.

The contractors shall also dispose of the original chiller which was replaced by the iCS 305 chiller. This chiller is sitting beside the existing chiller enclosure and shall be disposed of off site in accordance with health and safety regulations and via a certified disposal company.

The existing iCS 305 chiller installed in 2016 shall be kept operational after the removal of the older existing chiller and during the installation of the new chiller, buffer vessel, pipework etc. A temporary pipework and electrical solution utilising the existing pipework (and some new pipework if required) shall be installed to maintain the existing iCS 305 chiller in operation during the works. Valves shall be installed on the existing flow and return to the aquarium and comms room to facilitate the connection of the final pipework solution. The existing chiller and temporary electrics shall be suitably protected, retaining the existing attenuator and chiller air path, during the period where the existing enclosure has been removed and before the new enclosure is fully wind and weather tight.

The new chiller, ICS or equal and approved, as scheduled, shall be arranged to serve a new insulated steel buffer vessel. The new chiller shall be complete with hydraulic kit including primary circulation pumps, fill kit, expansion vessel and temperature and flow switches. New pipework and valves shall be installed from the new chiller to the new buffer vessel and from the new buffer vessel to the existing system. Chilled water shall be distributed from the buffer vessel via duty/standby electronically controlled variable speed pumps, as Wilo or equal and approved. The new pipework shall connect to existing pipework at the entry point to the Aquarium building at high level in the enclosure. The pipework shall be arranged to fully drain and automatically air to new AAVs.

The change over to the new chiller shall be carried out once the new chiller is commissioned and out of hours in accordance with the contract program and in agreement with the Employer.

Once the new chiller is operational and the new pipework from the buffer vessel is connected to the existing pipework supplying the building, the retained chiller shall be disconnected from the existing/temporary pipework and connected to the new buffer vessel as indicated.

The buffer vessel shall be supplied with full internal baffling to ensure that the cooling fluid stratifies. It shall be provided with pressure and temperature gauges, AVV and AAV, safety valve, access door, drain point and shall be insulated with a minimum of 75mm fibre wool with a full vapour barrier and suitable protective skin.

The chilled water system shall be commissioned by a recognised and reputable commissioning engineer. The commissioning engineer shall be required to attend site to commission the new chiller and system pumps and then recommission the existing chiller. The commissioning engineer shall also be responsible for the water treatment and commissioning the automatic dosing system. These operations will occur at different times in the contract.

Chilled water pressurisation shall be provided through a packaged unit with expansion vessel and high and low level alarms through the BMS system as Aquatech Pressmain or equal and approved.

Glycol top up/concentration maintenance shall be provided through an automatic chemical dosing unit with 40 litre tank, injection kit, rigid suction lance, multifunction valve, automatic electronically controlled pump and hose kit. The pump shall be set up and commissioned by the commissioning engineer. The automatic dosing system shall be supplied by Grundfos Dosing or equal and approved. The automatic dosing system shall be assembled, set to work and commissioned as part of the contract.

Chiller exhaust air shall be ducted complete with attenuation to discharge through the roof and terminate below existing windows.

The ducts shall have an up stand through the roof and shall be fully flashed through the roof to provide long lasting weather protection.

The Contractor shall include any necessary lifting of equipment to manoeuvre plant to the plant enclosure located in a restricted side walkway.

The existing and new chilled water system shall be fully flushed. The flushing shall be carried out and at time and duration agreed with the Employer (in particular their aquarium specialist).

Once fully flushed the system shall be filled and brought up to a 25% Ethylene Glycol concentration with ICS Flowcool IG industrial grade inhibited ethylene glycol via the dosing pot. The water treatment chemicals shall be as recommended by the Chiller manufacturer and shall be introduced to the required concentration. The cooling water shall be sampled, tested by the chemical manufacturer and certified as achieving the required concentration. An additional 50l of ICS Flowcool IG ethylene glycol shall be provided as part of the contract and supplied to the employer for future maintenance.

Intake air shall be provided through louvred openings in new plant enclosure. The louvres shall be installed to the manufacturer's recommendations and the installation shall be flashed and waterproofed as required to provide a weather proof installation

Cold water service pipework shall be run from local supply to serve the pressurisation unit complete with quick fill loop and braided removable hose. The cold water pipework shall be fully insulated and vapour sealed. The water pipe shall be valved inside the building and shall be arranged to allow the pipework to be fully drained. The fill loop flexible connection shall be disconnected

Chilled water pipework and fitting shall be installed in plastic ABS pipework with solvent welded joints to BS5391-1:2006.

Water services pipework and fittings shall be installed in copper tube table X to BS 2871.

All pipework shall be insulated with foil faced phenolic foam including pipe hangers and supports. Removable insulated vapour proof bags shall be provided and installed on all uninsulated items including the valves, buffer vessel access etc. All insulation shall be fully vapour sealed to prevent condensation forming.

Pipework and plant shall be identified and labelled in accordance with BS 1710.

Where existing pipework passes into the building it shall fully sealed with fire rated sealant.

Electrical.

The Contractor shall include to site survey the existing services systems to ensure a full and complete understanding of the connection points to the existing systems.

The Contractor shall visit site during the tender period so that a full understanding of the site constraints and the scope and magnitude of the works. If the tendering contractor decides not to attend site during the tender period should note that any claims for monies or delay arising from problems that could reasonably have been identified during pre-tender site visit shall not be entertained.

The Electrical Contractor shall design, supply and install power supplies to local isolators to serve equipment with final power wiring to be installed by the Controls Contractor.

70-70-25 Earthing and bonding systems

110 Earthing and bonding system

The Contractor shall supply and install the complete earthing system to comply with BS 7671 17th Edition of the IEE Wiring Regulations requirements for electrical installation and, where relevant, with British Standard Code of Practice BS 7430 and BS 6651 or local relevant codes. Earth bonding will not be shown specifically on the drawings.

All non-current carrying metal work associated with the electrical power distribution network equipment and ancillaries, and all extraneous metalwork including suspended ceilings, cladding, roofing, plant, pipework and the building structure, shall be effectively bonded and connected to earth at a common potential earth continuity system.

Protection against indirect contact shall be by means of earthed equipotential bonding and automatic disconnection of supply.

The circuit protective and bonding systems shall distribute radially and separately from the main LV distribution earthing systems, main and sub-main LV switchboards and distribution panels/boards.

All metalwork of the building shall be made electrically continuous throughout and connected to the main protective system. This shall include all building service including armoured cables, cable ladder rack, cable trays, trunking, conduit, ductwork, pipework, fixing systems, equipment, building structural and fabric steelwork, etc.

In particular, any metalwork which may provide an earth return such as hot and cold water pipes, metallic waste pipes, cooling system pipework, bottled gas installation, ductwork, etc that are within

two metres of any switch, socket outlet or any other electrical point / outlet shall be effectively bonded to the electrical earthing system and to the incoming water services.

All bonding links, cable terminations, and joints shall be tested for zero impedance. All metal paths forming part of the earth continuity system, cable armouring, circuit and circuit protective conductors, shall be individually tested and proven for the minimum continuity and earth loop impedance as specified by BS 7671 : 2008 17th Edition of the IEE Wiring Regulations.

The resistance between any point on the bonded system and the main earth shall not exceed 0.5 ohms when tested in accordance with BS 7671 : 2008 17th Edition of the IEE Wiring Regulations.

The whole system shall be tested on completion and test results shall be submitted to the Architect/Engineer for review.

The terminal block shall be arranged and labelled in the circuit orientation so that identification can be readily understood.

Sub-Circuit Distribution

All sub-circuit armoured supply cables emanating from the sub-distribution switchboards and control panels shall be terminated on the gland plates and bonded at both ends to the earthing bars with individual circuit protective conductors from their gland tags.

In addition to the armour bonding, a separate green, green / yellow LSF insulated standard copper circuit protective conductor in accordance with Chapter 54, Section 543 as BS 7671 : 17th Edition of the IEE Wiring Regulations shall be provided for all sub-main cables as indicated on the equipment schedules.

Each circuit protective conductor shall be terminated on the main earth bar of each sub-distribution switchboard, starter panel or control panel.

The separate green/green/yellow LSF insulated stranded copper circuit protective conductor shall be connected to the earthing terminal of each of the terminal switchgear/equipment earth.

Earthing for Final Circuits in Trunking and Conduit

Although metal trunking and conduit systems shall form part of the protective conductor metalwork and all connections in these systems shall be connected together to provide an effective earth path in accordance with Regulations 540-02-05, a completely separate circuit protective conductor shall be provided for each circuit in accordance with the Chapter 54, Section 543 of BS 7671 : 17th Edition of the IEE Wiring Regulations.

A separate circuit protective conductor shall be provided for each individual circuit, using a stranded copper green / yellow XLPE cable.

The circuit protective conductors shall distribute radially from the earthing bars of the sub-distribution switchboards from which the trunking and conduit systems emanate.

Each circuit protective conductor shall have its own termination point within the distribution switchgear and where these are multiple in number they shall be arranged and labelled in the circuit orientation so that identification can be readily understood,

Under no circumstances shall copper tape be used in conjunction with galvanised screws, nuts or washers, all such screws, nuts or washers shall be brass or electro tinned.

Main Equipotential and Supplementary Bonding

The Contractor shall supply and install all main equipotential earthing cables, but shall not be limited to the requirements as required by BS 7671 : Edition of the IEE Wiring Regulations.

Supplementary Bonding

The Contractor shall carry out supplementary bonding as required by BS 7671 : 17th Edition of The IEE Wiring Regulations.

Supplementary bonding shall be carried out using a minimum of single core 6mm² LSF cable and connected to the nearest earth bar located in the LV switchboards, distribution panels and distribution boards.

- All metal cable ladders, cable trays, trunking, conduit, etc.
- All metal pipework.
- All metal ductwork.
- All exposed metalwork including basin, sinks, waste pipes, handrails, metal decking, etc. Window/wall cladding.
- Extraneous steelwork / metalwork within easy reach of persons, i.e. two metres.
- Plant room equipment.
- All mechanical and production process equipment that can fortuitously come in contact with electrical services.
- Raised floor system.

Separate bonds shall be provided to each suspended ceiling in individual rooms.

70-70-40 Inspection and testing low voltage electrical installations

110 Inspection and testing of new low voltage electrical installations or changes to an existing installation

Testing, inspecting and commissioning shall be carried out in accordance with the requirements of the IEE Regulations 17th Edition, British Standard recommendations and this Specification. The testing, inspecting, commissioning shall be carried out upon completion of the installation, with witness tests

being carried out by the CBSE. In order for these tests to take place, the Contractor shall complete the installation and satisfy himself that the installation has been carried out in accordance with the requirements of the Specification and drawings, and only when he is satisfied that the installation is fully operational in accordance with these requirements shall he offer the installation to the CBSE for witnessing.

The lighting installation shall be commissioned in accordance with the CIBSE Commissioning Code L.

The Contractor shall satisfy himself of the fully operational requirements of each and every system covered by the electrical services specification, and for each system shall prior to carrying out the testing and commissioning submit to the CBSE a fully detailed method statement indicating in detail the sequence of testing to be undertaken. Each task identified in the method statement shall clearly indicate the required result or results, if more than one operation/output is applicable when the system is operating correctly.

The method statements shall clearly indicate all tasks that are to be undertaken to satisfactorily demonstrate the whole system is operating correctly in accordance with the specification and shall include the proving of all interlocks, remote signals, all inputs, outputs, etc.

Prior to offering the system to the CBSE for witnessing, the Contractor shall carry out all tests to satisfy himself that the systems are operating satisfactorily. Any costs incurred by the CBSE as a result of the Contractor failing to comply with this requirement may be reimbursed from the Contractor's account.

The testing and commissioning shall include all items of equipment and systems and any defect found on any item of equipment or system shall be rectified by the Contractor at no cost to the contract.

In addition, the Contractor shall carry out on site tests to determine the actual fault level, which shall be measured at the main switchgear panel incoming terminal and a label attached to the switchgear stating date and measured fault level in KA and the external earth loop impedance in ohms.

Earth loop impedance tests and insulation resistance test shall be repeated in front of the Engineer. All necessary labour, materials, consumables, plant and instruments shall be provided by the specialist switchgear contractor.

Similarly, the emergency lighting system shall be commissioned and demonstrated including the provision and commencement of the system log book.

It shall be a condition of the Contract that the Contractor shall produce a programme of dates to cover the testing and demonstrating of equipment and installation.

The programme dates shall be agreed with the Engineer.

Upon completion of the installation, the Contractor shall issue completion and inspection certificates for the whole installation prior to handover. Handover cannot be achieved without the appropriate certificates.

70-70-45 Low voltage distribution systems

110 Low voltage distribution system

The Contractor shall be responsible for visiting the site and understand the existing installation and what is required regarding the new installation. There is an existing chiller compound externally adjacent to the building as indicated on the drawings. The existing chiller within this compound is required to be kept in operation during the installation of an additional new chiller. This existing chiller feeds the existing Aquariums and associated comms room.

There is an existing distribution board in the existing chiller compound fed from a sub-main cable routed from the main panel within the main building. The existing distribution board within the existing chiller compound and associated circuits shall be stripped out and removed from site and discarded at an appropriate time during the programme of works to minimise the power down time for the existing chiller. The stripping out of the existing distribution feeding the existing chiller and associated services shall be coordinated with the client.

The existing sub-main cable feeding this distribution board shall be rerouted to form supply to the new DB/CC within the new chiller compound. This sub-main cable shall be tested and commissioned as if it were a new install.

A new DB/CC shall be provided to the new chiller compound to provide power to the new and existing chillers and associated services. The new DB/CC shall form feed to the new chiller control panel within the chiller compound. The new DB/CC shall be provided with check meter, outgoing ways to the chillers and mechanical control panel shall be provided with check meters.

The electrical system shall be provided with earthing in accordance with BS 7671 and BS7430.

70-70-75 Small power systems

110 Hard wired low voltage small power system

Design Parameters

The electrical installation shall be in accordance with the requirements of the following legislation:

- Electricity at Work Act
- Electricity Supply Regulations
- British Standards and Codes of Practice
- Health and Safety at Work Acts
- Local Authority Regulations
- BS 7671

Existing small power to the existing chiller compound shall be stripped out and removed from site. Devices within plant areas and shall utilise surface mounted metal clad accessories fed via surface mounted galvanised steel conduit.

The circuit arrangements shall generally take the form of ring or radial circuits protected by MCBs of the ratings shown and 30mA RCDs or RCBOs for socket outlet circuits.

Wiring shall take the form of 600/1000V grade LSF insulated single core cables drawn into cable tray and/or conduit run within the ceiling voids.

Electrical outlets and accessories shall be in full compliance with the requirements of BS 8300 and Part M of the Building Regulations, wiring devices shall be mounted in suitably accessible positions as detailed on the drawings or in accordance with mounting heights indicated on the Architect's drawings.

- Circuits shall take the form of 32 A ring circuits or radials. All RCDs shall be of the passive type and located within the associated distribution board.
- Specialist equipment/fixed equipment shall be served by dedicated radial circuits. Final connections shall be via switched/unswitched double pole fused connection units with integral neon outlets or suitably rated rotary isolators.

Location Requirement Installation

Plant Areas/within void spaces provide fixed equipment supplies to mechanical equipment and 13A twin socket outlet as required Surface mounted, MK Metalclad.

Electrical Services for Mechanical Systems

The system shall facilitate the proposals both in terms of mains power and control wiring.

The following items, with all control wiring to be 24V AC/DC and installed within dedicated containment shall be provided.

- (a) All associated 230V power supplies, control interlocks and 2no. Chiller Auxiliary supplies.
- (b) All associated 230V suppliers to the 2no. Chiller Hydraulic packs
- (c) All associated 400V power supplies the 2no. Chillers
- (d) All associated supplies to the Pressurisation unit, Dosing unit and chilled water pumps
- (e) All necessary contactors/interfaces required to ensure that mechanical equipment is shut down upon fire alarm activation.
- (f) The system shall incorporate a site compatible BMS equivalent controller to enable all plant to be centrally interrogated and time zones adjusted/set as necessary remotely.
- (g) All new plant systems shall be provided with local lockable rotary pattern isolators of suitable number of poles and rating.

70-80-35 General lighting systems

110 Hard wired general lighting system

Design Parameters

The installation shall provide a system of anti-panic and emergency escape lighting to the building to enable safe evacuation upon failure of the normal supply.

The emergency lighting installation shall be in accordance with the requirements of the following documents/legislation:

- BS 7671:
- BS 5266:
- Other Relevant British Standards and Codes of Practice
- CIBSE Code for Lighting and Lighting Guides
- Specific Requirements of Local Building Control and Fire Officer
- ICEL Emergency Lighting
- Health and Safety at Work Acts
- Local Authority Regulations

- The project Fire Strategy

The Contractor shall be responsible for the stripping out and removal from site of the existing lighting and associated services and cabling within the existing chiller compound. A new lighting system shall be installed within the new chiller compound via surface mounted linear LED type luminaires internally and circular IP65 rated surface mounted luminaires externally. The luminaires internally to the chiller compound shall be Thorn Force LED pro or equal and approved, the external luminaires shall be Thorn Piazza LED or equal and approved.

Emergency lighting within the chiller compound shall be provided in line with BS 5266, external lighting shall be provided externally to the access doors.

The internal lighting shall be controlled via grid type switches, the external lighting shall be controlled via combine Photocell/PIR. The lighting system shall be wired via 600/1000V grade LSF insulated singles drawn in trunking and conduits, protected via RCBO. 200 lux at floor level required within the chiller compound.

75-65-30 Fire detection and alarm systems

110 Fire detection and alarm systems in non-domestic premises

Design Parameters

The installation shall provide interactive fire detection and alarm system to protect new chiller enclosure building. The fire detection and alarm system shall be supplied and installed by the specialist supplier engaged by the Contractor.

The fire alarm detection system shall be installed in accordance with the requirements of the following documents/legislation:

- BS 7671:
- BS 5839-1 and BS 5839 -6: Fire Detection and Alarm System
- Other Relevant British Standards and Codes of Practice
- Specific Requirements of Local Building Control and Fire Officer
- EN 54

- Health and Safety at Work Acts
- Local Authority Regulations
- The project Fire Strategy

The chiller enclosure building shall be provided with fire alarm system protection as indicated on the drawings. The devices within the chiller compound shall be wired from a loop within the main building.

The fire alarm design, installation, commissioning and testing shall be carried out by an approved BAFE/LPC/BFSPA approved body who shall certify the scheme during the appropriate project stages on completion in accordance with prescribed standards.

The building shall be provided with a complete system comprising of addressable combined optical smoke detectors and flashing beacon, combined optical smoke detector and sounder, sounder bases and xenon flashing beacons.

Wiring of the equipment shall be in accordance with the manufacturer of the system but shall be in a minimum of 1.5 mm² FP200 cable with red LSF over-sheath insulated BS 6387 Category CWZ cabling. Cabling shall be installed on a dedicated medium duty cable tray or fixed direct to building utilising proprietary cable clips PVC coated steel clips.

All devices will be labelled.

(a) Automatic detectors shall be plug-in interchangeable type surface mounted and complete with LED to indicate when operated.

(b) Smoke detectors shall be of the optical type

Cabling shall be fitted with Critchley identification bands at each termination location. The identification band shall be a yellow background with black lettering and indicate the loop reference and numerical device number of the loop.

Operation of a manual call point or multiple point detection or zone activation shall immediately result in the following via interface units as required:

a) Display of the appropriate audible and visual signals on the control and indicating equipment.

b) Operation of outputs to ancillary services via interface units as required

c) Operation of the fire evacuate output to the fire alarm signalling system.

Manual call points shall match the site standard, be coloured red and of a type complying with BS 5839: Part 2 which can be operated safely by hand without the use of a striker.

They shall, as a minimum, be provided on final exits from the building. Additional manual call points shall be provided, to ensure that the maximum distance of travel to the manual call point from any point in the building does not exceed 30m.

Manual call points shall generally be surface or flush mounted (as appropriate) at a height of 1.1meter centres above finished floor level.

Automatic detectors shall comply with BS 5445: Parts, 5, 7 and 8 as appropriate.

High performance optical smoke and heat detectors shall have a common base to permit interchangeability. They shall incorporate a red LED, mounted in the detector or the base to indicate operation. Bases shall be fixed to suitable back boxes. Any special fixing brackets for mounting detectors in shall be provided as part of the Contract.

Where heat detectors are used, the type of heat detector used shall be determined on the basis of the ambient temperature and condition.

All wiring, interfacing relays and small power requirements required for interfacing with auxiliary systems shall be installed by the Fire Alarm Specialist. The interfacing relays shall be installed in suitable junction boxes adjacent to the item of plant or equipment. They shall take the form of volt-free change over contacts connected on the local loop.

The outputs shall be operated in accordance with the operational sequence contained in this specification. Upon clearance of a fire condition, the plant shall only be re-initiated following operation of a remote key switch located adjacent to the fire alarm control panel.

The fire alarm system zone diagram adjacent to the location of the fire alarm panel shall be updated.

75-75-05 Building monitoring and management systems

150 Building monitoring and management system

The Contractor shall appoint a specialist controls contractor to design, procure, supply, install, test & commission a Trend BMS mechanical controls system to serve the existing and new chiller installation and interface with existing building BMS updated with new supervisor graphics to reflect the changes to the system. The control specialist shall provide power from isolators the two chillers (one & new one existing), chilled water pumps (duty/standby), pressurisation unit, chemical dosing unit and control wiring to the entire installation. The control specialist shall provide cable containment as required.

The new BMS control panel shall have an IQ8 view to allow local interrogation of the system.

The control specialist will allow for maintaining a control strategy for the existing chiller to maintain it in operation while the existing systems and enclosure are removed.

A section of the existing Aquarium chilled installation is included on the BMS head end graphics which will need to be updated to include all new control items. The graphic will allow full adjustment of the control parameters for the chiller system.

The chillers shall be controlled from the BMS alternating lead/lag to equalise run hours. They shall be controlled from the thermostats mounted in the buffer vessel to ensure they do not start more often than recommended and provide chilled water at 6 deg C to the chilled water system. Flow and return chilled water temperatures and the buffer vessel temperatures shall be monitored, logged and displayed on the front end graphic.

The chilled water pumps shall be run as duty/standby via Bacnet control cards in each pump head with lead/ lag control to equalise run hours. Run hours for the chillers and pump heads shall be logged and displayed on the front end graphic.

The controls specialist shall be Lloret Controls System Ltd, Jon Adams 020 8410 4631 or equal and approved system

The exiting control panel shall be removed and disposed of in a suitable manner. The controller from the existing control panel shall be recovered and reused if possible or handed to the client as a spare.

A new BMS control interface panel will be supplied and installed within the new chiller enclosure with power supplies to chiller installation and BMS control panel from a new local distribution board by the electrical contractor. The power supplies to the chillers shall be terminated at a local isolator and the controls specialist shall wire from the local isolator to the chillers.

The control specialist shall provide power wiring for the pumps, pressurisation unit and dosing system.

The control specialist shall be responsible for any data wiring required and interfacing with the Clint to update the Supervisor terminal.

The new control interface panel will contain a new BMS controller that will be incorporated into the existing BMS network.

The new controller will have hard-wired connections to:

1. The existing and new chillers to enable /disable the operation, monitor a fault condition and allow remote control of the operating temperature.
2. The new chilled water pump to enable /disable the operation, monitor a fault condition.
3. The pressurisation unit to monitor a fault and high/low pressure conditions.
4. 4No Immersion temperature sensors for the CHW buffer vessel to provide set point adjustment and flow & return pipe temperature sensors for monitoring

The fascia of the control panel will provide HAND/OFF/AUTO selector switches and RUN/Fault indication lamps for each chiller, RUN/FAULT/HIGH PRESSURE/LOW PRESSURE indication lamps for the pressurisation unit, level fluid level warning for the dosing system, the fault /alarm indications shall also be indicated to the Supervisor terminal graphic.

The chillers will be continuously operated on a duty/standby principle with weekly duty rotation and each chiller will be graphically represented on the existing BMS head-end.

If there is no fault from the CHW pressurisation unit the duty chiller will be enabled to run and if a fault condition is monitored and alarm will be presented at the BMS head-end and the standby chiller will be enabled to run.

If there is a fault from the CHW pressurisation unit and alarm will be presented at the BMS head-end and both chillers will be disabled.

If the duty chiller is operating and CHW storage temperature in the buffer vessel does not meet the required temperature set-point within 15 minutes (set-point temperature will be user adjustable at the BMS head-end) the standby chiller will be enabled to operate until the CHW storage temperature is achieved.

The controls specialist shall supply a description of operation before the system commissioned to allow comment on the operation. The Des Op will fully describe the proposed operation of the plant in words.

The controls specialist shall be responsible for commissioning, testing and certifying their controls and electrical systems.

Specification

10/04/2018 - 16:31

60-45-10/110 Chilled water system

System outline

60-45-10/110 Chilled water system

- **System performance:** Installation of plant enclosure chilled water system
- **System:**
 - **Arrangement:** Two pipe.
 - **Pipeline circuits:** Variable flow.
- **Cooling source:** [90-40-10/330 Air cooled liquid chillers.](#)
- **Condensers:** [90-40-10/320 Air cooled condensing units.](#)
- **Pressurization units:** [90-10-70/400 Pressurization units.](#)
- **Pumps:** [90-10-70/360 Close coupled in line pumps.](#)
- **Water treatment:**
 - **Plant:** Automatic chemical dosing system
 - **Chemicals for closed circuit systems:** [90-15-95/317 Corrosion inhibitors for closed circuit systems.](#)
- **Pipelines:** Submit proposals.
- **Pipelines accessories:**
 - **Venting devices:** [90-10-60/310 Automatic air vents.](#)
 - **Separators:** [90-10-60/355 Combined air and dirt separators.](#)
 - **Gauges:** [90-10-60/370 Pressure gauges.](#)
 - **Accessories:** [90-10-60/400 Pipeline strainers](#) and [90-10-60/405 Pipe sleeves.](#)
- **Valves:**
 - **Isolating valves:** As per schedule
 - **Check valves:** As per schedule
 - **Regulating valves:** As per schedule
 - **Draining and venting devices:** As per schedule
 - **Accessories:** [90-10-90/360 Test points.](#)
- **Thermal insulation:** [90-90-40/360 Phenolic foam insulation.](#)
- **Vibration isolation:** [90-90-95/350 Pad mountings.](#)
- **System accessories:** [90-90-60/390 Services supports.](#)
- **Plant and equipment identification:** [90-90-55/480 Mechanical plant and equipment identification labels;](#)
[90-90-55/490 Valve charts and schematics;](#)
and [90-90-55/495 Valve identification labels.](#)
- **Execution:** [60-45-10/610 Removing chilled water systems;](#)
[60-45-10/615 Installing water based cooling systems;](#)
[60-45-10/620 Filling and pressure testing of chilled water systems;](#)
[60-45-10/630 Flushing and pre-commission cleaning of chilled water systems;](#)
and [60-45-10/640 Installing water treatment for chilled water and condenser water systems.](#)

- **System completion:** [60-45-10/810 Commissioning chilled water systems](#); [60-45-10/830 Performance testing chilled water systems](#); [60-45-10/840 Inspection and test records for chilled water systems](#); and [60-45-10/850 Demonstrations](#).

Execution

60-45-10/610 Removing chilled water systems

- **Scope:** The older existing ICS chiller is to be removed and suitably disposed of. The chiller shall be isolated, drained down, made safe, insulation stripped, pipework cut back and blanked, ventilation ductwork and attenuators cut back and removed, all extraneous brackets, supports etc. All removed disposed of with a suitable certified disposal company. The cooling fluid shall be captured and disposed of with a certified disposal company. No cooling fluid shall be allowed to escape into the environment or into the drainage system. The existing surplus chiller located on site shall also be removed and disposed of in a suitable manner.

60-45-10/615 Installing water based cooling systems

- **Standard:** To [BS EN 1264-4](#).

60-45-10/620 Filling and pressure testing of chilled water systems

- **Testing:** In accordance with [BSRIABG 29/2012](#).
- **Inspection and witnessing:** In accordance with the procedure in [BSRIABG 29/2012](#).
- **Duration of test:** 1 h.

60-45-10/630 Flushing and pre-commission cleaning of chilled water systems

- **Preliminary checks:** Thoroughly inspect pipework. Complete pressure tests before cleaning or chemical treatment.
- **Flushing:** In accordance with [BSRIABG 29/2012](#).
- **Cleaning:** In accordance with [BSRIABG 29/2012](#) and [BG 50/2013](#).
- **Waste products:** Neutralize, and dispose of to drain. Preferably direct to manhole.

60-45-10/640 Installing water treatment for chilled water and condenser water systems

- **Treatment:**
 - **Closed circuit systems:** In accordance with [BSRIABG 50/2013](#).
 - **Open circuit systems:** In accordance with [BSRIAAG 2/93](#).
- **Water sampling:** In accordance with [BS 8552](#).

90-10-60/640 Installing combined air and dirt separators

- **Position:** Fit with dirt drain at lowest point for removing dirt that sinks.

90-10-70/610 Installation of pumps generally

- **Pipeline connections:** Arrange to prevent transmission of pipeline forces to pump casing.
- **Pressure gauge tappings:** Provide in flow and return pipeline connections and in common suction and delivery pipeline.

- **Brackets:** Support pipeline mounted pumps on purpose made brackets lined with vibration absorbent material.
- **Alignment:** Align and balance to minimize vibration.
- **Belt tension:** Correctly tension drive belts.
- **Access:** Provide adequate space for service and maintenance.
- **Identification plate:**
 - **Format:** Engraved.
 - **Details:** Manufacturer's name and address, serial number, duty and maximum head, speed and electrical loading.

90-10-70/630 Installing pressurization units

- **Location of expansion vessel:** In the system return pipeline close to the heat source or chilled water unit.

90-10-70/640 Commissioning preparation

- **In-line pumps:** Change impeller if necessary.
- **Belt driven pumps:** Change belt and pulley if necessary.

90-40-10/610 Installing chillers and cooling towers generally

- **Fixing of equipment and components:** Fix on purpose made bases or supports.
- **Pressure testing of joints:** Immediately before installation of lagging and casing. Submit results.

90-40-10/620 Installing chillers

- **General requirements:** [90-40-10/610 Installing chillers and cooling towers generally](#).
- **Position:** Provide space for air circulation across the condenser heat transfer surface.
- **Access:** Provide for inspection and servicing of chiller and ancillary equipment.

90-90-55/610 Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

90-90-55/620 Installing valve charts and schematics

- **Fixing:** Contractor's choice.
- **Position:** Plant room.

90-90-55/630 Installing valve identification labels

- **Fixing:** Secure with metal chain.

System completion

60-45-10/810 Commissioning chilled water systems

- **Pre-commissioning:** In accordance with [BSRIA2/2010](#) and [CIBSE Commissioning Code W](#).
- **Commissioning:** In accordance with [BSRIA2/2010](#) and [CIBSE Commissioning Code W](#).
- **Seasonal commissioning:** In accordance with [BSRIA2/2013](#).

- **Variable flow systems:** In accordance with [CIBSEKS09 Commissioning variable flow pipework systems](#).
- **Notice (minimum):** 24 h.

60-45-10/840 Inspection and test records for chilled water systems

- **Records for water systems:** In accordance with [BSRIABG 2/2010 Commissioning water systems](#).
- **Record sheets:**
 - **Submission:** On completion.
 - **Number of copies:** Three.

60-45-10/850 Demonstrations

- **Running of plant:**
 - **Operation:** Run, maintain and supervise the installations under normal working conditions.
 - **Duration:** To be agreed.
- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

Ω End of system

70-70-25/110 Earthing and bonding system

System outline

70-70-25/110 Earthing and bonding system

- **System performance:** [70-70-25/210 Design of earthing and bonding systems](#); [70-70-25/240 Functional earthing design](#); and [70-70-25/290 Design to minimize undesirable static electricity](#).
- **Main incoming earth:** Existing.
- **Main earth electrode type:** Existing.
- **Main protective bonding conductors:** [90-55-15/343 Single core non-sheathed cables with thermoplastic PVC insulation](#) and [90-75-50/390 Copper tape](#).
- **Supplementary bonding conductors:** [90-55-15/343 Single core non-sheathed cables with thermoplastic PVC insulation](#).
- **Circuit protective conductors:** Cable armour and auxiliary.
- **Earth terminal type:** [90-75-50/310 Earth bars](#).
- **Accessories:**
- **Electrical identification:** [90-90-55/390 Equipment labels and warning notices type A](#) and [90-90-55/395 Electrical diagrams](#).
- **Execution:** [70-70-25/620 Measurement of characteristics of existing installations](#); [70-70-25/630 General installation](#); [70-70-25/640 Installing earth conductor joints and connections](#); [70-70-25/660 Installing earthing conductor](#); [70-70-25/680 Installing supplementary bonding conductors](#); [70-70-25/720 Notices and labels](#); and [70-70-25/730 Installing functional earthing conductors](#).
- **System completion:**

System performance

70-70-25/210 Design of earthing and bonding systems

- **Standards:** In accordance with [BS 7671](#) and [BS 7430](#).
- **Design:** Complete the design of the earthing and bonding systems.
- **Earthing conductor:** Size in accordance with [BS 7671](#), Regulation 543.1.3 and Size in accordance with [BS 7671](#), Regulation 543.1.4.
- **Main protective bonding conductors:**
 - **Connect the following to the main earthing terminal:**
 - **Size (minimum):** In accordance with [BS 7671](#), Regulation 544.1.1.
- **Supplementary bonding conductors:**
 - **Bond the following:**
 - **Size (minimum):** Minimum of 2.5 mm² if sheathed or where mechanical protection is provided, otherwise 4 mm².

- **Circuit protective conductors:** Size in accordance with [BS 7671](#), Regulation 543.1.3 and Size in accordance with [BS 7671](#), Regulation 543.1.4.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

70-70-25/240 Functional earthing design

- **Standard:** To [BS 6701](#).
- **Objectives:**
- **Connection type:**

70-70-25/290 Design to minimize undesirable static electricity

- **Design:**

Products

90-55-15/343 Single core non-sheathed cables with thermoplastic PVC insulation

- **Manufacturer:**
- **Standards:** To [BS EN 50525-1](#) and [BS EN 50525-2-31](#).
- **Third party certification:**
- **Cable type:** Manufacturer's standard.
- **Size:**
- **Execution:** [90-55-15/635 Installing low voltage cables](#) and [90-55-15/660 Installing low voltage cables in conduit and trunking](#).

90-75-50/310 Earth bars

- **Manufacturer:** Submit proposals.
- **Material:**
 - **Bar type:** Hard drawn copper to [BS EN 13601](#).
 - **Support:** PVC-U.
- **Size:**
 - **Profile:** 50 mm x 6 mm.
 - **Length:**
- **Predrilled connections (minimum):**
- **Disconnecting links:**
- **Execution:**

90-75-50/390 Copper tape

- **Manufacturer:**
- **Standards:** To [BS EN 13601](#).
- **Size:**
- **Cover:**
- **Execution:**

90-90-55/390 Equipment labels and warning notices type A

Shared by: [70-70-25/110 Earthing and bonding system](#); and [70-70-45/110 Low voltage distribution system](#).

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:**
 - **Lettering:**
- **Typography:**
 - **Font:**
 - **Size:**
- **Notice wording:** Distribution Board reference, as indicated on drawing ???.

90-90-55/395 Electrical diagrams

Shared by: [70-70-25/110 Earthing and bonding system](#); and [70-70-45/110 Low voltage distribution system](#).

- **Material:** Engraved plastics laminate.
- **Format:** Single line engineering drawings to [BS EN 61082-1](#).
- **Information to be included:** Supply characteristics. Maximum demand. Cable types and sizes. Switchgear ratings. Protective device types, ratings and function. Prospective fault current values at each item of switchgear. Earth fault loop impedance values at each item of switchgear. Circuits containing equipment vulnerable to testing.

Execution

70-70-25/620 Measurement of characteristics of existing installations

- **External earth fault loop impedance (Ze):** Direct measurement.
- **Earth fault loop impedance (Zs):** Calculate from measurement of the sum of the resistance of the line conductor and the resistance of the circuit protective conductor and addition to external earth loop impedance (Ze) and Direct measurement.
- **Results:** Submit.

70-70-25/630 General installation

- **Standards:** In accordance with [BS 7430](#) and [BS 7671](#).

70-70-25/640 Installing earth conductor joints and connections

- **Number of joints:** Minimize.
- **Contact surfaces:** Clean. Coat with corrosion inhibitor.
- **Bimetallic joints:** Do not cross-contaminate.

- **Protection to joints and connections:**
- **Connections to test points:** Clamp.
- **Copper tape jointing:**
 - **Type:**
 - **Copper tape overlap (minimum):** 100 mm.
- **Protective cable terminations:** Compression lugs with phosphor bronze nuts, bolts and washers.

70-70-25/660 Installing earthing conductor

- **Conductor location:** Install between the main incoming earth and the main earthing terminal in one continuous length.
- **Connection:** Make with compression lugs and phosphor bronze nuts and bolts and spring washers.
- **Earthing conductor route:**
- **Connection to earth electrodes:** Heavy duty copper alloy mechanical clamps.
- **Protection to earthing conductor:** Rigid conduit.

70-70-25/680 Installing supplementary bonding conductors

- **Earth connections:** Connect with compression lugs.

70-70-25/720 Notices and labels

- **Earth bars:** Describe each connection and label with 'SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE'.
- **Earthing and main protective bonding connections:** Describe each connection and label with 'SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE'.
- **Supplementary bonding connections:** Describe each connection and label with 'SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE'.
- **Telecommunications functional earth connections:** Label with 'TELECOMMS EARTH – DO NOT REMOVE'.

70-70-25/730 Installing functional earthing conductors

- **Standard:** To [BS 6701](#).
- **Labelling:** Identify the purpose of functional earth cables along their length using clip-on cable markers.
- **Spacing (maximum):** 3 m.

90-55-15/635 Installing low voltage cables

- **Standard:** In accordance with [BS 7671](#).
- **Timing:** Do not start internal cabling until building enclosure provides permanently dry conditions.
- **Preparation:** Store cables above 5°C for 24 hours before installation. Clear cable path of debris.
- **Installation temperature (minimum):** 5°C.

- **Cables:** Install in one length. Dress cables flat, free from twists, kinks and strain.
- **Cable pulling:** Do not overstress. Prevent kinks and twisting of the cable.
- **Cable protection:** Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.
- **Concealed cable runs to wall accessories:** Run vertically from the accessory.
- **Exposed cable runs:**
- **Distance from other services running parallel (minimum):** 150 mm. Position cables below heating pipes.
- **Jointing and termination:**
 - **Final circuit cables:** At electrical accessories only.
 - **Core connections:** Using compression lugs to equipment without integral clamping terminals.
 - **Terminating cables when not using glands:** Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

90-55-15/660 Installing low voltage cables in conduit and trunking

- **Cable installation:** Orderly and capable of being withdrawn.
- **Single core wiring:** Arrange using the loop-in method.
- **Cables within trunking:** Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
- **Cables in vertical conduit:** Provide cable clamps in accessible conduit boxes at 5 m intervals.
- **Extra low voltage cables:** Install within a separate partition from low voltage cables where installed in multi compartment trunking.

Ω End of system

70-70-40/110 Inspection and testing of new low voltage electrical installations or changes to an existing installation

System outline

70-70-40/110 Inspection and testing of new low voltage electrical installations or changes to an existing installation

- **General requirements:**
 - **Electrical test engineer:** Electrical installation contractor.
 - **Approval:** [National Inspection Council for Electrical Installation Contracting \(NICEIC\)](#).
 - **Evidence of approval:** Submit.
 - **Test equipment calibration:** UKAS approved.
- **Execution:** [70-70-40/610 Test equipment calibration](#) and [70-70-40/620 Inspection and testing electrical installations generally](#).
- **System completion:** [70-70-40/860 Electrical installation certificates](#).

Execution

70-70-40/610 Test equipment calibration

- **Test equipment calibration:** UKAS approved.

70-70-40/620 Inspection and testing electrical installations generally

- **Standards:** In accordance with [BS 7671](#) and [IET Guidance Note 3](#).
- **Notice before commencing tests (minimum):**
- **Installed equipment standards:** Verify and confirm compliance with the relevant equipment standards.
Verify and confirm that all parts of the fixed installation are selected and erected correctly.
Verify and confirm that the fixed installation is free from visible damage or otherwise defective.
- **Electronic devices:** Isolate to prevent damage during testing.
- **Continuity of protective conductors:**
 - **Parallel earth paths:** Isolate before testing.
 - **Equipment:** Continuity tester with short circuit current of at least 200 mA, and a no load d.c. or a.c. voltage between 4 V and 24 V.
- **Insulation resistance (minimum):**
 - **SELV and PELV circuits:**
 - **Other circuits less than or equal to 500 V (excluding SELV and PELV):** 2 megohm when tested at 500 V d.c.
 - **Circuits above 500 V:**
- **External earth fault loop impedance (Ze):** Direct measurement.
- **Connection of test equipment to existing switchgear:** Submit proposals.
- **Earth fault loop impedance (Zs):** By direct measurement.
- **Measurement locations:** Origin, switchgear, fixed equipment and outlets, circuit extremities.

- **Prospective fault current:**
 - **Method:** Direct measurement.
 - **Location:** Origin, and at points where protective devices are required to operate under fault conditions.
- **Phase sequence:** Verify.
- **Cable containment:** Measure electrical continuity and insulating properties of containment. Submit results.

System completion

70-70-40/860 Electrical installation certificates

- **Standard:** In accordance with [BS 7671](#), Appendix 6 and To [National Inspection Council for Electrical Installation Contracting \(NICEIC\)](#) standard.
- **Format:** Electronic, type written results.
- **Test equipment identity:** Record on test certificates.
- **Certificates of calibration:** Submit for each test instrument.
- **Schedule of test results:** Submit three copies.

Ω End of system

70-70-45/110 Low voltage distribution system

System outline

70-70-45/110 Low voltage distribution system

- **System performance:** [70-70-45/210 Design of low voltage distribution systems](#); [70-70-45/215 Low voltage distribution circuit cables generally](#); [70-70-45/220 Selection of conduit, trunking and ducting](#); [70-70-45/230 Input power supply characteristics](#); and [70-70-45/235 Service conditions for low voltage switchgear and controlgear assemblies](#).
- **Connection to low voltage supply:** Submit proposals.
- **Switchgear:** New MCB distribution shall be provided
- **Distribution circuit cabling:** Existing
- **Cable accessories:** [90-55-10/320 Cable bands](#).
- **Containment:** [90-55-10/335 Cable trays](#).
- **Containment accessories:** [45-50-10/335 Hexagon head stainless steel nuts and bolts](#).
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Monitoring and metering:** [90-65-55/325 Digital multifunction metering equipment](#).
- **Power conditioning equipment:** Not required
- **Accessories:** [90-50-45/470 Control and protective switching devices](#).
- **Electrical identification:** [90-90-55/395 Electrical diagrams](#); [90-90-55/390 Equipment labels and warning notices type A](#); and [90-90-55/390 Equipment labels and warning notices type B](#).
- **Execution:** [70-70-45/610 Removing low voltage distribution systems](#); Removal Existing chiller compound distribution board
[70-70-45/615 Alterations to existing switchgear](#); Reroute existing cable feeding existing chiller compound
and [70-70-45/625 Installing low voltage distribution systems](#).
- **System completion:** [70-70-45/810 Inspecting, testing and commissioning of switchgear generally](#); [70-70-45/820 Documentation](#); [70-70-45/830 Spares and consumables](#); and [70-70-45/840 Maintenance](#).

System performance

70-70-45/210 Design of low voltage distribution systems

- **System designer:** Member of the Institution of Engineering and Technology ([IET](#)) and Member of the Chartered Institution of Building Services Engineers ([CIBSE](#)).
- **Design:** Complete the design of the low voltage distribution system.
- **Standard:** In accordance with [BS 7671](#).

- **Provision of low voltage distribution:** Provide electrical supplies to equipment requiring power.
- **Spare capacity throughout the low voltage distribution system:** 20%
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

70-70-45/215 Low voltage distribution circuit cables generally

- **Proposed selection of low voltage distribution cables:** Submit drawings, technical information, calculations and manufacturers' literature.
- **Conductor sizes (minimum):** Existing cable feeding existing chiller compound distribution board shall be rerouted and reused
- **Cable sizes not stated:** Submit.
- **Format:** Existing sub-main cable feeding the existing chiller compound distribution board shall be established and recorded as a part of the testing and commissioning process and submitted as a part of the O&M manual and electrical system infrastructure recorded details for this project.

70-70-45/220 Selection of conduit, trunking and ducting

- **Standard:** In accordance with [BS 7671](#).
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Conduit, trunking and ducting sizes not stated:** Refer to Drawings.

70-70-45/230 Input power supply characteristics

- **Supply impedance:** Impedance shall be measured and recorded as a part of the testing and commissioning process
- **Earthing type:** Earthing shall be provided in line with BS7671 and BS 7430
- **Nominal voltage:** 400v
- **Nominal frequency:** 50 Hz.
- **Type of protective device in the input supply circuit:** Type D MCB to [BS EN 60898-1](#).

70-70-45/235 Service conditions for low voltage switchgear and controlgear assemblies

- **Service conditions:**
 - **Ambient air temperature:**
 - Indoor locations:** The existing cable is routed from main electrical room internal to the main building to the external and fixed to the main building wall on route to the chiller compound
 - Outdoor locations:**
 - **Relative humidity:**
 - Indoor locations:**
 - Outdoor locations:**
 - **Pollution degree category:**
 - **EMC environment:**

- **Altitude:**
- **Special service conditions:**
- **Conditions during transport and storage:**

Products

45-50-10/335 Hexagon head stainless steel nuts and bolts

- **Manufacturer:** Contractor's choice.
- **Bolts:**
 - **Standard:** To [BS EN ISO 4014](#) and To [BS EN ISO 4016](#).
 - **Size:**
 - Thread diameter:**
 - Length:**
 - **Steel grade:**
- **Nuts:**
 - **Standard:**
 - **Property class:**
- **Accessories:**
- **Execution:**

90-50-45/470 Control and protective switching devices

- **Manufacturer:** Schneider, MEM
- **Standards:** To [BS EN 60947-1](#) and [BS EN 60947-6-2](#).
- **Method of operation:** Submit proposals.
- **Method of control:**
- **Reset after overload:** Local manual resetting.
- **Rearming after short-circuit:**
- **Utilization category:**
- **Execution:**

90-55-10/320 Cable bands

- **Manufacturer:** Contractor's choice.
- **Material:** Manufacturer's standard.
- **Protective covering:**

90-65-55/325 Digital multifunction metering equipment

- **Manufacturer:** Schneider, MEM
- **Display type:** Manufacturer's standard.
- **Ingress protection (minimum):** Manufacturer's standard.
- **Metering functions:** Active energy (kWh);
Active power (kW);
Apparent power (kVA);

Frequency (Hz);
Maximum active power demand (kW);
Phase currents (A);
Power factor;
Pulsed output (kWh);
and Voltage between phases (V).

- **Mounting:** Submit proposals.
- **Execution:**

[90-90-55/390 Equipment labels and warning notices type A](#)

Shared by: [70-70-25/110 Earthing and bonding system](#); and [70-70-45/110 Low voltage distribution system](#).

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:**
 - **Lettering:**
- **Typography:**
 - **Font:**
 - **Size:**
- **Notice wording:** Distribution Board reference, as indicated on drawing ???.

[90-90-55/390 Equipment labels and warning notices type B](#)

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** Manufacturer's standard.
- **System notice wording:** Submit proposals.

[90-90-55/395 Electrical diagrams](#)

Shared by: [70-70-25/110 Earthing and bonding system](#); and [70-70-45/110 Low voltage distribution system](#).

- **Material:** Engraved plastics laminate.
- **Format:** Single line engineering drawings to [BS EN 61082-1](#).

- **Information to be included:** Supply characteristics. Maximum demand. Cable types and sizes. Switchgear ratings. Protective device types, ratings and function. Prospective fault current values at each item of switchgear. Earth fault loop impedance values at each item of switchgear. Circuits containing equipment vulnerable to testing.

Execution

70-70-45/610 Removing low voltage distribution systems

- **Scope:**

70-70-45/615 Alterations to existing switchgear

- **Standards:** In accordance with manufacturer's instructions and type test certification.
- **Alterations:** Submit records of alterations made to assemblies.

70-70-45/625 Installing low voltage distribution systems

- **Standard:** In accordance with [BS 7671](#).
- **Layout:** Position cabling and equipment to provide safe and easy access for operation and maintenance.

System completion

70-70-45/810 Inspecting, testing and commissioning of switchgear generally

- **Standard:** In accordance with [BS 7671](#).
- **Notice before testing and commissioning:**
- **Switches and circuit breakers:** Clean to remove all visible traces of dust.
- **Protective devices settings:** Configure to match the grading study.
- **Switchboard monitoring:** Continuous for 30 minutes following first energizing.
- **Additional inspecting and testing:** Check levelling and alignment of assembly.
Check operation of instruments and metering devices.
Check and adjust tightness of busbar connections and supports.
Check tightness of bolted connections.
Check busbar joints with duct or resistance measurements.
Check earth connections at compartments, switches and earth electrodes.
Check clearance of live parts from direct contact.
Check polarity and phase sequence of protective devices.
Check operation of protective devices using secondary and primary current injection.
Manually operate protective devices.
Carry out earth fault protection simulation tests.
Check functional operation of circuit breakers.
Check operation of switch tripping devices.
- **Testing and commissioning results:**
- **Certificates of calibration for meters and instruments:** Submit.

70-70-45/820 Documentation

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:**
- **Record drawings:**
 - **Content:**
 - **Drawing format:**
 - **Number of copies:**
- **Submittal date:** At handover.

70-70-45/830 Spares and consumables

- **Supply the following spares:**
 - **Fuses:**
 - **Operating handles for circuit breakers and switches:** One per device.

70-70-45/840 Maintenance

- **Servicing and maintenance:** Undertake.
- **Duration:**

Ω End of system

70-70-75/110 Hard wired low voltage small power system

System outline

70-70-75/110 Hard wired low voltage small power system

- **System performance:** [70-70-75/210 Design of low voltage small power systems;](#)
[70-70-75/215 Low voltage small power cables generally;](#)
and [70-70-75/220 Selection of conduit, trunking and ducting generally.](#)
- **Connection to low voltage supply:**
- **Final circuit cabling:** [90-55-15/334 Single core non-sheathed cables with LSHF insulation type A.](#)
- **Cable accessories:**
- **Containment:** [90-55-10/380 Rigid conduit type A](#) and [90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting.](#)
- **Containment accessories:**
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Final connections:**
- **Partial installation:** Required.
- **Power conditioning equipment:**
- **Electrical accessories and outlets:** [90-60-25/365 Multi-gang power outlets;](#)
[90-60-25/345 Standard socket outlets;](#)
and [90-60-25/320 Surface and concealed wiring enclosures.](#)
- **Controls and starters:**
- **Accessories:**
- **Electrical identification:**
- **Execution:**
- **System completion:**

System performance

70-70-75/210 Design of low voltage small power systems

- **Provision of small power:** For fixed and portable equipment requiring power.
- **Design:** Complete for the low voltage small power systems.
- **Standards:** In accordance with [BS 7671](#) and To [BS 8488](#).
- **Diversity:** In accordance with [IETGuidance Note 1](#).
- **Spare capacity throughout the small power system:** 20%.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

70-70-75/215 Low voltage small power cables generally

- **Standard:** In accordance with [BS 7671](#).

- **Proposed selection of low voltage cables:** Submit drawings, technical information, calculations and manufacturers' literature.
- **Conductor sizes (minimum):** 2.5 mm² and 4 mm².
- **Cable sizes not stated:** Submit.
- **Format:**

70-70-75/220 Selection of conduit, trunking and ducting generally

- **Standard:** In accordance with [BS 7671](#).
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Conduit, trunking and ducting sizes not stated:** Submit.

Products

90-55-10/380 Rigid conduit type A

Shared by: [70-70-75/110 Hard wired low voltage small power system](#); and [70-80-35/110 Hard wired general lighting system](#).

- **Manufacturer:**
- **Standards:** To [BS EN 61386-1](#) and [BS EN 61386-21](#).
- **Mechanical properties:**
 - Resistance to compression:
 - Resistance to impact:
- **Transport, installation and application:**
 - Lower temperature (minimum):
 - Upper temperature (maximum):
- **Resistance to bending:** Rigid.
- **Electrical characteristics:**
- **Resistance to external influences:**
 - Protection against ingress of solid objects (minimum): To [BS EN 60529](#), IP3X.
 - Protection against ingress of water (minimum): To [BS EN 60529](#), IPX0.
- **Resistance to corrosion:**
- **Tensile strength:**
- **Resistance to flame propagation:**
- **Suspended load capacity:**
- **Colour:**
- **Sizes (OD):**
- **Execution:**

90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting

Shared by: [70-70-75/110 Hard wired low voltage small power system](#); and [70-80-35/110 Hard wired general lighting system](#).

- **Manufacturer:**
- **Standards:** To [BS EN 50085-1](#) and [BS EN 50085-2-1](#).
- **Installation position:**
- **Format:**
- **Resistance to compression:**
- **Resistance to impact:**
- **Temperature properties:**
 - **Storage and transport temperature (minimum):**
 - **Installation and application temperature (minimum):**
 - **Application temperature (maximum):**
- **Resistance to flame propagation:**
- **Electrical properties:**
- **Protection by enclosure:**
 - **Protection against ingress of solid objects (minimum):** To [BS EN 60529](#), IP4X.
 - **Protection against ingress of water (minimum):** To [BS EN 60529](#), IPX1.
 - **Protection against access to hazardous parts (minimum):** To [BS EN 60529](#), IPXXD.
- **Access method:**
- **Screening:**
- **Sizes:**
- **Compartments:**
- **Accessories and fittings:**
 - **Generally:** Factory made by the cable trunking or ducting manufacturer and of the same material type and finish as the cable trunking or ducting.
 - **Types:**
- **Execution:**

90-55-15/334 Single core non-sheathed cables with LSHF insulation type A

- **Manufacturer:**
- **Standards:** To [BS EN 50525-1](#) and [BS EN 50525-3-41](#).
- **Third party certification:**
- **Cable type:**
- **Size:**
- **Execution:**

90-60-25/320 Surface and concealed wiring enclosures

- **Manufacturer:**
- **Standards:**
 - **Concealed enclosures:** To [BS 4662](#).
 - **Surface enclosures:** To [BS 5733](#).
- **Enclosure:**
 - **Material:**

- **Finish:**
- **Enclosure depth (minimum):**
- **Execution:**

90-60-25/345 Standard socket outlets

- **Manufacturer:**
- **Standard:** To [BS 1363-2](#).
- **Ingress protection (minimum):** To [BS EN 60529](#), IP 2X.
- **Arrangement:**
- **Control:**
 - **Type:**
 - **Switch position:**
 - **Indicator lamp:**
- **Interlock:**
- **Accessories:**
- **Mounting:**
- **Cable termination:** Screw.
- **Plate:**
 - **Material:**
 - **Finish:**
- **Insert colour:**
- **Execution:**

90-60-25/365 Multi-gang power outlets

- **Manufacturer:**
- **Standard:** To [BS 1363-2](#).
- **Rating:**
- **Outgoing ways:**
 - **Type:**
 - **Fusing:**
 - **Quantity:**
- **Features:**

Ω End of system

70-80-35/110 Hard wired general lighting system

System outline

70-80-35/110 Hard wired general lighting system

- **System performance:** [70-80-35/210 Design of general lighting systems](#);
[70-80-35/215 Design of emergency lighting systems](#);
[70-80-35/220 Escape route lighting](#);
[70-80-35/225 Open area lighting](#);
[70-80-35/230 High risk task area lighting](#);
[70-80-35/270 Lighting cables generally](#);
and [70-80-35/280 Conduit, trunking and ducting generally](#).
- **Final circuit cabling:** [90-55-15/334 Single core non-sheathed cables with LSHF insulation type B](#)
and [90-55-15/350 Thermosetting insulated and thermoplastic sheathed \(LSHF\) cables](#).
- **Containment:** [90-55-10/380 Rigid conduit type A](#);
[90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting](#);
and [90-55-10/380 Rigid conduit type B](#).
- **Containment accessories:**
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Luminaire types:** [90-60-50/410 Combined emergency luminaires](#);
[90-60-50/405 General purpose luminaires](#);
and [90-60-50/420 Self-contained emergency luminaires](#).
- **Lamp types:** [90-60-50/336 Self-ballasted LED lamps](#).
- **Connections to luminaires:** [90-55-15/388 Ordinary duty heat resistant PVC insulated and sheathed flexible cables](#);
[90-55-15/390 Ordinary duty PVC insulated and sheathed flexible cables](#);
[90-60-25/425 Ceiling roses](#);
and [90-60-25/430 Luminaire supporting couplers](#).
- **Lighting controls:**
- **Accessories:**
- **Electrical identification:**
- **Execution:**
- **System completion:**

System performance

70-80-35/210 Design of general lighting systems

- **Design:** Complete the design of the general lighting systems and Complete commissioning checklist in accordance with [Commissioning Code L](#), Appendix LA2.
- **Standard:** To [BS EN 12464-1](#) and In accordance with [SLLCode for lighting](#).
- **Design calculations:**

- **Submit the following information:**

70-80-35/215 Design of emergency lighting systems

- **System designer:**
- **Design:** Complete the design of the emergency lighting and signage systems.
- **Standards:**
- **Submit the following information:** Luminaire layout drawings;
Luminaire photometric data, including lamp light output data at beginning and end of battery discharge;
Lamp and luminaire technical information;
and Schedule of design and calculated uniformity values.
- **Emergency lighting classification:**
 - **Type:** Stand alone 3 hour emergency maintained
 - **Mode of operation:**
 - **Facilities:**
 - **Duration of emergency mode:** 180 minutes.

70-80-35/220 Escape route lighting

- **Position:** Refer to Drawings.
- **Minimum horizontal illuminance at floor level on centre line of escape route:** 1 lx.

70-80-35/225 Open area lighting

- **Position:** Refer to Drawings.

70-80-35/230 High risk task area lighting

- **Position:**
- **Minimum maintained illuminance on the reference plane:** 200 lux within the chiller compound

70-80-35/270 Lighting cables generally

- **Standard:** In accordance with [BS 7671](#).
- **Proposed selection of low voltage cables:** Submit drawings, technical information, calculations and manufacturers' literature.
- **Conductor sizes (minimum):**
 - **Lighting circuits:** 2.5mm.
 - **Final connection:**
- **Cable sizes not stated:** Submit.
- **Format:**

70-80-35/280 Conduit, trunking and ducting generally

- **Standard:** In accordance with [BS 7671](#).
- **Requirement:** Submit proposals, including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Conduit, trunking and ducting sizes not stated:** Submit.

Products

90-55-10/380 Rigid conduit type A

Shared by: [70-70-75/110 Hard wired low voltage small power system](#); and [70-80-35/110 Hard wired general lighting system](#).

- **Manufacturer:**
- **Standards:** To [BS EN 61386-1](#) and [BS EN 61386-21](#).
- **Mechanical properties:**
 - Resistance to compression:
 - Resistance to impact:
- **Transport, installation and application:**
 - Lower temperature (minimum):
 - Upper temperature (maximum):
- **Resistance to bending:** Rigid.
- **Electrical characteristics:**
- **Resistance to external influences:**
 - Protection against ingress of solid objects (minimum): To [BS EN 60529](#), IP3X.
 - Protection against ingress of water (minimum): To [BS EN 60529](#), IPX0.
- **Resistance to corrosion:**
- **Tensile strength:**
- **Resistance to flame propagation:**
- **Suspended load capacity:**
- **Colour:**
- **Sizes (OD):**
- **Execution:**

90-55-10/380 Rigid conduit type B

- **Manufacturer:**
- **Standards:** To [BS EN 61386-1](#) and [BS EN 61386-21](#).
- **Mechanical properties:**
 - Resistance to compression:
 - Resistance to impact:
- **Transport, installation and application:**
 - Lower temperature (minimum):
 - Upper temperature (maximum):
- **Resistance to bending:** Rigid.
- **Electrical characteristics:**
- **Resistance to external influences:**
 - Protection against ingress of solid objects (minimum): To [BS EN 60529](#), IP3X.
 - Protection against ingress of water (minimum): To [BS EN 60529](#), IPX0.

- **Resistance to corrosion:**
- **Tensile strength:**
- **Resistance to flame propagation:**
- **Suspended load capacity:**
- **Colour:**
- **Sizes (OD):**
- **Execution:**

90-55-10/410 Cable trunking and cable ducting for wall and ceiling mounting

Shared by: [70-70-75/110 Hard wired low voltage small power system](#); and [70-80-35/110 Hard wired general lighting system](#).

- **Manufacturer:**
- **Standards:** To [BS EN 50085-1](#) and [BS EN 50085-2-1](#).
- **Installation position:**
- **Format:**
- **Resistance to compression:**
- **Resistance to impact:**
- **Temperature properties:**
 - **Storage and transport temperature (minimum):**
 - **Installation and application temperature (minimum):**
 - **Application temperature (maximum):**
- **Resistance to flame propagation:**
- **Electrical properties:**
- **Protection by enclosure:**
 - **Protection against ingress of solid objects (minimum):** To [BS EN 60529](#), IP4X.
 - **Protection against ingress of water (minimum):** To [BS EN 60529](#), IPX1.
 - **Protection against access to hazardous parts (minimum):** To [BS EN 60529](#), IPXXD.
- **Access method:**
- **Screening:**
- **Sizes:**
- **Compartments:**
- **Accessories and fittings:**
 - **Generally:** Factory made by the cable trunking or ducting manufacturer and of the same material type and finish as the cable trunking or ducting.
 - **Types:**
- **Execution:**

90-55-15/334 Single core non-sheathed cables with LSHF insulation type B

- **Manufacturer:**
- **Standards:** To [BS EN 50525-1](#) and [BS EN 50525-3-41](#).

- **Third party certification:**
- **Cable type:**
- **Size:**
- **Execution:**

90-55-15/350 Thermosetting insulated and thermoplastic sheathed (LSHF) cables

- **Manufacturer:**
- **Standard:** To [BS 7211](#).
- **Third party certification:**
- **Cable type:**
- **Size:**
- **Execution:**

90-55-15/388 Ordinary duty heat resistant PVC insulated and sheathed flexible cables

- **Manufacturer:**
- **Standards:** To [BS EN 50525-1](#) and [BS EN 50525-2-11](#).
- **Third party certification:**
- **Cable type:**
- **Size:**
- **Sheath colour:**
- **Execution:**

90-55-15/390 Ordinary duty PVC insulated and sheathed flexible cables

- **Manufacturer:**
- **Standards:** To [BS EN 50525-1](#) and [BS EN 50525-2-11](#).
- **Third party certification:**
- **Cable type:**
- **Size:**
- **Sheath colour:**
- **Execution:**

90-60-25/425 Ceiling roses

- **Manufacturer:**
- **Standard:** To [BS 67](#).
- **Rating:** 6 A.
- **Material:** Plastics.
- **Colour:** White.
- **Mounting:**
- **Execution:**

90-60-25/430 Luminaire supporting couplers

- **Manufacturer:**

- **Standard:** To [BS 7001](#).
- **Plug type:** Rewireable, independent.
- **Pin configuration:**
- **Colour:**
- **Cable type:**
- **Cable size:**
- **Flex length (maximum):**
- **Execution:**

90-60-50/336 Self-ballasted LED lamps

- **Manufacturer:**
- **Standards:** To [BS EN 62560](#) and [BS EN 62612](#).
- **Third party certification:**
- **Cap type:**
- **Wattage:**
- **Colour temperature:**
- **Colour rendering index (Ra):**
- **Rated life (minimum):**
- **Initial lumens (minimum):**
- **Energy efficiency label:**
- **Dimmable:**

90-60-50/405 General purpose luminaires

- **General requirements:** [90-60-50/440 Control gear generally](#).
- **Manufacturer:**
- **Standards:**
- **Electric shock classification:**
- **Photometric performance:** To [BS EN 13032-1](#).
- **Supply circuit conductor connections:** Screw terminals.
- **Internal fuse:**
- **Input voltage:** 230 V a.c.
- **Luminaire power factor:** Correct to minimum 0.9 lagging.
- **Luminaire type:**
- **Features:**
- **Ingress protection (minimum):**
- **Ballasts CELMA energy efficiency index (minimum):**
- **Control gear position:**
- **Lamps:**
 - **Number:**
 - **Type:**
- **Execution:**

90-60-50/410 Combined emergency luminaires

- **General requirements:** [90-60-50/440 Control gear generally](#).
- **Manufacturer:** Thorn
- **Standards:** To [BS EN 60598-1](#) and [BS EN 60598-2-22](#).
- **Third party certification:**
- **Electric shock classification:** Manufacturer's standard.
- **Photometric performance:** To [BS EN 13032-1](#) and [BS EN 13032-3](#).
- **Supply circuit conductor connections:** Screw terminals.
- **Internal fuse:**
- **Input voltage from normal supply:** 230 V a.c.
- **Input voltage from emergency supply:**
- **Luminaire power factor:**
- **Luminaire type:**
- **Features:**
- **Ingress protection (minimum):**
- **Ballasts CELMA energy efficiency index (minimum):**
- **Control gear position:**
- **Indicators:**
 - **Charging:**
 - **Fault:**
 - **Position within luminaire:** Readily visible. Fix to luminaire body.
- **Primary lamps:**
 - **Number:**
 - **Type:**
- **Secondary lamps:**
 - **Number:**
 - **Type:**
- **Accessories:**
- **Execution:**

90-60-50/420 Self-contained emergency luminaires

- **General requirements:** [90-60-50/440 Control gear generally](#).
- **Manufacturer:**
- **Standards:**
- **Third party certification:**
- **Photometric performance:** To [BS EN 13032-1](#) and [BS EN 13032-3](#).
- **Supply circuit conductor connections:** Screw terminals.
- **Internal fuse:**
- **Input voltage:** 230 V a.c.
- **Luminaire power factor:**
- **Mode of operation:**

- Duration:
- Luminaire type:
- Features:
- Ingress protection (minimum):
- Ballasts CELMA energy efficiency index (minimum):
- Control gear position:
- Indicators:
 - Charging:
 - Fault:
 - Position within luminaire: Readily visible. Fix to luminaire body.
- Graphical symbol format:
- Batteries:
 - Standard: To [BS EN 61951-1](#).
 - Type: Sealed nickel-cadmium.
 - Life (minimum) when operating under normal conditions at 25°C and subject to complete charge and discharge every 6 months: 4 years.
 - Labelling: Indelibly mark with year of manufacture and installation.
- Lamps:
 - Number:
 - Type:
- Execution:

90-60-50/440 Control gear generally

Shared by: [90-60-50/405 General purpose luminaires](#); [90-60-50/410 Combined emergency luminaires](#); and [90-60-50/420 Self-contained emergency luminaires](#).

- Third party certification: [ENEC](#).
- Ballasts:
 - For fluorescent lamps: To [BS EN 60921](#), [BS EN 61347-1](#) and [BS EN 61347-2-8](#).
 - For discharge lamps: To [BS EN 60923](#), [BS EN 61347-1](#) and [BS EN 61347-2-9](#).
- Lamp starters generally: To [BS EN 60927](#), [BS EN 61347-1](#) and [BS EN 61347-2-1](#).
- Electronic control gear:
 - For fluorescent lamps: To [BS EN 60929](#), [BS EN 61347-1](#) and [BS EN 61347-2-3](#).
 - For battery supplied self-contained emergency lighting: To [BS EN 61347-1](#) and [BS EN 61347-2-7](#).
 - For discharge lamps: To [BS EN 61347-1](#) and [BS EN 61347-2-12](#).
 - For LED modules: To [BS EN 61347-1](#) and [BS EN 61347-2-13](#) and [BS EN 62384](#).
- Digital addressable control gear:
 - For digital addressable fluorescent lamps: To [BS EN 62386-102](#) and [BS EN 62386-201](#).
 - For digital addressable self-contained emergency lighting: To [BS EN 62386-102](#) and [BS EN 62386-202](#).

- **For digital addressable high intensity discharge lamps:** To [BS EN 62386-102](#) and [BS EN 62386-203](#).
- **For digital addressable low voltage halogen lamps:** To [BS EN 62386-102](#) and [BS EN 62386-204](#).
- **For digital addressable incandescent lamps:** To [BS EN 62386-102](#) and [BS EN 62386-205](#).
- **For digital addressable LED modules:** To [BS EN 62386-102](#) and [BS EN 62386-207](#).

Ω End of system

75-65-30/110 Fire detection and alarm systems in non-domestic premises

System outline

75-65-30/110 Fire detection and alarm systems in non-domestic premises

- **System performance:** [75-65-30/210 Design of fire detection and alarm systems in non-domestic premises](#);
[75-65-30/230 Performance of fire detection and alarm systems](#);
[75-65-30/255 Actuation of fire protection systems](#);
[75-65-30/265 Interfaces to equipment](#);
and [75-65-30/285 Automatic transmission of alarm signals](#).
- **System manufacturer:** Existing.
- **System type:** Existing.
- **Detection devices:**
 - **Atmosphere:** Normal.
 - **Types:**
- **Equipment interconnectivity:**
- **Cable containment:** [90-55-10/335 Cable trays](#) and [90-55-10/380 Rigid conduit type C](#).
- **Containment accessories:**
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Internal alarms:**
 - **Primary:**
 - **Secondary:**
- **External alarms:**
- **Controls:**
- **System accessories:**
- **Execution:**
- **System completion:**

System performance

75-65-30/210 Design of fire detection and alarm systems in non-domestic premises

- **System designer:** Fire Alarm Specialist.
- **Standards:** Complete the design of the fire detection and alarm system in accordance with [BS 5839-1](#).
- **Category:** L3.
- **Coverage:**
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **System design certificate:** Submit with design proposals.

75-65-30/230 Performance of fire detection and alarm systems

- **Spare system capacity:** n/a
- **Number of devices per zone (maximum):** Refer to design drawing.

75-65-30/255 Actuation of fire protection systems

- **Standard:** In accordance with [BS 7273-4](#).
- **Objectives:** As existing.

75-65-30/265 Interfaces to equipment

- **Interfaces to equipment not forming part of the fire detection and alarm system:** Design system to interact with the equipment in the event of a fire or fault signal.
- **Equipment and mode of operation:** interface unit to be provided to the chiller control panel to switch of units in the event of fire

75-65-30/285 Automatic transmission of alarm signals

- **Means of signal transmission:**
 - **Primary:** existing
 - **Secondary:**
- **Transmission path monitoring:** Required.
- **Signals to be transmitted to ARC:** Separately identifiable signals for pre-alarm, alarm, fault, device isolated and zone isolated.

Products

90-55-10/360 Flexible conduit

- **Standard:** To [BS EN 61386-23](#).
- **Material:** Metallic.
- **Mechanical properties:**
 - **Resistance to compression:** Medium.
 - **Resistance to impact:** Medium.
 - **Resistance to bending:** Flexible.
 - **Tensile strength:** Medium.
 - **Suspended load capacity:** Medium.
- **Ingress protection (minimum):** To [BS EN 60529](#), IP x4.
- **Sizes (OD):** Contractor's choice.
- **Execution:** ;
[90-55-10/765 Conduit, trunking and ducting zones](#);
and [90-55-10/715 Installing pliable and flexible conduit](#).

90-55-10/380 Rigid conduit type C

- **Manufacturer:** Contractor's choice.
- **Standard:** To [BS EN 61386-21](#).
- **Material:** Metallic.

- **Mechanical properties:**
 - **Resistance to compression:** Medium.
 - **Resistance to impact:** Medium.
 - **Resistance to bending:** Rigid.
 - **Tensile strength:** Medium.
 - **Suspended load capacity:** Medium.
- **Ingress protection (minimum):** To [BS EN 60529](#), IP x4.
- **Sizes (OD):** Contractor's choice.
- **Execution:** [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/735 Installing conduit connections to equipment](#); and [90-55-10/765 Conduit, trunking and ducting zones](#).

Execution

[90-55-10/700 Installing conduit, trunking and ducting](#)

Shared by: [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); [90-55-10/735 Installing conduit connections to equipment](#); and [90-55-10/765 Conduit, trunking and ducting zones](#).

- **Standards:** To [BS 7671](#) and in accordance with [IET Guidance Note 1](#).
- **Preparation:** Cut square. Remove burrs and sharp edges to make smooth.
- **Protection of metallic conduit, trunking and ducting:**
 - **Joints and ends:** Remove grease, oil, dirt and rust before applying protective paint. Paint immediately following installation.
 - **Protective paint:**
 - Generally:** Compatible with conduit, trunking and ducting finish.
 - Type:** Match factory finish.
- **Cross-sectional area:** Maintain throughout the conduit, trunking and ducting length.
- **Arrangement:** Position vertically and horizontally in line with equipment served, and parallel with building lines.
- **Distance from other services running parallel (minimum):**
 - **Generally:** 150 mm.
 - **Above radiators:** 1000 mm.
- **Drainage of conduit, trunking and ducting:** Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.
- **Fire barriers:** Provide to maintain integrity of fire compartments.
- **Rewireable installations:** Enable rewiring from accessible boxes or accessories only.
- **Support:** Independently fix and support conduit, trunking and ducting from building structure.
- **Cleaning:** Clean insides of conduit, trunking and ducting before installing cables.
- **Cabling:** Install when conduit, trunking and ducting enclosure is complete.

- **Submittals:** Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.

[90-55-10/710 Installing conduit generally](#)

Shared by: [90-55-10/715 Installing pliable and flexible conduit](#); [90-55-10/720 Installing rigid metallic conduit](#); and [90-55-10/735 Installing conduit connections to equipment](#).

- **Fixing:** Fix securely. Fix boxes independently of conduit.
- **Changes of direction:** Conduit boxes or bends site formed by machine. Do not use elbows, tees or inspection bends.
- **Joints:**
 - **Generally:** Manufacturer's jointing fittings.
 - **Number of joints:** Minimize.
 - **Lengths of conduit:** Maximize.
 - **Open ends:** Plug.
 - **At movement joints in structure:** Manufactured expansion coupling. Install adaptable boxes on both sides of joint at a maximum distance of 300 mm.
- **Connections to boxes, trunking, equipment and accessories:** Screwed couplings with rubber bushes at open ends.
- **Conduit boxes:**
 - **Generally:** Install flush with finished surfaces. Provide extension rings if required.
 - **Fixing screws:** Countersunk, or round-headed screws.
 - **Number of fixings (minimum):** Two.
 - **Lids:** Fasten with brass slot pan head screws.
- **Rear outlet boxes:** Locate where surface conduits pass through walls to external equipment.
- **Draw-in boxes:**
 - **Spacing (maximum):** 10 m.
 - **Number of bends between draw-in boxes (maximum):** Two.
 - **Floors:** Do not install draw-in boxes in floors.
- **Conduit in walls:** Avoid concealed horizontal runs.
- **Suspended ceiling installations:** Fasten outlet boxes to structure above ceiling.

[90-55-10/715 Installing pliable and flexible conduit](#)

- **General requirements:** [90-55-10/710 Installing conduit generally](#) and [90-55-10/700 Installing conduit, trunking and ducting](#).
- **Joints:** Push fit.
- **Connections to trunking:** Female adaptors and externally screwed brass bushes.
- **Connections to equipment:** Flange mount.

[90-55-10/720 Installing rigid metallic conduit](#)

- **General requirements:** [90-55-10/710 Installing conduit generally](#) and [90-55-10/700 Installing conduit, trunking and ducting](#).

- **Fixings:** Distance saddle; Saddle; and Spacer bar saddle.
- **Joints:** Screwed.
- **Threaded conduits:** Tightly screw to ensure electrical continuity, with no thread showing.
- **Conduit connections to boxes and items of equipment, other than those with threaded entries:** Earthing coupling with male brass bush and protective conductor.

90-55-10/735 Installing conduit connections to equipment

- **General requirements:** [90-55-10/710 Installing conduit generally](#) and [90-55-10/700 Installing conduit, trunking and ducting](#).
- **Surface mounted equipment:**
 - **Concealed conduit:** Conceal the final connection.
 - **Exposed conduit:** Contain the final connection from the conduit box within flexible metal conduit.
- **Equipment subject to vibration:** Flexible metal conduit of adequate length to facilitate removal of equipment for maintenance. Final termination in swivel connectors.
- **Connections to external equipment:** [90-55-10/360 Flexible conduit](#).

90-55-10/765 Conduit, trunking and ducting zones

Shared by: [90-55-10/360 Flexible conduit](#); and [90-55-10/380 Rigid conduit type C](#).

- **General requirements:** [90-55-10/700 Installing conduit, trunking and ducting](#).
- **Ceiling voids:**
 - **Clear distance between underside of conduit, trunking and ducting and topside of ceiling (minimum):** 150 mm.

Ω End of system

75-75-05/150 Building monitoring and management system

System outline

75-75-05/150 Building monitoring and management system

- **System performance:** [75-75-05/210 Design](#) supply and install BMS controls system.
- **Cooling systems linked to BMMS:** Chilled water system.
- **Air conditioning systems linked to BMMS:**
- **Communication systems linked to BMMS:**
- **Cables:** As Specialist's recommendations.
- **Containment:** [90-55-10/325 Cable baskets](#) and [90-55-10/335 Cable trays](#).
- **Rewireable installations:** Required.
- **Concealed installations:** Required.
- **Control equipment power supply:** Mains supply.
- **Execution:** [75-75-05/610 Removing building monitoring and management systems](#) and [75-75-05/620 Installation of building monitoring and management systems](#).
- **System completion:** [75-75-05/820 Commissioning](#).

System performance

75-75-05/210 Design

- **Design:** Complete the design of the building monitoring and management system.
- **Standards:**
 - **Communications network:** To [BS EN 50174-1](#).
 - **Communications protocol:** To [BS EN ISO 16484-5](#).
 - **Documentation of plant and application specific functions:** To [BS EN ISO 16484-3](#).
- **Requirements:** Submit proposal including detailed design drawings, technical information, calculations and manufacturers' literature.

Execution

75-75-05/620 Installation of building monitoring and management systems

- **General:** Install in accordance with [BSRIAAG 9/2001](#).

System completion

75-75-05/820 Commissioning

- **General:** Commission in accordance with [BSRIAAG 9/2001](#) and [BCIAStart up and commissioning guide](#).

Ω End of system

External references report

BCIA	
Parent system	Clause
Building monitoring and management system	75-75-05/820 Commissioning
BSRIA	
Parent system	Clause
Chilled water system	60-45-10/810 Commissioning chilled water systems
Building monitoring and management system	75-75-05/620 Installation of building monitoring and management systems
Chilled water system	60-45-10/630 Flushing and pre-commission cleaning of chilled water systems
Chilled water system	60-45-10/620 Filling and pressure testing of chilled water systems
Chilled water system	60-45-10/620 Filling and pressure testing of chilled water systems
Chilled water system	60-45-10/840 Inspection and test records for chilled water systems
Chilled water system	60-45-10/640 Installing water treatment for chilled water and condenser water systems
Chilled water system	60-45-10/810 Commissioning chilled water systems
Chilled water system	60-45-10/640 Installing water treatment for chilled water and condenser water systems
Chilled water system	60-45-10/810 Commissioning chilled water systems
Building monitoring and management system	75-75-05/820 Commissioning
Chilled water system	60-45-10/630 Flushing and pre-commission cleaning of chilled water systems
CIBSE	
Parent system	Clause
Chilled water system	60-45-10/810 Commissioning chilled water systems
Chilled water system	60-45-10/810 Commissioning chilled water systems
Chilled water system	60-45-10/810 Commissioning chilled water systems
Hard wired general lighting system	70-80-35/810 Testing and commissioning of general lighting systems
AG 2/93	
Parent system	Clause
Chilled water system	60-45-10/640 Installing water treatment for chilled water and condenser water systems

AG 9/2001	
Parent system	Clause
Building monitoring and management system	75-75-05/620 Installation of building monitoring and management systems
Building monitoring and management system	75-75-05/820 Commissioning
BG 2/2010	
Parent system	Clause
Chilled water system	60-45-10/840 Inspection and test records for chilled water systems
Chilled water system	60-45-10/810 Commissioning chilled water systems
Chilled water system	60-45-10/810 Commissioning chilled water systems
BG 29/2012	
Parent system	Clause
Chilled water system	60-45-10/620 Filling and pressure testing of chilled water systems
Chilled water system	60-45-10/630 Flushing and pre-commission cleaning of chilled water systems
Chilled water system	60-45-10/620 Filling and pressure testing of chilled water systems
Chilled water system	60-45-10/630 Flushing and pre-commission cleaning of chilled water systems
BG 44/2013	
Parent system	Clause
Chilled water system	60-45-10/810 Commissioning chilled water systems
BG 50/2013	
Parent system	Clause
Chilled water system	60-45-10/630 Flushing and pre-commission cleaning of chilled water systems
Chilled water system	60-45-10/640 Installing water treatment for chilled water and condenser water systems
BS 3790	
Parent system	Clause
Chilled water system	90-10-70/320 Pumps generally
BS 5422	
Parent system	Clause
Chilled water system	90-90-40/360 Phenolic foam insulation
Chilled water system	90-90-40/360 Phenolic foam insulation
BS 5975	

Parent system	Clause
	00-50-70/750A Existing structures
BS 7074-3	
Parent system	Clause
Chilled water system	90-10-70/400 Pressurization units
Chilled water system	90-10-70/400 Pressurization units
BS 8552	
Parent system	Clause
Chilled water system	60-45-10/640 Installing water treatment for chilled water and condenser water systems
BS EN 10226-1	
Parent system	Clause
Chilled water system	90-10-70/320 Pumps generally
BS EN 1092-2	
Parent system	Clause
Chilled water system	90-10-70/320 Pumps generally
BS EN 1092-3	
Parent system	Clause
Chilled water system	90-10-70/320 Pumps generally
BS EN 1264-4	
Parent system	Clause
Chilled water system	60-45-10/615 Installing water based cooling systems
BS EN 12812	
Parent system	Clause
	00-50-70/750A Existing structures
BS EN 13166	
Parent system	Clause
Chilled water system	90-90-40/360 Phenolic foam insulation
BS EN 13831	
Parent system	Clause
Chilled water system	90-10-70/400 Pressurization units
Chilled water system	90-10-70/400 Pressurization units
BS EN 14511-1	
Parent system	Clause
Chilled water system	90-40-10/330 Air cooled liquid chillers
Chilled water system	90-40-10/330 Air cooled liquid chillers
BS EN 14511-2	

Parent system	Clause
Chilled water system	90-40-10/330 Air cooled liquid chillers
Chilled water system	90-40-10/330 Air cooled liquid chillers
BS EN 14511-3	
Parent system	Clause
Chilled water system	90-40-10/330 Air cooled liquid chillers
Chilled water system	90-40-10/330 Air cooled liquid chillers
BS EN 14511-4	
Parent system	Clause
Chilled water system	90-40-10/330 Air cooled liquid chillers
Chilled water system	90-40-10/330 Air cooled liquid chillers
BS EN 16297-1	
Parent system	Clause
Chilled water system	90-10-70/320 Pumps generally
BS EN 16644	
Parent system	Clause
Chilled water system	90-10-70/320 Pumps generally
BS EN 378-1	
Parent system	Clause
Chilled water system	90-40-10/330 Air cooled liquid chillers
Chilled water system	90-40-10/330 Air cooled liquid chillers
BS EN 50174-1	
Parent system	Clause
Building monitoring and management system	75-75-05/210 Design
BS EN 60335-1	
Parent system	Clause
Chilled water system	90-10-70/320 Pumps generally
BS EN 60335-2-51	
Parent system	Clause
Chilled water system	90-10-70/320 Pumps generally
BS EN 809	
Parent system	Clause
Chilled water system	90-10-70/320 Pumps generally
BS EN 837-1	
Parent system	Clause
Chilled water system	90-10-60/370 Pressure gauges
BS EN ISO 16484-3	
Parent system	Clause

Building monitoring and management system	75-75-05/210 Design
BS EN ISO 16484-5	
Parent system	Clause
Building monitoring and management system	75-75-05/210 Design
BS EN ISO 5198	
Parent system	Clause
Chilled water system	90-10-70/320 Pumps generally
BS EN ISO 9906	
Parent system	Clause
Chilled water system	90-10-70/320 Pumps generally
BS ISO 21940-21	
Parent system	Clause
Chilled water system	90-10-70/320 Pumps generally
Commissioning Code L	
Parent system	Clause
Hard wired general lighting system	70-80-35/810 Testing and commissioning of general lighting systems
Commissioning Code W	
Parent system	Clause
Chilled water system	60-45-10/810 Commissioning chilled water systems
Chilled water system	60-45-10/810 Commissioning chilled water systems
Guidance Notes: Environmental Hygiene (EH): Workplace exposure limits. Containing the list of workplace exposure limits for use with the Control of Substances Hazardous to Health Regulations 2002 (as amended)	
Parent system	Clause
	00-40-70/360A Product hazards
KS09 Commissioning variable flow pipework systems	
Parent system	Clause
Chilled water system	60-45-10/810 Commissioning chilled water systems
Start up and commissioning guide	
Parent system	Clause
Building monitoring and management system	75-75-05/820 Commissioning

