MAX FORDHAM

Mayford Estate

Preliminaries for the Mechanical, Electrical & Public Health (MEP) Installations

For London Borough of Camden

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CONTENTS

1.0 Introduction 5

1.1 The Mechanical, Electrical & Public Health (MEP) Engineering Services documentation 5

1.2 Other Design Information 5

1.3 Record information and reports 5

1.4 Privacy 6

2.0 The Engineering Services Works 7

2.1 Scope of MEP Engineering Services 7

2.2 Installation Site Works Mobilisation Period 7

3.0 Tendering requirements 8

3.1 Tender Information 8

3.2 Checking Documents 8

3.3 Basis of Tender 8

3.4 Provision for Complete Working Installation 9

3.5 Site Visit 9

3.6 Selection of Plant & Equipment 9

3.7 Tender Submission 9

3.8 Anticipated Project Cost 10

3.9 Provisional Sums 11

3.10 Utilities and Statutory Authorities 11

4.0 Design Responsibilities 13

4.1 Contractor Design responsibilities 13

4.2 Performance Specified MEP installations 13

4.3 Responsibility Matrix 14

4.4 Builders Work 14

4.5 Prefabrication of MEP Elements 15

4.6 Fire Stopping of Services Penetrations 15

5.0 Coordination 16

5.1 Additional Co-Ordination Responsibilities of the Mechanical Contractor: 16

5.2 Coordination of Trades: 17

5.3 Coordination of MEP Services: 17

5.4 Coordination of Services on Site: 17

5.5 Maintainability: 17

6.0 Materials & Equipment Selection 19

6.1 Certification Standards for Materials & Equipment 19

6.2 Electromagnetic Compatibility 19

6.3 Pressure Directive: 20

6.4 ATEX Directive: 20

6.5 EU Declaration of Conformity: 20

6.6 Equipment specified by the Consultant 21

7.0 Existing MEP systems, Equipment and temporary works 22

7.1 Surveys: 22

7.2 Site Dimensions and Levels: 22

7.3 Existing Mains: 22

7.4 Facilities for Removal of Equipment: 22
7.5 Risks to Health and Safety: 22
7.6 Maintenance of Existing Services: 23
7.7 Strip-out 23
7.8 Interruption of Supply 23
8.0 Health and Safety 24
8.1 CDM Regulations: 24
9.0 Information Flow 25
9.1 Drawings 25
9.2 Drawing Definitions 25
9.3 Prefabrication Proposals 28
9.4 Programme 28
9.5 Heating Network Compliance Gateway Submission 29
9.6 Commissioning and Handover plans 29
9.7 Alternative Contractors Proposals 29
9.8 Technical Submissions 30
9.9 Samples 33
9.10 RFIs and TQs 33
9.11 BREEAM 33
10.0 Construction 33
10.1 Method Statements 33
10.2 Quality Control 34
10.3 Factory Testing 36
10.4 Development of Record Information 36
10.5 Beneficial Use 37
10.6 Snagging 37
11.0 Handover, Completion and Commissioning 38
11.1 Record Information 38
11.2 Operation and Maintenance Manuals 40
11.3 Building User Guides 42
11.4 Testing and Commissioning 42
11.5 Completion and Handover Procedures - Software, keys, spares, meter readings, etc 47
12.0 Network Operation and Training 49
12.1 Two Year Operational and Maintenance Period 49
12.2 General Staff Training 50
12.3 Proving Period and Fine Tuning 51
12.4 Seasonal Commissioning 52
12.5 Maintenance During Rectification Period 52
13.0 Rectification of Defects 52
14.0 Appendix A 53
14.1 Design, Commissioning & Handover Information Responsibilities 53

1.0 INTRODUCTION

1.1 The Mechanical, Electrical & Public Health (MEP) Engineering Services documentation

This document SPEC-200 the "MEP Preliminaries" sets out the Contractor's responsibilities in relation to design, coordination, management and documentation for the MEP installations. This document forms part of the design information and should be read in conjunction with the Main Contract Preliminaries and all associated documents.

The MEP installations are also described by the following documents:

- SPEC-100 – Project specific description of the MEP installations
- SPEC-200 – Project preliminaries setting out the Contractor's responsibilities in relation to design, coordination, management and documentation.
- SPEC-300 – Reference specification setting out the required standards for installation, testing and workmanship for the MEP installations.
- Drawings and schedules listed in Appendix A of SPEC 100

1.2 Other Design Information

Obtain and take notice of all other relevant design information relating to the project as listed in the Main Contract Preliminaries. Some key documents include, but are not limited to the following:

Design information	Source of information
Record design information	London Borough of Camden
Client brief	London Borough of Camden
Survey information	London Borough of Camden

The Contractor shall review the design documents and give notice of any inconsistencies, errors, omissions or inadequacies that are apparent.

1.3 Record information and reports

The Contractor shall obtain and take notice of all available record information, reports and regulatory requirements relating to the project, including but not limited to:

- Site services / Utility record drawings
- Existing building record drawings
- Planning conditions
- All others listed in Main Contract Preliminaries
- Existing Asbestos surveys from the Estate's distribution services, plant rooms, communal spaces and within dwellings

The existing record drawing information that was available at the Stage 3 design stage provided by Camden Council, has been used to determine the dwelling types, site layouts and accommodation schedule. Existing site

wide heating and water services layouts have been produced from the record information provided and further survey investigations to assist the Contractor with their tender and coordination responsibilities.

An estate-wide buried heating, domestic water and electrical services survey was carried out by 40SEVEN in 2020. The Contractor is to obtain a copy of this survey, however surveys of all other services and a topographical survey of the site are required to complete an update estate-wide buried services survey before commencing trial holes and coordination drawings.

1.4 Privacy

The information contained in the tender documentation shall be treated as private and confidential.

2.0 THE ENGINEERING SERVICES WORKS

2.1 Scope of MEP Engineering Services

The MEP Engineering Services included in the project works and covered by this specification comprise the following installations for the building(s) and site:

- Mechanical services.
- Public health services.
- Electrical services.
- Building management system.

In relation to these MEP Engineering Services, the Contractor shall complete the design, coordination, drawing production, manufacture/fabrication, supply, installation, testing, setting to work, commissioning, system proving, making good of defects and fine tuning as described by the contract documentation.

The Contractor shall include for all the labour & materials required to deliver a complete, effective and safe working installation.

Allow for the coordination and cooperation with others when designing and installing the MEP Engineering Services.

2.2 Installation Site Works Mobilisation Period

The Contractor shall carry out an extensive site mobilisation period whilst the detailed design is finalised, and the installation drawings produced. This is to finalise distribution details and coordination before installation works on site begins.

This mobilisation period will consist of the following but not be limited to:

- Estate-wide existing buried services survey, excluding buried heating, water and low voltage.
- Pilot holes to confirm existing service routes that cannot be confirmed through above ground surveying techniques
- Final site coordination drawings from buried services survey and pilot holes
- All Dwelling entry points confirmed through void dwelling opening up works
- Trial riser installations
- Detailed design calculations
- Installation dimensioned drawings
- Traffic management plan
- Detailed installation phasing and sequencing plan

Refer to the MEP prelims specification (Max Fordham Spec 200) for further information on the two-stage contract procurement.

3.0 TENDERING REQUIREMENTS

3.1 Tender Information

These conditions are supplementary to those stated in the invitation to tender and on the Form of Tender and Agreement.

3.2 Checking Documents

The Contractor shall check the tender documentation for obvious errors and omissions. Should any such errors or omissions be discovered, the Contractor shall inform the Contract Administrator (CA) / Employer's Agent (EA) immediately in writing in order that a correction may be issued before the date for submission of the tender.

3.3 Basis of Tender

Design & Build – RIBA Stage 3 Tender – Contractor to complete design
With the exception of the performance specified MEP installations listed in clause 4.2 below, the tender documents for the MEP engineering services include MEP design developed to RIBA Stage 3. The contractor shall carry out the design for all aspects of the MEP engineering services as part of a Design and Build tender process.

All design responsibility for the correct operation and compliance with the Performance Objectives and Design Parameters within this specification rest with the Contractor. The contractor's design shall meet the Employer's Requirements for the MEP Engineering Services in full, including concepts, performance requirements, details, materials and equipment specifications. Any information relating to the size and duty of equipment that has been included within the tender information, has been included to indicate the assumptions used to establish the space requirements and distribution routes, and should not be relied upon for the purposes of the Contractor's design. The tender price must include for the cost of a complete working installation within the scope of the design described by the Employers requirements, whether explicitly indicated on the drawings or not.

The Contractor shall be required to complete a questionnaire before submitting their tender to identify how they approached and delivered previous projects on a similar basis and how they will deliver this project.

The contractor must not rely on further design detail from the client/employer to complete their design. Max Fordham LLP will be retained by the client/employer to review Contractor's design proposals for compliance with the Employer's Requirements, attend site to inspect services installations and check commissioning of M&E systems prior to Practical Completion.

As part of the tender process, the contractor shall review the MEP designs, performance requirements, details, materials and equipment specifications and report any concerns with completing, and taking full ownership of the design and installation on this basis.

The contractor may offer alternative design proposals as part of his subsequent design development but these must be presented as optional, including details of the benefits to the client (such as capital, maintenance or running cost savings).

The contractor shall include for the provision of a complete working installation as set out in clause 3.4.

3.4 Provision for Complete Working Installation

As well as the MEP plant, equipment and materials described within the tender documentation, the Contractor shall also include in the tender price all other components that are required for the proper and safe working of the MEP Engineering Services systems, whether explicitly described in the contract documents or not.

3.5 Site Visit

Before tendering, ascertain the nature of the site, any access constraints and all local conditions and restrictions likely to affect the execution of the MEP Engineering Services. Inspect any existing installations relevant to the works and study all available existing records.

Arrangements for visiting the site must be made with prior agreement with the CA/EA.

3.6 Selection of Plant & Equipment

Where manufacturers, suppliers or installers of products are identified by name, or names, but NO reference is made to "Or Equivalent" the submitted tender must include the specified manufacturers, suppliers or installers.

Where manufacturers, suppliers or installers of products are identified by name, or names, but reference is made to "Or Equivalent" the submitted tender must also include the specified manufacturers, suppliers or installers. The Contractor shall submit full technical details of any alternatives to the CA/EA with an associated revised cost with their tender returns.

The Contractor shall fully re-evaluate and price for all parts of the MEP Engineering Services and building design that may be affected by the implementation of the alternative. Where manufacturers, suppliers or installers of products are NOT identified by name, the Contractor shall select products that comply in all respects with the specification. The Contractor shall submit full technical details to the CA/EA with their tender returns demonstrating compliance.

The Technical Submittal for alternative proposals must include all information set out in clause 9.8. Incomplete submittals will be rejected by the CA/EA.

3.7 Tender Submission

Tenders shall comply with the requirements of this Specification. Where the Tenderer wishes to submit an alternative for consideration, it shall be submitted as a separate proposal. The alternative proposal shall include a full description, including details of the variation from the Specification and the cost and programme effect of the proposal.

Alterations and qualifications to the specification must not be made without the written consent of the CA/EA. Tenders containing such alterations or qualifications may be rejected.

In addition to the Main Contract Preliminaries tender requirements, the Contractor shall provide the following information:

- Tender Summary pricing document included at the start of the MEP Specification (SPEC 100), completed in full.
- Method statements for any MEP works requiring interruptions of supplies, out of hours working, noisy work, road closures or disruption to other building users or neighbours. See clause 10.1 for further method statements required prior to the commencement of the contract works.
- Programme and proposal of site mobilisation works that is required to complete the detailed design and installation drawing process before installation work starts.

- Programme indicating the sequence and timing of the principal parts of the MEP works including periods for planning, design, procurement, installation and commissioning.
- Sequencing and phasing programme indicating the installation of the below ground network and the connection of dwellings in a manner that allows the heat and water supply to the dwellings to remain live.
- All H&S information required by the Main Contract Preliminaries, CDM Regulations and all other legal obligations.
- Management procedures to be adopted for the project.
- Details of management and resourcing of MEP design duties and responsibilities including design capability.
- MEP commissioning and testing procedures and management.
- Quality control management and procedures including a statement outlining the MEP management team, stating the definition of each person's role, and the commitment to the project. Include the curriculum vitae and references for each of the key personnel that will be used on the project and a line management diagram.
- Any foreseen difficulties with delivery periods for materials and equipment.

3.8 Anticipated Project Cost

A costing exercise has been carried out for the heating network project works and as part of a transparent project approach between the Client and Contractor, the anticipated project costs have been itemised below.

The costs allow for the worst-case installation cost where each dwelling on Mayford Estate has the hot and cold water pipe work replaced, space heating and radiators replaced. During the site mobilisation period and detailed design stage, the Contractor shall survey each dwelling and determine the extend of the pipe work and radiator replacement. Upon the findings of the surveys, the Contractor shall offer the savings to the Client.

Item	**Lump Sum (£ Ex.VAT)**
Mayford Estate district heating plantroom works (MEP)	*TBC*
Heating network	*TBC*
Cold water network	*TBC*
Metering network	*TBC*
Typical flat riser strip out (MEP)	*TBC*
Typical flat installation (MEP)	*TBC*
Typical flat riser access installation and making good.	*TBC*
Total flat installations (MEP)	*TBC*
Typical maisonette riser strip out (MEP)	*TBC*
Typical maisonette installation (MEP)	*TBC*
Typical maisonette riser access installation and making good.	*TBC*
Total maisonette installations (MEP)	*TBC*
Typical maisonette riser strip out (MEP)	*TBC*
Typical house installation (MEP)	*TBC*

Typical house riser access installation and making good.	*TBC*
Total house installation (MEP)	*TBC*
Commissioning	*TBC*
Provisional sums (excluding Contractor preliminaries and OH&P) • Estate wide topographical survey • Estate wide buried services survey, excluding heating, water and LV. • Asbestos	*TBC*
Grand total (excluding Contractor preliminaries and OH&P, design fees)	*TBC*

3.9 Provisional Sums

The Contractor shall include for the cost and programme associated with the provisional sums detailed in the Main Contract Preliminaries.

- Estate wide topographical survey.
- Estate wide buried services survey, excluding heating, water and LV.
- Private garden excavation and reinstatement.
- Refurbishment and demolition asbestos survey where required.

3.10 Utilities and Statutory Authorities

The Contractor shall carry out all works relating to the utility services disconnections, diversions and provision of new supplies, including:

- Obtain/finalise quotations for all necessary utility works
- Place orders for works to meet programme.

The Contractor shall

- Liaise with the Statutory Authorities and provide any test notices required to ensure final connections are made in accordance with the requirements of the programme.
- Notify the District Surveyor, Building Control Officer and Fire Officer directly in respect of all tests and demonstrations relevant to life safety installations, and include for all necessary attendance, documentation, etc., to ensure full Statutory Authority approval of the installation.
- Observe and comply with the requirements of all Statutes and Bye-Laws.
- Serve notices on the Authorities having control of the road surfaces before the same are broken up and likewise serve notices on the owners of sewers, drains, water, gas or other mains, electric cables, tramways and other services which may in any way be affected by the execution of the MEP Engineering Services.
- Advise CA/EA of their obligations relating to agreement of all necessary wayleaves in good time to ensure no delay to the programme.

- Inform all necessary parties when work necessitates such notices to be given.

4.0 DESIGN RESPONSIBILITIES

4.1 Contractor Design responsibilities

The contractor shall be responsible for carrying out the following reviews, design development, technical submittals and coordination.

- **Contractor Design Review** – Review the MEP design information and advise the CA/EA of any errors or discrepancies that are reasonably apparent in the design, specification & drawings provided by or on behalf of the Employer. Prior to placing orders for materials and equipment, the contractor shall check schedules for any discrepancies, such as between model/catalogue number and the specified duty/description. Prior to commencing installation on site, the contractor shall check that the MEP design information is compatible with best practice installation standards and current manufacturers' installation instructions/requirements. The Contractor shall be responsible for the compatibility and correct installation of all components.
- **Contractor Design** – The Contractor shall employ specialist subcontractors and/or consulting engineers to complete the design of MEP installations which have been performance specified (listed in clause 4.2 below) and all other MEP engineering services installations forming part of the Design & Build contract. The Contractor shall submit design proposals which meet the requirements of the MEP Engineering Services documentation in full – including any concepts, performance requirements, details, materials and equipment specifications.
- **Coordination Drawings** – For all MEP installations, issue Coordination Drawings and 3D model from which they were where generated (if required by the MC prelims) showing the interrelationship between the various MEP services, structure and architectural details. The coordination drawings must demonstrate the proper separation of MEP services, maintenance access arrangements and plant replacement strategies. See clause 5.0 for more detail.
- **Technical Submittals** – For all MEP installations, provide manufacturers drawings/details/schedules indicating proposed equipment selections and arrangement. See clause 9.8 for Technical Submittals requirement.
- **Installation Drawings** – For all MEP installations issue Installation Drawings incorporating sufficient detail enable to works to be installed on site. See clause 9.2 for more detail.

The Contractor shall request such further information as may be required to carry out the MEP Engineering Services in sufficient time to meet the programme.

4.2 Performance Specified MEP installations

Performance specified MEP systems

- Ss_70_30_25_25 Earthing and bonding of extraneous metal
- Ss_75_10_21_21 Structured cabling and associated containment
- Ss_75_50_28_29 Fire alarm equipment selection and configuration
- Ss_75_70_54_10 Building controls/BMS.
- Modularisation of any prefabricated MEP installations – see clause 4.5.
- Capacity, location, routes and design of electrical cable ways (conduit, trunking, tray, basket, etc.).

Coordination/arrangement/selection/workmanship/commissioning/maintenance

- Waste pipework size/arrangement to meet Building Regulations
- Control of thermal expansion.
- Control of plant vibration.
- Temporary access platforms and safe working access for installation
- Brackets, supports and plant bases (including roof plant support platforms)
- Pipework trace heating systems.
- Drainage & venting of pipework.

- Builders work requirements (final setting out and confirmation of sizes and extent). See clause 4.4 below.
- Detailed setting out of mechanical, electrical and plumbing plant.
- Selection of commissioning valves, automatic flow balancing valves and control valves (and actuators) to suit system pressures and flows.
- Arrangement of MEP installations to facilitate maintenance and replacement access
- Alternative equipment and plant items selected by the Contractor (see clauses 3.6 and 0).
- Prevention of biological contamination of water systems during testing and commissioning, in particular Pseudomonas and Legionella control.
- Water treatment to prevent corrosion in closed hydraulic systems
- Detailed proposals for cleaning, flushing, testing, and commissioning.
- Temporary installations and sectional commissioning to facilitate phased handover where required
- Survey, isolation, identification, disconnection, strip out and disposal of existing M&E services.
- Phasing, sequencing and temporary supplies necessary to ensure MEP supplies are maintained to other occupied parts of the building/site/surrounding area.
- Temporary power and lighting systems, including 3h self-contained emergency lighting for public escape routes through the Contractor's site.

4.3 Responsibility Matrix

Contractor shall provide all design information set out in the responsibility matrix in Appendix A of this document.

4.4 Builders Work

As part of their design, the Consultant has provided Builders Work Information sufficient to allow development of the structural design.

The contractor shall

- Check and confirm (in writing) that the structural design drawings incorporate all necessary builderswork holes and openings.
- Confirm and amplify any further non-structural provided by the CA/EA.
- Provide builders work information, appropriate to the stage of design development. Revise, supplement and/or issue final information, drawings/details for the actual requirements of the contract works.
- Provide fully dimensioned drawings showing both size and position of builders work making due reference to the structural engineering and architectural final dimensioned detailed drawings.
- Mark out on site all cut holes and chases required, any pockets cast in concrete, any inserts, any built in sleeves or similar items.
- All builders work information shall be provided to comply with the programme and include sufficient time for the necessary approvals.
- Where alternative equipment or materials has been offered that the CA/EA has accepted and which subsequently varies the works in any way whatsoever, then undertake the redesign of the associated builders work.

Marking Out of Builders Work Holes on Site:
Mark out on site actual locations of minor non-structural holes through walls, partitions, floors, etc. and also chases in non-fair-faced walls and the like in preference to providing drawings of such builders work requirements.

Builders Work Information to Be Provided:

- All builders work drawings shall be fully dimensioned.
- Builders work drawings to be provided shall be as follows:

    - Details of all bases for plant formed in concrete, brickwork or blockwork
    - Details of all attendant builders work, holes, chases, etc. for conduits, cables and trunking etc. and any item where access for a function of the installation is required
    - Details of all types of purpose made brackets for supporting service or plant/equipment
    - Details of all accesses into ceilings, ducts, etc.
    - Details of all special fixings, inserts, brackets, anchors, suspensions, supports etc.
    - Details of all sleeves, puddle flanges, access chambers
- Submit all necessary load and thrust calculations with drawings/details.

Structural Steelwork:

- No steelwork shall be cut, drilled or welded without written approval from the Client's structural Engineer.
- The cutting and drilling of structural steelwork shall be agreed with the CA/EA prior to the commencement of the work and shall require application in writing with all necessary drawings/details.
- Fixings to steelwork shall be
    - the approved clamp type
- All fixings shall be of the correct size and type for the fixing load applied and the type shall be approved prior to commencement of the works.
- Permitted holes in steelwork must be drilled - burning by means of welding equipment is prohibited.

Pre-Cast Concrete:

- Holes may not be cut in precast concrete without written approval from the CA/EA.
- Under no circumstances will holes be cut in pre-stressed concrete

Secondary Steelwork:

- The Contractor shall include in their tender for the supply and installation of all steelwork required to support the services from the primary structure.

4.5 Prefabrication of MEP Elements

Where the Contractor proposes to adopt a prefabrication strategy provide fabrication drawings for comment.

4.6 Fire Stopping of Services Penetrations

It is critical that the fire compartmentation is effective in case of fire. The Contractor will take responsibility for making sure that the fire-stopping is carried out all areas of the building and in accordance with the fire strategy, the Building Regulations, manufacturers information and all other relevant standards.

The Contractor will employ a FIRAS Certified Specialist Installer who is also a registered member of the Association for Specialist Fire Protection (ASFP) to carry out all of the fire-stopping of services penetrations, and certify the work.

The Contractor will:

- Use a fully certified, traceable system of fire-stopping products which are LPCB / CERTIFIRE approved and CE marked – from a quality fire-stopping manufacturer, e.g. Astroflame, PFC Corofil or Promat.
- Coordinate the fire-stopping process and produce detailed documentary evidence for inclusion in the O&M manuals
- Ensure that all of the fire compartmentation requirements of Approved Document B (England), Section 2 (Scotland), BS 9991 (Residential) and BS9999 (All Buildings) are met.
- Meet any additional fire-stopping requirements required by the Fire Engineer and the Approved Inspector

- Follow all latest guidance from the Association for Specialist Fire Protection, as set out in the latest available version of 'Fire Stopping and Penetration Seals for the Construction Industry' and all relevant document to which it refers.
- Ensure that the all necessary active fire/smoke separation devices are incorporated into the engineering services to meet Approved Document B (England), Section 2 (Scotland), BS 9991 (Residential) and BS9999 (All Buildings)
- Ensure all fire rated ductwork, Fire-Smoke Dampers, Fire Dampers and Motorised Smoke Control dampers are suitably rated for their location, properly installed in accordance with manufacturers' instructions and standard details, and that these devices are LPCB certified and CE marked.
- Make sure that all intumescent pipe collars are suitably rated for their location, properly installed in accordance with manufacturers' instructions and standard details, and that these devices are LPCB certified and CE marked.

As part of the documentation and demonstration process the Contractor shall:

- Offer areas for inspection to the Fire Engineer, Approved Inspector and Employer's representatives prior to covering up with wall finishes, floor finishes or ceilings.
- Note that the Contractor has full responsibility for making sure the fire-stopping is complete and to the correct standard – these quality inspections are not exhaustive and serve only as cross-checks that the work is generally being managed and carried out in accordance with the ERs.
- Make a complete photographic record of all fire-stopping penetrations before and after application of the fire-stopping systems/materials and include in the O&M manuals. Mark the location and direction of these photographs on the building compartmentation drawings.
- Make good (and completely re-install where necessary) any fire-stopping where additional holes have been cut and services have been run through after the first round of fire-stopping. All making good must be to the same standard as the original fire-stopping, in accordance with the system manufacturer's standard details and installation guidelines.

If any of the inspections by other consultants highlight potential problems or lapses of quality with fire-stopping, the Contractor will carry out a full review of their photographic records and identify any other areas where a similar problem may occur. The Contractor will open up risers, ceilings walls and/or floors wherever necessary, carry out remedial works to re-install the correct fire-stopping, and then make good.

5.0 COORDINATION

5.1 Additional Co-Ordination Responsibilities of the Mechanical Contractor:

Notwithstanding the overall responsibility of the Main Contractor to programme and coordinate the entire works, the contractor responsible for the mechanical services installations (the "Mechanical Contractor") is to allow for and price within their tender the following additional responsibilities:

(a) the overall coordination of all services installations within the MEP Engineering Services, utilising information provided by others for the structure, architectural form, electrical installations, security installations, fire protection installations, and all other specialist services installations.

(b) Production of composite Builders Work Drawings incorporating all services installation requirements.

(c) arranging receipt of, and reviewing, all other services contractor's coordinated drawings, and immediately advising, confirming and agreeing with the said contractors and the Main Contractor any necessary alterations/changes/amendments in order to make these drawings truly and fully coordinated with each other.

The Mechanical Contractor is to nominate a representative to be responsible, in conjunction with the Main Contractor, for the management and programming of the entire services coordination for the MEP Engineering Services including, but not limited to, chairing services coordination meetings, preparing a schedule of drawings

required, preparing a production programme, reporting on progress, and supervising the timely production of coordinated drawings by each of the relevant services contractors.

Cooperation of Others:

All other services contractors (electrical, security, fire, etc.) are to ensure that the programming and production of their design and working drawings allows the Mechanical Contractor to fulfil their obligations under this clause. Each individual contractor will retain full responsibility for the programming and accuracy of the information provided by them

5.2 Coordination of Trades:

Allow for co-ordinating the contract works with the works of other trades and installations which may be on site during the period of the contract.

5.3 Coordination of MEP Services:

All aspects of the works require detailed co-ordination to avoid any possible clash or conflict with other trades and disciplines. Undertake such co-ordination in relation to the MEP Engineering Services.

- No extra cost or claim will be allowed due to conflict of works or installations, where full liaison with other trades and disciplines would have prevented such an occurrence.
- When any new, revised or updated architectural, structural or services information is issued by the CA/EA under the authority of an instruction, examine such information and if necessary modify the works accordingly to prevent any clashes or abortive work due to such instruction.
- No extra cost or claim will be allowed to cover any clashes or abortive work that result from not requesting an explanation or seeking clarification in respect of any such revision.
- No extra cost or claim will be allowed due to conflict of works or installations, where full liaison with other trades and disciplines would have prevented such an occurrence.

5.4 Coordination of Services on Site:

Allow for co-ordinating the contract works with the works of other trades and installations which may be on site during the period of the contract either during or prior to their incorporation into the works.

- Where minor clashes of services occur on site that were not foreseeable at the design or co-ordination drawing stage then these clashes or minor co-ordination matters shall be resolved by discussion and agreement with other trades and disciplines. The CA/EA shall be informed of the action to be taken by an approved means.

5.5 Maintainability:

- At all times give proper consideration to the future maintenance of the installed plant and services, and shall include for such component parts as are provided by the manufacturer of equipment and plant for this purpose.
- Ensure that adequate space for maintenance is provided and that all serviceable components can be dismantled and replaced with minimal disturbance to the surrounding installations and building components. Demonstrate that all plant and equipment incorporated into the MEP Engineering Services can be safely and easily maintained in full compliance with:
    - Health and Safety legislation
    - CDM requirements
    - British Standards

    - Health Technical Memoranda.
- All parts of the service installations are to be selected and designed for minimum maintenance during their life. The planned and preventative maintenance requirements of the installed services and plant are to be coordinated within the design.
- All conduit, trunking, pipework and the like for future use will be installed with draw wires and located to afford access for and to facilitate or addition of further circuits etc. without the removal of fixed sections of walls, ceilings and the like.
- Where pipes cross access routes at low level purpose made step-overs shall be installed to provide safe access and prevent damage to the services.

6.0 MATERIALS & EQUIPMENT SELECTION

6.1 Certification Standards for Materials & Equipment

The Contractor shall ensure all MEP materials and equipment installed are suitable for operation in the environment in which they can reasonably expected to operate and have been tested and certified to meet the standards described below.

- Ensure systems plant and equipment required to operate under fire conditions are tested, selected, certified and arranged to ensure correct operation in the temperatures and fire conditions specified.
- Ensure all MEP plant, systems and equipment are suitable for operation at full capacity under the worst case operating conditions (with appropriate margins) to suit the site including:
    - Height above sea level
    - Internal conditions such as temperature and humidity
    - External conditions such as temperature, humidity, moisture, coastal conditions (e.g. sand & salinity), exposure/wind speeds, local ecology/flora and fauna.
    - Power supply characteristics – Confirm with the Supply Authority before ordering any equipment dependent upon voltage or frequency. And ensure all electrical equipment supplied and installed is suitable for the power supply characteristics measured on site.
- Unless stated otherwise the MEP materials and equipment shall comply with, and be certified to the appropriate British Standard (BS) or Code of Practice (CP) and where no BS or CP is applicable comply with
    - The Agrément Certificate for the particular item.
    - CIBSE recommendations and guides to current practice.
    - BS 7671 Requirements for Electrical Installations
    - Guidance published by IEE and IET.
    - Building Regulations
    - Energy Related Products (ErP) Directive
- 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 (e.g. British Board or Agrément Certificate).

6.2 Electromagnetic Compatibility

The Contractor shall ensure that all equipment and systems are installed to provide electromagnetic compatibility within the system and with any other systems installed in the same area.

Ensure all equipment meets the requirements of the appropriate electromagnetic compatibility standard including:

- Industrial, Scientific and Medical – BS EN 61000-6-4 and BS EN 55011.
- Household electrical appliances, portable tools and similar apparatus – BS EN 55014.
- Fluorescent lamps and Luminaires – BS EN 55015.
- Information technology equipment – BS EN 55022.
- Mains signalling – BS EN 50065.
- Broadcast receivers and associated equipment – BS EN 55013 and BS EN 55020.
- Industrial process measurement and control – BS EN 60801.
- Other equipment to generic standards
- Emissions
- Domestic, commercial and light industrial
- BS EN 61000-6-3.
- Heavy industrial
- BS EN 61000-6-4

- Immunity
- Domestic, commercial and light industrial
- BS EN 61000-6-1
- BS EN 55014-2
- Heavy industrial
- BS EN 61000-6-2.
- Particular environments
- BS EN 61000
- Ensure all apparatus covered by the Wireless Telegraphy Act meets regulations issued by Ofcom.
- Ensure all equipment and systems meet the requirements of BS 6701 and BS EN 41003.
- Ensure that all cable installations meet the minimum guidance separation in EMC of Installations and Recommended Cable Separations, published by the ECA.
- Ensure that all cable installations meet the minimum separation in BS 7671 and BS EN 50174.

6.3 Pressure Directive:

All pressure equipment and assemblies with a maximum allowable pressure greater than 0.5 bar shall comply with the European Community (EU) Pressure Equipment Directive (PED) 97/23/EC.

Pressure equipment shall be marked as a minimum with:

a) unique identification of the manufacturer
b) unique identification of model and serial number
c) the year of manufacture
d) maximum/minimum allowable pressure limits
e) CE marking

Provide:

- A declaration of conformity for all pressure equipment.
- Copies as part of the record documentation.

Ensure all components or sub-assemblies in their finished assembly are used within their safe operating range and correctly installed and tested.

Ensure that adequate instructions are provided by the manufacture for the safe installation, testing and operation.

Instructions shall be provided within the Operating and Maintenance Manual to ensure for the safe maintenance and operation of the equipment when in operation.

Pressure equipment and assemblies below the specified pressure / volume thresholds must:

a) be safe
b) be designed and manufactured according to sound engineering practice

6.4 ATEX Directive:

All equipment and protective systems used in potentially explosive atmospheres shall comply with the ATEX Directive 94/9/EC of the European Parliament and the Council.

6.5 EU Declaration of Conformity:

Provide an EU Declaration of Conformity prior to delivery to site.

The declaration shall state the following as a minimum:

- The manufacturer (or representatives).
- Description of equipment.
- The harmonised standard(s) that have been applied.
- The signatory who has been empowered to enter into commitments on behalf of the manufacturer.
- The last two digits of the year in which the CE marking was affixed.

6.6 Equipment specified by the Consultant

Where materials and equipment have been specified by the consultant the Contractor shall check that:

- In the absence of specific design, performance or installation standards being stated seek the instructions of the CA/EA prior to commencement of the MEP Engineering Services and with adequate time so as not to cause delay.
- When new editions, versions and amendments are published during the construction, seek the instructions of the CA/EA with respect to any modifications or changes necessary.

7.0 EXISTING MEP SYSTEMS, EQUIPMENT AND TEMPORARY WORKS

7.1 Surveys:

- Ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the MEP Engineering Services works.
- Before commencing work, carry out a survey and examination of buildings, structure and engineering services affected by the works.
- Examine all available drawings of the engineering services and report any discrepancies to the CA/EA.
- Full buried services survey of the estate to determine final coordination of the below ground services distribution.

7.2 Site Dimensions and Levels:

Install all engineering services using a laser levelling system 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.

As the development advances measure on site all works by others that may foreseeably affect the works. These dimensions shall be incorporated into the installation 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.

7.3 Existing Mains:

Existing services shall not be interfered with, nor interrupted in any way without the prior written permission of the CA/EA.

Be responsible for any damage entailed and make good any such damage to the satisfaction of the CA/EA at no extra cost.

7.4 Facilities for Removal of Equipment:

Ensure isolation and drain down of any item of equipment without isolating large sections of the remaining system.

7.5 Risks to Health and Safety:

The nature and condition of the existing services have not been fully ascertained. All information relating to the existing services should be checked by the contractor on site. The contractor shall carry out risk assessments and ascertain the nature and condition of the existing services prior to working around or amending existing services.

7.6 Maintenance of Existing Services:

- Fully maintain the following existing services during the progress of the contract works:
  - Electrical services
  - Data services
- Include in the contract price all costs to maintain the existing services at all times during the duration of the contract works.
- Submit with the tender a method statement outlining how the maintenance works is to be undertaken including any necessary specialist maintenance.
- Prior to commencement of the contract works submit a method statement to the CA/EA outlining how the existing services are to be maintained including all planned and preventative maintenance measures.
- Provide any additional work and materials necessary to maintain these services at all times during the duration of the contract works.
- Make all connections to existing services
  - out of normal working hours.
- Existing services disturbed or damaged during the contract works are to be reinstated
  - Submit to the CA/EA a method statement outlining the method and procedures for the remedial and reinstatement works.
  - Any shut down of existing services to undertake remedial and reinstatement works shall be to an agreed procedure.
  - Reinstate fully in accordance with the standards of quality as defined in the specification and to the satisfaction of the CA/EA.

Maintain new services during the rectification period as set out in clause 12.4

7.7 Strip-out

Provide method statements for surveying, identifying, isolating and stripping out existing services.

7.8 Interruption of Supply

Work that requires interruption or interference with the operation of any existing services or buildings shall not be commenced without prior written permission of the CA/EA.

14 days' notice of intention to proceed with such works shall be given to the CA/EA.

8.0 HEALTH AND SAFETY

8.1 CDM Regulations:

- The management of health and safety is to be undertaken in conformity with the requirements of The Construction (Design and Management) Regulations 2015, and the corresponding Approved Code of Practice.
- See the Main Contract Prelims for further details.

9.0 INFORMATION FLOW

9.1 Drawings

Information Provided by Others:
Instructions, drawings, or other information required to be provided by the CA/EA will be provided in due time upon written request provided always that such information is not requested unreasonably distant from nor unreasonably close to the date upon which it is necessary.

Provide written request to the CA/EA in good time for any information required.

Supply of Information:
The CA/EA will provide supplementary information from time to time as may be necessary to enable the completion of the MEP Engineering Services Works in accordance with the contract conditions. Allow for such progressive release of further information by the CA/EA during the course of executing the MEP Engineering Services Works.

In order to facilitate the orderly and timely production of all further information that shall be considered necessary, submit to the CA/EA for approval a programme indicating the progressive release of such information to enable the completion of the MEP Engineering Services in accordance with the contract conditions.

Progress:
At regular intervals as agreed with the CA/EA provide progress reports during the execution of the contract works in addition to any other similar information required by the contract conditions.

The reports shall include:

- particulars of materials and equipment on site, or installed
- site labour employed
- progress of the works
- Record progress of the MEP Engineering Services Works weekly on a copy of the programme.

Mark up for inspection and record purposes a set of the latest drawings as the works progress. The progress drawings shall be available for inspection by the CA/EA at any time.

9.2 Drawing Definitions

The Tender Drawings:
Drawings produced to enable those tendering to interpret the design and to submit a tender for executing all or any part of the MEP Engineering Services Works as defined elsewhere.

The tender drawings are listed in Appendix A of SPEC-100

Sketch Drawings:
Line diagrams and layouts indicating basic proposals, location of main items of plant, routes of main pipes, air ducts and cable runs in such detail as to illustrate the incorporation of the engineering services within the project as a whole and with respect to any zoning.

Sketch Schematics:
Line diagrams indicating main items of plant and their interrelationship in such detail as to illustrate the incorporation of the engineering services within the project as a whole.

Detailed Schematics:
Line diagrams describing the interconnection of components in a system and showing the engineering

principles. The main features of a schematic drawing are as follows:

- The drawings include all the functional components that make the system work, such as ducts, pipes, cables, busbars, plant items, pumps, fans, valves, dampers, control devices, strainers, terminals, electrical switchgear and components, security and fire sensors and control equipment.
- Symbols and line conventions in accordance either with a recognised standard, such as ISO or BS, or a supplied legend.
- Drawings labelled with appropriate pipe, duct, busbar and cable sizes, pressures and flow rates.
- The drawings indicate components which have a sensing, control or measurement function.
- Identify major components on the schematic drawing for cross-referencing purposes.
- All data essential to testing and commissioning including:
    - volumetric flow rates.
    - design total pressure losses at equipment.
    - location of dampers.
    - location of valves and flow measuring stations.
    - electrical fault levels.
    - current ratings.
    - short circuit capacities and tripping times.

Detailed Design Drawing:
A drawing showing the intended locations of plant items and service routes in such detail as to indicate the design intent. The main features of detailed design drawings should be as follows:

- 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 nevertheless 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 line or single line layouts as required to demonstrate that the routes are feasible.
- Symbols and line conventions in accordance with either a recognised standard, such as ISO or BS, or supplied legend.
- The drawing should indicate the space available for major routing in both horizontal and vertical planes.

Coordinated Working Drawings:
Drawings 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 drawings should make allowance for installation working space and space to facilitate commissioning and maintenance.
- The drawings should be spatially co-ordinated and there should be no physical clashes between components when installed. Critical dimensions, datum levels and invert levels should be provided.
- The spaces between pipe and duct runs down on the drawing should make allowance for the service at the widest point. Insulation, standard fittings dimensions and joint widths should therefore have been allowed for on the drawing.
- The drawing should indicate positions of main fixing points and supports where they have significance to the structural design of spatial constraints.

Installation Drawing:
A drawing based on the detailed drawing or co-ordination drawing with the primary purpose of defining that information needed by the tradesman on site to install the works. The main features of installation drawings should be as per co-ordinated working drawings plus:

- Allowances should be made for inclusion of all supports and fixings necessary to install the works.
- The drawing should make allowances for installation details provided from manufacturer's drawings.
- Allowances should be made for plant and equipment. This includes any alternatives to the designers original specified option that have been chosen.

Manufacturer's Drawing:
Drawing prepared by a manufacturer, fabricator or supplier for a particular project, and which is unique to that project. Examples include drawings for ductwork, pre-fabricated pipework, sprinkler systems, control and switchgear panels and associated internal wiring, pre-fabricated plant, customised plant and equipment.

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

- The drawings should be to a scale not less than that of the installation drawings
- Locations of all mechanical, electrical and public health systems and components installed including ducts, pipes, cables, busbars, plant items, pumps, fans, valves, dampers, control devices, strainers, terminals, electrical switchgear and components, security and fire sensors and control equipment.
- The drawing should be labelled with appropriate pipe, duct and cable sizes, pressures and flow rates.
- The drawings should have marked on them 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.

Builders Work Details
Drawing to show requirements for building works necessary to facilitate the installation of the engineering services.

Unless stated or agreed with the CA/EA the following builders work details can be marked out on site:

- Holes less than the threshold dimension stated elsewhere.
- Electrical socket and switch boxes.
- Openings that are best cut into blockwork and partitions.

Builders work drawn information to be provided shall include:

- Details of all bases for plant formed in concrete, brickwork or blockwork to a scale of not less than 1:20
- Details of all attendant builders work, holes, chases, etc. for conduits, cables and trunking etc. and any item where access for a function of the installation is required to a scale of not less than 1:100
- Details of all-purpose made brackets for supporting service or plant/equipment to a scale of not less than 1:50
- Details of all accesses into ceilings, ducts, etc. at a scale of not less than 1:50
- Details of all special fixings, inserts, brackets, anchors, suspensions, supports etc. at a scale of not less than 1:20

Plantroom 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/EA.

Protect surfaces of such information by

- Pressure lamination.
- Framing under glass or other rigid, transparent, cleanable and protective surface.

Hang using suitable fixings and provide backboards if necessary

A sample shall be submitted for approval to the CA/EA prior to commencing production.

- Schematic drawings of circuit layouts showing:
    - Location, identification and duties of equipment.
    - Location of controls devices.
    - Circuit layout.
- Valve schedules in the form of printed sheets showing the number, type, location, application/service and symbol, and normal operating position of each valve.
- Control schematics.
- Location of mechanical and electrical plant and equipment items.
- First aid instructions for treatment of persons after electric shock.
- Location of isolating switch for electricity supply.
- Location of main incoming gas valve serving gas meter and isolation point.
- Location of main incoming water main and isolation point.
- Location of sprinkler fire main control valve.
- Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
- All other items required under Statutory or other regulations.

9.3 Prefabrication Proposals

Provide fabrication drawings for comment.

9.4 Programme

Provide a detailed programme(s) clearly illustrating how the overall programme:

- Will be achieved within the contract period.
- Demonstrate compliance with the Main Contract programme.

Provide the detailed programme:

- within one month of the award of the contract

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

- Statutory authority approvals including Building Regulations.
- The latest dates for release of final information required from the CA/EA.
- Required method statements.
- Ordering dates and manufacturing periods. The proposed delivery to site for each item of major plant to be clearly defined.
- The period required for the production, approval and issue of:
    - Builders work information
    - Co-ordinated working drawings
    - Installation drawings
    - Manufacturer's drawings.

Allow adequate time for the examination and approval by the CA/EA. Actual activities of production, adjustment, resubmission and review must be identified

- Installation periods for each system
- Work resulting from instructions issued in respect to the expenditure of provisional sums.
- Concurrent work by other trades.
- Any temporary works necessary for the completion of the engineering services installations.

- Period required for operating the systems, load simulation tests and final adjustment.
- Environmental load testing.
- Period for instructing the Employer training.
- Pre-commissioning, commissioning and performance testing of the engineering services installations.
    - The period required and latest dates for the production, approval and issue of record drawings and operating and maintenance instruction manuals.
    - Provide programme information as
    - critical path network.
- Provide a separate and detailed commissioning programme for agreement with the CA/EA. Make due allowance for the following.
    - Commissioning, demonstration and instruction procedures.
    - Provision of written notice before each (or series of) test, inspection, commissioning or demonstration procedures are to be carried out, not less than 1 week
    - Demonstration to the CA/EA that test instruments and equipment are accurate.

9.5 Heating Network Compliance Gateway Submission

Documentary evidence shall be produced at certain points during the project to demonstrate that the requirements of the CIBSE CP1.2 Code of Practice and Camden Heating Networks Design and Delivery Supplement have been met. This will be interrogated by a suitable qualified professional staff for and on behalf of Camden.

The end of each stage offers an opportunity to review the work completed and to check that the objectives in the code of practice have been met.

The evidence provided creates an audit trail and evidence pack across all stages of development which makes integration of the supply chain easier.

The objective and outputs of each gateway are identified in the CIBSE CP1.2 Code of Practice document.

The Contractor shall agree with the client the method of submitting and approving documents and evidence for gateway acceptance, this method may use an internet cloud based platform. The method must allow the evidence submission packs to be viewed, approved, rejected, commented on, and stored for reference.

9.6 Commissioning and Handover plans

The Contractor shall develop and issue for comment separate plans for commissioning and handover as set out in sections 11 & 12. Due to the phased approach of the project, commissioning plans shall be issued for first draft as soon as on site work commences.

9.7 Alternative Contractors Proposals

Where the CA/EA has accepted proposed alternative equipment or materials prior to the award of the contract and which subsequently varies the main works and/or the MEP Engineering Services Works in any way whatsoever, then:

- Be responsible for meeting all the additional costs and technical requirements arising from such a change
- No claim for additional costs or delay to the completion of the works will be allowed.
- Undertake the redesign of all engineering services and builders work affected by these equipment changes at no additional cost or extension or delay to the programme.

- Be responsible for ensuring that alternative equipment, materials and variations to the MEP Engineering Services Works do not impact on the Target Emissions Rate and on the 'as constructed' calculation Buildings Emissions Rate not achieving compliance.

Should any alternative item proposed not carry appropriate certification, ensure independent testing is carried out to confirm compliance at no additional cost.

9.8 Technical Submissions

Review of Submittals by consultant:
The consultant will review the contractors Technical Submittals for general conformity with the design intent. Our comments should be fully considered by the contractor before proceeding with any procurement, fabrication, manufacture or installation. These comments do not constitute formal design team approval and do not relieve the Contractor of responsibility for full conformance with the design drawings, specifications and applicable regulations. Reference should also be made to comments by other team members where indicated.

The consultant will give Technical Submittals the following status.

- A - No objections to contractor's proposals
- B - No objections subject to incorporation of comments
- C - Rejected - re-submit revised proposals to reflect comments

Technical submittals for Equipment
Any variations from the specified requirements shall be highlighted on each submittal. Technical submittals must be specific for the equipment in question. Standard literature and extracts from manufacturers catalogues will not be acceptable.

Schedule of Drawings and Submittals:
Provide a schedule of all proposed drawings and submittals required for comment. The schedule shall be provided

- No later than 4 weeks from contract appointment

Indicate as a minimum the following information on the schedule:

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

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

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

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

Allow adequate time in the programme in order not to cause delays.

The full extent of all submittals shall be indicated in the schedule.

Group submittals for a particular part of the building or building engineering service as agreed with the CA/EA.

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

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

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

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

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

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

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

The timescale for review or comment or otherwise on all submittals shall be 14 working days from the date of receipt by the CA/EA

Equipment Performance Details:
Details of the equipment selected for inclusion into the MEP Engineering Services Works shall include the following information:

- Plant item description, reference identification and serial number.
- Electrical input rating - kVA, Volts, Phase.
- Operating mode - duty, standby, generator etc.
- Starting characteristics - starter type, current, starts/hour and starting time.
- Performance characteristics - (full load current and power factor).
- Noise level.
- Weight.

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

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

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

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

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

The medium for transfer of information shall be

AutoCad drawing files shall be

- DWG

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

The standard drawing size is to be:

- either A1 or A0 (avoid both)

Scales used on drawings shall be:

- selected to convey clearly the proposals

Review of Submittals:
The CA/EA will take up to 2 weeks to review submittals. The contractor is to allow sufficient time in the programme for this review process along with the time required for any subsequent revisions and comments.

The CA/EA or their appointed representative may review proposals and drawings (including Installation Drawings) submitted by the Contractor for these MEP Engineering Services Works or parts thereof, for general compliance with the design intent and performance criteria. The CA/EA will not 'approve' any drawings or other information submitted for review.

Review will not relieve the Contractor of any responsibilities or obligations under the contract and it will remain the sole responsibility of the Contractor to ensure the contract requirements are met. The Contractor will remain liable for any defects in or omissions from the information supplied by them.

Any changes to drawings or other information that are needed to meet the contract requirements are deemed to have been taken into account within the contract sum and programme.

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

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

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

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

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

Form and Number of Submittals to be Provided:
Drawn information provided by the Contractor is to be produced using the latest version of AutoCAD, or in a CAD package fully compatible with AutoCAD.

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

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

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

Provide drawn information for the design team and client in the following forms:-

Design & Installation drawings:

- Initial copies for comment - print form
- Final copies for distribution - print form
- Provide drawn information for the design team and client in the following numbers
- Initial copies for comment - 2 or as stated in the Main Contract Preliminaries if greater.
- Final copies for design team - 2 or as stated in the Main Contract Preliminaries if greater.

As-installed drawings:

- Maintain site record copy up to date as the work proceeds.

Record drawings:

- Initial copies for comment - 2 or as stated in the Main Contract Preliminaries if greater.
- 2 preliminary sets for use during commissioning.
- One reduced set incorporated into each O&M manual.
- Set as .dwg AutoCAD drawings presented on a CD.

Plant room schedules and schematics:

- Initial copies for comment - 2 or as stated in the Main Contract Preliminaries if greater.
- 2 preliminary sets for use during commissioning.
- One framed set for plantrooms.
- One reduced set incorporated into each O&M manual.
- Set as .dwg AutoCAD drawings presented on a CD.

9.9 Samples

For all contractor design elements, provide samples for all items that will be visible following the completion of the building. In particular, any human interfaces such as building and lighting control interfaces should be provided for comment by the Client. Provide samples at least 3 months prior to the date they need to be ordered to avoid delays to the construction contract. Provide any other samples specifically identified in the MEP specification work sections.

Sample items to be provided include but are not limited to:

- Heating control interfaces;
- Electrical accessories.

9.10 RFIs and TQs

Issue Requests for Information and Technical Queries through the agreed procedure for the project as outlined in the Main Contract Prelims.

9.11 BREEAM

There are no BREEAM requirements for the heating network upgrade works.

10.0 CONSTRUCTION

10.1 Method Statements

Submit method statements to the CA/EA prior to commencement of the contract works for each item of work, and in particular:

- Develop and issue all method statements listed in the Main Contract Preliminaries
- Procedures for the control of legionella prior to handover
- Precautions to be taken to reduce risk of Pseudomonas contamination of all water systems (Mechanical Contractor only).
- Any works requiring interruptions of supplies, out of hours working, noisy work, road closures or disruption to other building users or neighbours
- Project phasing and sequencing plan of installation to minimise site distribution and retain a live heat supply, water supply and electrical supply to the residents throughout the project works

10.2 Quality Control

Drying Out:
Make due allowance in the sequence of the work to provide heat for drying out. This activity shall not relieve any responsibilities to hand over the installation in good order.

The interim period from the time of commencement of use for drying out to the handover shall not be considered as constituting any part of the defect liability period.

Where underfloor heating cast in screed forms part of the works, ensure flow temperatures and heating periods meet the screed manufacturer's requirements during the drying out period.

Use or Disposal of Materials:
- Remove from the site any rubbish and debris arising out of the execution of the contract works
    - on a daily basis.
- Clear all rubbish and any debris arising out of the execution of the contract works to a central area where others will remove it from the site
    - on a daily basis.
- Do not discharge any oil, noxious liquids or gases and all water discharged shall be reasonably free from impurities.
- All waste is to be recycled where possible.
- Comply with the requirements of BREEAM where required

Storage:
Weatherproof, safe and secure storage shall be provided for all materials and equipment.

All materials and equipment and materials shall be offloaded, stored and transported in accordance with manufacturer's recommendations.

All electrical equipment and components shall be kept dry and free from dust.

Plug, cap or seal open ends on all ductwork, tubes, conduit, trunking and associated equipment whilst in storage and during transportation to site.

Provide racks to prevent distortion of pipes, conduit and similar materials.

Protection And Packaging:
All plant, equipment, materials and prefabricated elements of the MEP Engineering Services Works shall be properly packaged and protected against damage during delivery, storage and until fully, finally and properly installed and set to work.

Submit to the CA/EA a method statement on protection proposals for both stored and installed plant, equipment and materials.

Protection shall also include adverse effects of environmental conditions prevalent in the stored and installed location.

Any plant or equipment subject to incorrect storage or inadequate protection will be deemed unacceptable for incorporation into the works and new plant or equipment will be required as a replacement.

Damaged plant, equipment and materials or that suffering from deterioration shall be replaced prior to handover.

All plant, equipment and materials shall be protected against ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building works and operations of others.

All open ends of pipes, ducts, conduit, and trunking etc. shall be capped except when being worked upon.

- After removal of any temporary protection paint parts liable to corrosion.
- Filter media shall only be installed when the plant items concerned are commissioned and tested.

Install items such as grilles, diffusers, light fittings, switches, electrical accessories etc. as near to practical completion as practicable.

Materials Used:
No acoustic insulation or thermal insulation or sound attenuation materials shall be manufactured with any form of animal hair.

All materials supplied shall be a type that will not support bacteria.

Substances publicised by the Health and Safety Executive, Building Research Establishment, British Standards Institution or other authorities or professional bodies as being deleterious to Health and Safety shall not be incorporated into any part of the MEP Engineering Services Works.

Deleterious materials shall not be utilised on any part of the MEP Engineering Services Works. Deleterious materials include but are not limited to:

- halon/CFC's
- asbestos or products containing asbestos
- urea formaldehyde or materials which may release formaldehyde
- materials comprised in whole or part of man-made and/or naturally occurring mineral fibres which have a diameter of 3 microns or less and a length of 200 microns or less or which contain fibres not sealed or otherwise not stabilised to ensure that fibre migration is prevented
- lead where the metal or its corrosion products may be directly ingested, inhaled or absorbed
- polyurethane or polyisocynate foam
- polychlorinated biphenyls (PCBs) or similar compounds
- pentachlorophenol, lindane or tributyltin (TBT) oxide
- extruded polystyrene other than low ozone depletion materials
- any other substances generally known to be deleterious at the time of installation
- The Contractor shall alert the Employer and CA/EA to the risks in respect of any installed material that is subsequently identified as deleterious or potentially deleterious and shall advise as to the best and most economic course of action.

All jointing materials shall be of a type approved by the respective authority.

Warrant that deleterious materials are not incorporated in the MEP Engineering Services Works.

Notify the CA/EA, in writing, as soon as reasonably practicable of any material designated by the Building Research Establishment, British Standards or codes of practice as deleterious at any time during the contract.

Fire Precautions:
Take all reasonable fire precautions in respect of stores, workshops and other installations. Where it is necessary to use any naked flame or welding equipment in executing the contract works and where combustible materials are in use, adequate protection shall be given to other adjacent materials and

personnel. Suitable fire extinguishers shall be readily available at the position where such work is proceeding.

Damage to Structure:

- Exercise due care and attention in carrying out the contract works and be fully responsible for any damage caused to the structure or building finishes.
- Obtain permission from the CA/EA before any holes are cut in floors, walls or steelwork, etc.

Equipment Guarantees:
Plant and equipment guarantees shall commence at the date of practical completion and run for a minimum of 12 months after this date.

Any costs associated with this requirement shall be included in the contract price.

Site Modifications:
Site modifications to assemblies shall not be made without written approval of the CA/EA.

Where site modifications to assemblies are authorised undertake in accordance with manufacturer's certified drawings and instructions.

Ensure that all modifications undertaken comply with the relevant standards and all test certification obtained.

Dimensions:

- Where installations are dependent upon site dimensions ensure that these are available before proceeding with the MEP Engineering Services Works.
- Dimensions should not be scaled from drawings.
- Where dimensions are indicated on drawings check these on site, as appropriate, to ensure building construction tolerances and manufacturing tolerances can be accommodated.
- Equipment should not be ordered or manufactured using dimensions indicated on the Tender drawings.

Workmanship and Materials:

- All materials, articles and workmanship shall be of the best quality and execution as detailed in the specification and drawings.
- All equipment and materials to be installed shall be new unless otherwise indicated.
- All equipment shall be installed in accordance with the manufacturer's written instructions and recommendations.
- All materials considered by the CA/EA to be unsound or not in accordance with the specification shall immediately be removed and properly replaced to the satisfaction of the CA/EA at no additional cost. All work carried out imperfectly or with faulty materials must be immediately removed and properly replaced to the satisfaction of the CA/EA at no additional cost.
- The manufactured articles specified shall serve as a quality standard.
- Where manufactured items are not specified by name submit with the tender all necessary details of proposed articles. The CA/EA shall approve these articles before their use is permitted.

10.3 Factory Testing

Carry out factory testing where described within individual work sections in the MEP specification.

10.4 Development of Record Information

Continually mark up a set of drawings on site to ensure ongoing development of Record Information.

10.5 Beneficial Use

- Systems shall not be used before practical completion without prior approval of the CA/EA.
- Systems used before practical completion not for the benefit of the Employer must have all defective consumable elements replaced by new including:
    - lamps and tubes
    - filters
- Replacement of consumable elements shall be not more than 14 days prior to practical completion.
- If instructed by the CA/EA, operate the installations or any part of them prior to practical completion, provided that such operation is practicable and does not prejudice the responsibilities and obligations under the contract.
- All costs arising from the use of such installations will be reimbursed at rates or where no such rates are applicable at reasonable rates agreed with the CA/EA before commencing operation of the installations.

10.6 Snagging

Inspection before Concealment:
Whenever work requiring inspection or testing is subsequently to be concealed give the following the notice to the CA/EA so that inspections may be made or tests witnessed before concealment

- 5 days' notice

11.0 HANDOVER, COMPLETION AND COMMISSIONING

11.1 Record Information

Standards:
Provide operating and maintenance manuals, system records and full documentation in accordance with the following standards:

- BS EN 50131-1 - Intruder alarm systems.
- BS 5839 - Fire detection and alarms in buildings.
- BS 6701 - Telecommunications equipment and telecommunications cabling.
- BS 7671 - Requirements for electrical installations (IEE Wiring regulations)
- BS EN 12170 - Heating Systems with a trained operator
- BS EN 12171 - Heating Systems not requiring a trained operator
- BS EN 62305 - Protection against lightning.
- Building Regulations (Approved Document Part L2)
- Comply with the requirements of the CDM Regulations in providing the appropriate input to the Construction Phase Plan and health and safety file for the contract works.

Record Documents:
Provide:

- Record drawings and schedules.
- Plant room and switch room drawings, schedules and schematics.
- Operating and maintenance manuals.
- Blank maintenance logs.
- Log books
    - in compliance with the Building Regulations.
    - in accordance with CIBSE TM 31.
- Ensure record documents clearly record the arrangements of the various sections of the MEP Engineering Services Works as actually installed and identify and locate all component parts.
- Ensure record documents make it possible to comprehend the extent and purpose of the MEP Engineering Services Works and the method of operation thereof.
- Ensure record documents set out the extent to which maintenance and servicing is required and how, in detail, it should be executed.
- Ensure record documents provide sufficient, readily accessible and proper information 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.
- Ensure that building log books contain all the information necessary to comply with the Building Regulations Approved Document Part L2.

Record Drawings and Schedules:

- Prepare record drawings and schedules based on the As Installed Drawings maintained on site during the progress of the contract works.
    - The scale of the drawings shall be not less than the scale at which the design or installation drawings were produced.
- 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 installer and the consultant.
- Endorse all such documents

    - 'Record drawings'
- Where agreed with the CA/EA certain detailed information may be provided in schedule form.
- Where portions of the work are to be concealed, draft copies of record drawings shall be supplied to the CA/EA before the work is concealed in order to facilitate checking and examination.
- Prepare electrical drawings in accordance with BS EN 61082.
- Issue at practical completion the complete approved package of record drawings in the following numbers and format:
    - CAD format on 2no. Kingston USB flash drives. The USB flash drives shall be labelled and secured in a foam lined book sized box which shall be labelled identifying project title, issue date and index of contents.
    - Number of sets of complete record drawings (no) 2
    - 'White' prints.
    - Number of sets of complete record drawings (no) 2
- Provide reduced scale copies for inclusion in the operating and maintenance manuals as stated elsewhere.

Record drawings and schedules must include, but are not limited to:

- Location, including level if buried, of utility service connections, including those provided by the appropriate Authority, indicating points of origin and termination, size and material of service, emergency shut-off isolation locations, pressure and/or other relevant information.
- Disposition and depth of all underground systems.
- Schematic drawings of each system indicating principal items of plant, equipment, zoning, means of isolation, etc. in sufficient detail to make it possible to comprehend the system operation and the inter-connections between various systems.
- Details of the principles of application of automatic controls and instrumentation.
- Diagrammatic dimensioned plans and sections of each system or service showing sizes and locations of all ancillaries, plant, equipment controls, test points, and means of isolation etc. including any items forming an integral part of the engineering systems provided by others (such as plenum ceilings, builders' work shafts, chimneys etc.).
- Identification of all terminals/cables etc. by size/type and duty/rating as recorded from the approved commissioning results.
- Detailed wiring drawings/diagrams/schedules for all systems, including controls, showing origin, route, cable/conduit size, type, number of conductors, length, termination size and identification, and measured conductor and earth continuity resistance of each circuit. Ensure routes indicate if cable/conduit is surface mounted, concealed in wall chase, in floor screed, cast in-situ, above false ceiling etc.
- Details of co-ordination of wiring and connections with cable core identification, notation of fire alarm, security, control and instrumentation and similar systems provided as part of the MEP Engineering Services Works.
- Details to show inter-connections between the MEP Engineering Services Works and equipment or systems provided by others to which wiring and connections are carried out as part of the MEP Engineering Services Works.
- Location and identity of each room or space housing plant, machinery or apparatus.
- Dimensioned plans and sections of plantrooms, service subways, trenches, ducts and other congested areas where in the opinion of the CA/EA smaller scale drawings cannot provide an adequate record. Indicate the location, identity, size and details of each piece of apparatus.
    - The scale of drawings to be the scale at which the design or installation drawings were produced.
- Manufacturer's drawings of equipment indicating
    - general arrangement and assembly of component parts which may require servicing.
    - internal wiring diagrams together with sufficient physical arrangement details to locate and identify component parts.
- Schedules as required to locate, reference and provide details of ratings and duty of all items incorporated into the MEP Engineering Services Works together with all fixed and variable equipment settings established during commissioning.

- For each programmable control item
    - schedules indicating for each input and output point connected
    - full data in respect of that point including reference
    - type of input/output
    - connected equipment reference
    - set values of temperature or pressure etc.
    - set values of start/stop/speed change times etc.
    - alarm priority
    - control specification reference
    - any other such applicable parameters
    - Each spare input and output point including reference, type of input/output and space for future entry of appropriate parameters as listed above.
- Logic flow diagrams for each individual control or monitoring specification and for each building services engineering system to illustrate the logical basis of the software design.
- Schedules setting out details of all initial values of user-defined variables, text statements for alarm messages etc.

Plant Room 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/EA.

- Protect surfaces of such information by
    - Pressure lamination
    - Framing under glass or other rigid, transparent, cleanable and protective surface
- Hang using suitable fixings and provide backboards if necessary
- A sample shall be submitted for approval to the CA/EA prior to commencing production.
- Schematic drawings of circuit layouts showing:
    - Location, identification and duties of equipment
    - Location of controls devices
    - Circuit layout
- Valve schedules in the form of printed sheets showing the number, type, location, application/service and symbol, and normal operating position of each valve.
- Control schematics.
- Location of mechanical and electrical plant and equipment items.
- First aid instructions for treatment of persons after electric shock.
- Location of isolating switch for electricity supply.
- Location of main incoming gas valve serving gas meter and isolation point.
- Location of main incoming water main and isolation point.
- Location of sprinkler fire main control valve.
- Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
- Location of metering facilities.
- All other items required under Statutory or other regulations.
- Prepare electrical drawings in accordance with BS EN 61082.

11.2 Operation and Maintenance Manuals

Presentation of the Operating and Maintenance Manuals:

- Agree format and contents with the CA/EA.
- Provide the operating and maintenance manuals in the following form:
    - Encase the manuals in A4 size, plastic-covered, loose leaf, four ring binders with hard covers, each indexed, divided and appropriately cover- titled. Fold drawings larger than A4 and include in the binder so that they may be unfolded without being detached from the rings.
    - Electronic format: a copy each on a CD and memory stick.

- Provide copies of the operating and maintenance manual as follows:
  - Draft copies for comment (no) 1
  - Final copies for Client use (no) 3
- Provide a draft copy of the operating and maintenance manual to the CA/EA for comment
- Timescale:
  - Weeks before the contract completion date (no) no less than 6
- The draft copy of the manual shall conform to the final format required by the specification to enable all relevant comments to be made by the CA/EA.
- Although it will not be necessary for the draft copy to contain testing and commissioning certificates, it will be complete in every other way.

Operating and Maintenance Manuals:
The operating and maintenance manuals must include:

- A full description of each of the systems installed, written to ensure that the Employer's staff fully understand the scope and facilities provided.
- A description of the mode of operation of all systems including services capacity and restrictions.
- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- A photo-reduction of all record drawings together with an index. Reduced size of drawings to be A3
- Legend of all colour-coded services.
- Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.
- The name, address and telephone number of the manufacturer of every item of plant and equipment together with catalogue list numbers.
- Manufacturer's technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.
- A copy of all test certificates, inspection and test Records, commissioning and performance test records including, but not limited to, electrical circuit tests, corrosion tests, type tests, start and commissioning tests, for the installations and plant, equipment, valves, etc., used in the installations.
- A copy of all manufacturer's guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturers.
- Copies of insurance and inspecting Authority certificates and reports.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.
- Procedures for seasonal change-overs and/or precautions necessary for the care of apparatus subject to seasonal disuse.
- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- Details of lubrication for lubricated items including schedules of lubricant type, frequency, etc.
- Details of regular tests to be carried out (e.g. water analysis for pseudonomas.)
- Details of procedures to maintain plant in safe working conditions.
- Details of the disposal requirements for all items in the works.
- A list of normal consumable items.
- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- A list of any special tools needed for maintenance cross-referenced to the particular item for which required.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.
- Hospital Operational Policy.
- Back-up copies of any system software.

- Documentation of the procedures for updating and/or modifying software operating systems and control programmes.
- Instructions for the creation of control procedure routines and graphic diagrams.
- Details of the software revision for all programs provided.
- Two back-up copies of all software items, as commissioned.
- Copies of relevant HSE/CIBSE/IET Guidance notes etc.
- Contractual and legal information including but not limited to
    - Details of local and public authority consents
    - Details of design team, consultants, installation contractors and associated subcontractors
    - Start date for installation, date of practical completion and expiry date for the Rectification Period
    - Details of warranties for plant and systems including expiry dates, addresses and telephone numbers.
- A provision for update and modification.

11.3 Building User Guides

Provide contents applicable to the Building Services Systems for incorporation into a Building User Guide that will be produced by the Contractor or other Specialist including:

- Information on heating, cooling and ventilation and how they can be adjusted.
- Information on energy-efficient features and strategies and how they should be used.
- Information on water use and water saving features/benefits.

11.4 Testing and Commissioning

General:
The Contractor is to comply with the requirements of Appendix A Table D "Allocation of Commissioning Responsibilities", document no J6828-MXF-XX-XX-SH-J-00001 "Testing, Commissioning & Handover Schedules", and the following clauses:

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

- 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 and 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 and includes the re-assessment of design values and control set points to achieve the required system performance.

Programme:
Prepare comprehensive programmes for the pre-commissioning checks, setting to work, testing, commissioning, system proving and environmental testing of the contract works.

Timescale:

- To be completed and co-ordinated with other trades at least 6 weeks before the start of commissioning.
- 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.

Commissioning and Testing:
Generally comply with CIBSE Commissioning Code M, CIBSE CP1.2 Code of Practice for Heating Networks and the Camden Heating Networks Design and Delivery Supplement.

Appoint an "approved" engineer or commissioning manager, to supervise and coordinate the whole of the testing, commissioning, performance testing and instruction of client's staff.

Compile a separate and comprehensive testing and commissioning programme, coordinated with the main project programme, on a system by system basis. Issue to the CA/EA for comment at least 1 month prior to the testing and commissioning commencement date. Due allowance is to be made for, but not limited to, the following:

- issue of method statements and risk assessments;
- review of "commissionability;
- pre-commissioning checks, system cleaning/flushing where relevant, setting to work, testing, commissioning, and performance testing of all engineering services installations;
- any concurrent work by other trades;
- periods for any off-site plant or equipment inspection and/or test;
- demonstration of system(s) performance to the satisfaction of the CA/EA;
- client demonstrations and training;
- any proving periods required;
- preparation and provision of the "Commissioning Plan" (see clause 11.4);
- preparation and provision of Record Drawings and Operating & Maintenance Manuals

Provide formal method statements supported by risk assessments detailing the procedures for carrying-out on (and off) site testing and commissioning.

Review the design of the works in relation to "commissionability" (i.e. the ability of a system to be commissioned satisfactorily).

During the testing and commissioning period provide weekly progress reports detailing the status of each system to be commissioned including results, technical issues, the input of others over the next week, etc. Issue to the CA/EA.

Up-date the commissioning programme as the work proceeds taking into account true progress on site. Issue revised programme as part of the weekly report.

Give notice to the CA/EA of when testing and commissioning is ready for inspection and/or witnessing. Give not less than 5 working days.

The CA/EA will only witness testing and commissioning results once it has been confirmed by the Contractor, in writing, that satisfactory results have been achieved. The purpose of witnessing by the CA/EA is to confirm recorded results and determine if the specified requirements have been satisfied, and in no way relieves the Contractor of their responsibilities under the Contract. If following test or inspection any system or plant item is shown to be defective or not conforming to the specification the CA/EA will reject such defective parts, and after rectification by the Contractor may wish to re-inspect the system or systems involved.

Provide all the necessary labour and facilities to enable tests to be witnessed and inspections carried out on site and/or at manufacturer's works. Provide all specialised personnel (including manufacturer's

representatives) and co-ordinate their activities. Allow for all the costs incurred.

Test all equipment, material and systems as detailed in Work Sections. If an inspection or test fails, repeat the procedure, until satisfactory results are obtained.

Complete all tests before any paint, cladding or similar materials are applied or before services are concealed. Ensure all requirements such as cleanliness, protection from harmful external and internal elements etc. are provided prior to commencement of commissioning.

Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust, as necessary, to meet the specified design requirements.

Provide all necessary instruments and recorders to monitor systems during commissioning and performance testing.

Provide test equipment subject to a quality assurance procedure complying with ISO9001:2015 .

Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the CA/EA.

Maintain on site full records of all commissioning and performance testing, cross referenced to system components and on completion of the MEP Engineering Services Works include a copy in each Operating and Maintenance Manual.

Provide all certification documents for review by the CA/EA before any system is offered for final acceptance.

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

Demonstrate to the CA/EA that all system components are operating correctly, and the completely integrated installation will function in accordance with the specified performance requirements.

Only after a successful demonstration to the CA/EA will the Contractor be able to commence staff training as Section 10.1.

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
- Pressure testing of hydraulic systems
- Air leakage testing of ductwork systems

The CA/EA shall be given the opportunity to witness all static tests.

Advance notice of the tests shall be given to the CA/EA.

Timescale:

- days prior to test (no) 7

Pre-Commissioning Checks:
Ensure all pre-commissioning examinations and tests have been undertaken and that each system, including components, or item of equipment is complete and in a safe condition prior to start-up.

All necessary notices shall be displayed.

Completion for operational purposes implies the bulk of snagging has been offered to the CA/EA and that remedial work has been completed. All fans, pumps etc. tested for operation, polarity, phase sequence and impedance etc.

Finalise commissioning programme, taking into account site progress and availability of related services, with CA/EA and Contractor and agree access required for controls, etc.

Building Regulations Commissioning Plan:
As required by Part L2 of the Building Regulations, Section 2 clauses 2.5 to 2.7 inclusive, it is the Contractors responsibility to demonstrate that the building services installations have been installed, inspected and commissioned in accordance with the requirements of Part L of the Building Regulations.

As part of showing compliance the Contractor is to provide a "commissioning plan" (as defined in clause 2.6(a) of Part L2) and a "commissioning report" (as defined in clause 2.6(b) of Part L2) detailing that the inspection and commissioning activities necessary to establish that the MEP Engineering Services Works complies with Part L have been completed to a reasonable standard. It is for the Contractor is to demonstrate to the local Building Control office that the person(s) providing this report are suitably qualified. This plan is to be available prior to Practical Completion.

(Note: this clause is not relevant to MEP Engineering Services Works, or those parts of the MEP Engineering Services Works, classed as domestic dwellings under Part L1 of the Building Regulations).

System Demonstration:

Subsequent to the completion of all testing and commissioning to the satisfaction of the CA/EA and when directed operate the plant and demonstrate that the overall systems function correctly in accordance with the requirements of the specification.

- During this period be responsible for the recording of results and the operation and maintenance of the plant.
- Provide the following:
    - An operational report of the demonstration
    - Schedule of the conditions maintained within the space for a period of

Plant and Equipment Performance Testing:
Where stated elsewhere plant and equipment shall be tested at the works of the manufacturer or in a recognised and approved testing facility to demonstrate the performance complies with the stated and specified duties.

These tests shall be in addition to works tests as stated elsewhere.

Performance testing shall demonstrate but not limited to the following:

- Full, partial and minimum load
- Response to load change
- Efficiency
- Noise levels

The tests shall be conducted to simulate design conditions and all ancillary plant and equipment needed to support the tests together with all instrumentation shall be provided and included in the contract cost.

Upon successful completion of the performance tests the plant and equipment shall be thoroughly cleaned and returned to its new condition and correctly packaged for delivery to site.

Test certificate records of the tests shall be issued to the CA/EA as stated elsewhere.

Allow for all expenses of the CA/EA to attend inspections and witness tests. Allow for 2no. persons.

Inspections and Tests:
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 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.

Maintain all records on site for inspection.

BMS Witnessing Requirements:

- The CA/EA or nominated representative will implement the following witnessing requirements.
- Ensure that on-site commissioning staff facilitate the following witnessing process.
    - The BMS hardware is installed in accordance with the requirements as stated elsewhere.
    - Verify any operator software and associated graphics.
    - Witness completely the control of any main and/or critical items of plant along with a random sample of other points.
    - Points witnessing
    - If less than 300 points, witness all points.
    - Between 300 and 1000 points witness 50% (minimum of 300 to be witnessed).
    - If more than 1000 points witness 20% (with a minimum of 500 points witnessed).
    - Reserve the right to witness 100% of the points if the failure rate is greater than 5%.
    - Witness the operation of all of the controls logic.
    - Witness one of several identical items of plant in detail with the others witnessed on a random basis.
    - Verify the system security access.
    - Verify that all safety-related functions perform to that specified, e.g. plant shutdown on fire condition.
    - Verify all plant restarts according to that specified after building power failure and local power failure.
    - Witness all power meter data-points to ensure that they match the meters.
    - Ensure that trend logs are used when witnessing points in order to monitor the performance of control actions
    - Verify the handover of all operating manuals and system documentation.
    - Verify the handover of backup copies of software.
    - Verify the completion of any specified system operator training.

Rotating Equipment:
Immediately prior to practical completion adjust, ease and lubricate moving parts as necessary to ensure easy and efficient operation.

Ensure that temporary electrical supplies are provided to enable rotating plant items delivered and/or installed to be run at regular intervals to avoid damage or deterioration.

If temporary electrical supplies are not available ensure that rotating plant is hand-turned.

11.5 Completion and Handover Procedures - Software, keys, spares, meter readings, etc

Supply of Computer Hardware and Software:
Obtain on behalf of the end user all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Ensure that application software is written in compliance with BS 7649.

Recommended Spare Parts:
Before Practical Completion submit to the CA/EA a schedule of spare parts as stated elsewhere and recommend any that should be obtained and kept in stock by the Employer for maintenance of the installations included in the MEP Engineering Services Works.

- Time scale
    - 4 weeks before Practical Completion

State against each item the manufacturer's current price, including packaging and delivery to site. Identify those items that are additional to those specified for inclusion as stated elsewhere.

Recommended Tools:
Prior to Practical Completion submit to the CA/EA a schedule of tools and portable instruments as stated elsewhere and recommend any that should be obtained and kept in stock by the Employer for maintenance of the installations included in the MEP Engineering Services Works.

- 4 weeks before Practical Completion

Production of Handover Information:
The Contractor is to comply with the requirements of Appendix A Table E "Production of Handover Information" and drawing no J6828-MXF-XX-XX-SH-J-00001 "Testing, Commissioning & Handover Schedules", and the following clauses:

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

- All the contract works are complete.
    - With the exception of minor snags or limited defects as agreed with the CA/EA 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 report signed by an approved competent person
- A complete demonstration of the contract works with fully functional operational controls tested has been undertaken in the presence and to the satisfaction of the CA/EA.
- All necessary certification by the Employer's insurers has been completed.
- All approved record documentation including record drawings, operation and maintenance manuals, etc. is issued
- All information required for the health and safety file is issued to the satisfaction of the CDM Coordinator.

The information shall include:

- A written description of plant operation.
- Basic security access to the system.
- Comprehensive instructions for switching on, operation, switching off, isolation, fault finding and procedures for dealing with emergency conditions.
- Instructions for any precautionary measures necessary.
- All necessary Statutory Authority approvals have been undertaken and written confirmation established
- Completion and issue of log books in accordance with Building Regulations.
- It should be noted that this log-book is in addition to the Operating & Maintenance Manuals and is to be issued as a separate document. The log-book is in effect a summary of the O&M manuals suitable for day-to-day use by the building managers/users.
    - Air permeability test certificate in accordance with Building Regulations.
    - Should adequate record documentation not be available Practical Completion will not be granted.

Reading of Meters:
Record readings of all water, gas, and electricity meters immediately on completion of the MEP Engineering Services Works and forward to the CA/EA

Inspection by Employer's Insurers:
Where indicated elsewhere installations, equipment, plant or materials are to be inspected by a representative acting for the Employer's insurers.

The installations, equipment, plant or materials shall satisfy the insurance company's requirements in all respects.

- Inform the CA/EA when the installation or equipment is ready for examination
- Provide a programme for the inspection and certification by the Employer's insurers.
- All necessary information shall be provided to enable the insurers to approve the design before manufacture.
- Arrange for the attendance of the insurance company's representative at agreed stages of manufacturer and installation.
- All necessary attendance, access and facilities for inspecting and testing as is required shall be provided.
    - Certification shall have been received from the insurers before equipment or installations subject to inspection and certification will be accepted on behalf of the Employer.

Operation of Systems before the Production of Drawings and/or Operating and Maintenance Manuals:
- Provide attendance, at no expense to the Employer, to put into service, operate 24 hours a day and maintain the systems to the Employer's requirements, including the provision of suitable competent labour, in the event that the Record Drawings and/or Maintenance Manuals are not available when the MEP Engineering Services Works would, in the opinion of the CA/EA, otherwise qualify for Practical Completion.
- In the event of the Subcontractor failing to provide this service satisfactorily the Employer shall be entitled to make their own arrangements and recover the full cost through the contract.

12.0 NETWORK OPERATION AND TRAINING

12.1 Two Year Operational and Maintenance Period

After achieving Practical Completion the Contractor shall operate and maintain the complete heating network including the plantroom for a 24 month period, or for the period of the Defects Liability Period if longer, from the date of Practical Completion.

The Contractor shall allow for in their tender the complete cost over the 24 month period to fine tune the network, provide in-depth heating network operational training to the incumbent facility engineer, carry out seasonal commissioning and the rectifications of defects.

Provide attendance, at no expense to the Employer, to put into service, operate 24 hours a day and maintain the systems to the Employer's Requirements, including the provision of suitable competent labour, in the event that the Record Drawings and/or Maintenance Manuals are not available when the Works would, in the opinion of the CA, otherwise qualify for Practical Completion.

<u>The fine tuning is to include:</u>

- Refer to clause 12.4 below

<u>Heat network training is to include:</u>

- To ultimately up-skill the incumbent maintenance engineer to understand the sophistication of operating the heating network to the maximum efficiency and performance
- Ensure all central plant is operating in automatic mode with BMS control strategy seeking maximum performance
- Understanding the operation of the low carbon heating source plant
- Understand the requirements, benefits and complete control strategy of the variable volume hydraulic systems including pumping arrangement and control, pressure and bypass control, and temperature control
- To be able to monitor the network performance in terms of losses, operating temperatures, plant efficiencies and energy usage

<u>Operational and Maintenance is to include:</u>

- An operational and maintenance plan that sets out how the operation of the heating network will be carried out to maximise operating performance and efficiency
- Maintain and operate the works covered by this specification for twenty-four months, or for the period of the Defects Liability Period if longer, from the date of Practical Completion - the energy center, low carbon heating plant, distribution network and control facility
- To continue to monitor the operating of the complete hydraulic system against commissioning flow rates and analyze performance
- To monitor and ensure the low carbon heating technology is operating at its optimum as the lead source
- To ensure the network is operating and meeting the project KPIs
- To monitor the performance of the HIUs and ensure they're operating to the commissioned parameters
- To monitor the heat meter data and network performance on a weekly, monthly and annual report basis
- Correct operation of the plant sequencing through the seasons
- Maintaining and logging the desired flow temperature
- Ensuring a low return temperature is achieved and logged, this will include working with customers to encourage reductions in return temperature
- Ensuring the network losses are no greater than the design
- Ensuring all the metering and billing is operational

- The logging of the Mayford Estate and Somers Town heat network performance shall be carried out the remote monitoring
- Proving a reliable supply of heat with 100% availability of the year 24/7
- Filtration units to be monitored and inspected regularly to ensure solids are removed
- A comprehensive water treatment regime shall be implemented including sampling and monitoring, chemical dosing and recording of results
- The system shall be monitored to detect leaks by daily recording of make-up water and anomalies investigated
- An annual operating report identifying the full energy balance of the scheme
- Sign off and acceptance at the end of 24 month period once KPIs are proven
- The maintenance works shall be in accordance with the recommendations set out in the appropriate standard.
- The maintenance works shall include:
    - Planned preventative maintenance to maintain the installations in efficient working order including routine checks, adjustments, lubrication and replacement of consumable spares, etc.
    - Preparation of work schedules and recording activities.
    - Providing breakdown and emergency cover.
    - Planning and undertaking shut-downs for maintenance works.
    - Employing of all necessary specialist maintenance to ensure optimum operation of plant items and specialist systems.
    - Attendance on and supervision of specialist maintenance.
    - Carrying out all necessary safety checks .
    - Carrying out system proving of the works to include the measuring, recording, evaluating and reporting on the seasonal performance of the systems against their design values.
    - Water sampling including laboratory analysis and monitoring of heating LTHW, domestic water systems.
    - Liaison with the employer.
- Emergency maintenance response times shall be 4 hours.
- Ensure that the maintenance recommendations set out in the appropriate standard can be achieved and are appropriate for the installations. Advise with the tender submission

No longer than 4 weeks prior to Practical Completion submit to the CA a detailed planned preventative maintenance programme for the works and a method statement outlining how the maintenance works is to be undertaken including any necessary specialist maintenance.

No longer than 4 weeks prior to Practical Completion submit to the CA a detailed planned operational and logging procedure programme for the works and a method statement outlining how the operational works is to be undertaken including any necessary specialist involvement and maintenance.

<u>Maintenance during rectification period is to include:</u>

- Refer to clause 12.5 below

12.2 General Staff Training

Prior to Practical Completion explain and demonstrate the purpose, function and operation of all the installations including all items and procedures listed in the operation and maintenance manual to Employer's maintenance and operational staff. This is separate to the 24-month upskilling training program the Contractor shall allow within the 24-month operation and maintenance package.

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

Submit a detailed programme for training the Employer's staff to the CA/EA for approval a month prior to the first proposed training date.

See Schedule J6828-MXF-XX-SH-J-00003 for the time to be allowed at Tender for the purpose of staff training. Allow for the presence of all individuals (including specialists) outlined within the schedule under 'Attendance (Contractor Side)'. Allow for the training of 10 Employer's staff at each training session outlined within the schedule.

This training is to include:

- Training and instruction on the operation and maintenance on all installations within the building.
- Training and instruction from all relevant specialists and suppliers employed by the Contractor during the works.
- Provide each staff member taking part in the training with all appropriate reference and training manuals.
- Review the contents of the Operation and Maintenance manuals along with any Simple Building User Guides with the Employer's staff while carrying out training sessions.

Training on the control and monitoring systems within the building (whether stand-alone or centralised systems) is to include:

- Familiarisation with the interface systems;
- Fault finding demonstrations;
- 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.

Record the training sessions and provide these recordings to the Employer on DVDs. The videos on the DVDs are to be indexed such that the recordings are given a suitable title allowing the desired video to be found quickly.

Following practical completion and occupation of the building, be available for a period as agreed with the CA/EA to assist the Employer's personnel in the operation of the various systems together with the various specialist designers and installers involved in the works (e.g. controls, security, fire alarm, etc.)

The Contractor is responsible for the correct operation and maintenance of the installation during any such periods of instruction.

12.3 Proving Period and Fine Tuning

Requirements for the mechanical works contract:
In conjunction with the controls specialist monitor the operation and performance of the automatic controls system in maintaining the required performance parameters of the installed mechanical and electrical plant over the first 12-month period of operation following Practical Completion.

Over this period provide monthly reports on the performance and operation of the controls system to include observations and proposals for remedial works and/or refinement of the control strategy. Adjust and fine-tune the controls to optimise performance. Carry out software modifications instructed by the Services Engineer (Max Fordham LLP). Carry out further client training/demonstrations if necessary. Up-date controls O&M Manuals as and if necessary.

Allow for at least 2 suitably qualified and experienced personnel including the controls specialist and a mechanical engineer.

Include for no less than 4 half-days per person per month over the 24-month.

Agree meeting dates on site with the Services Engineer (Max Fordham LLP) and Employer.

Requirements for the electrical works contract:
In conjunction with the lighting controls supplier/specialist under take post-occupancy checks of the lighting controls system over the first 12-month period of operation following Practical Completion.
Adjust and fine-tune the operation of the lighting controls (including interfaces with other systems if necessary)

to correct and optimise their performance. Carry out further client training/demonstrations if necessary.

Allow for at least 2 suitably qualified and experienced personnel including the lighting controls supplier/specialist and an electrical engineer.

Include for no less than 4 half-days per person per month over the 24-month.

Agree meeting dates on site with the Services Engineer (Max Fordham LLP) and Employer.

Note: the time to be allowed under this clause is not to be used for the rectification of latent defects. Defects are to be dealt with in the usual way through the Contract.

12.4 Seasonal Commissioning

Carry out seasonal commissioning as part of the 24-month operation and maintenance period to achieve maximum operating network performance across the year.

The district heating LTHW flow temperature shall be reduced to 65°C during the warmer summer months between May and September. The average return temperature shall not exceed 35°C during this period. The pumping volumes, system bypasses, and network operating temperatures shall be closely monitored through the reduced flow temperature period to ensure operating performance to the dwelling systems are not affecting in a negative way.

The central plant, associated ancillary plant, low carbon heating technology plant shall be monitored closely throughout the year and the Contractor shall allow for continual commissioning to achieve the project KPIs at the end of the 24-month operation period.

12.5 Maintenance During Rectification Period

During the Rectification Period, carry out all maintenance, fine tuning and adjustments recommended by manufacturers, system specialists and published guidance to ensure that equipment and system warranties are maintained.

13.0 RECTIFICATION OF DEFECTS

Comply with the Rectification of Defect clauses within the Main Contract Prelims.

14.0 APPENDIX A

14.1 Design, Commissioning & Handover Information Responsibilities

Allocation of Design Responsibilities

Table A: the consultant carried out the design
Except where specifically stated in clause 4.2, the Consultant has developed and completed the design of the mechanical & electrical specialist works described within the tender documentation.

TABLE A GENERAL DESIGN ACTIVITIES

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
A1	Production of Drawings				See Section 9 of these Preliminaries for definitions and BRSIA BG6/2014 for example drawings and BIM model information.
	Sketch Drawings	✓			
	Schematic Drawings	✓			Issued as tender drawings as reasonably necessary in the opinion of MFLLP to enable the Contractor to prepare Coordination & Installation Drawings.
	Design Intent Drawings	✓			As above.
	Detailed Design Drawings		✓		
	Coordination Drawings		✓		
	Installation Drawings		✓		Including setting out information where not given by MFLLP on the Detailed Design Drawings. This includes setting out of visible equipment & accessories to the approval of the CA/EA. Co-ordination of the Installation Drawings is to be managed by the Mechanical Contractor (see Preliminaries clause 5.0).
	Installation Wiring Diagrams		✓		
	Manufacturer's Drawings		✓		

TABLE A GENERAL DESIGN ACTIVITIES

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
	Manufacturer's Certified Drawings		✓		
	As-installed Drawings		✓		To be marked up on site as the work proceeds.
	Record Drawings		✓		
	Builders Work Drawings (design stage)		✓		
	Builders Work Drawings (installation stage)		✓		Based on the Installation Drawings prepared by the Contractor. Co-ordination of the Builders Work Drawings is to be managed by the Mechanical Contractor (see Preliminaries clauses 4.4 & 5.0).
	Specialist Drawings		✓	✓	"Other" = Specialist Designer appointed by the Contractor.
A2	Spatial Co-ordination (i.e. overall responsibility for resolving difficult spatial clashes).		✓		Process to be managed by the Mechanical Contractor (see Preliminaries clause 5.0).
A3	Confirmation of plant or system sizing MFLLP is responsible for all installed plant & system sizes/capacities other than those items that are identified below. These items require final confirmation by the party indicated.				
	• Selection of commissioning valves and/or automatic flow balancing valves.		✓		
	• Alternative plant or equipment suppliers to those specified in the tender documentation.		✓		See Preliminaries clauses 3.6 & 0.
A4	On-site Co-ordination.		✓		Process to be managed by the Mechanical Contractor (see Preliminaries clause 5.0).

TABLE A GENERAL DESIGN ACTIVITIES

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
A5	System Compatibility Confirm the compatibility of plant/equipment specified for use within the same system or where an interface is required between systems.		✓		

Table based on BSRIA Technical Note BG 6/2014 "Allocation of Design Responsibilities for Building Engineering Services"

Table B: the contractor completes the design
The Contractor shall complete the design of the MEP Engineering Services Works or specialist elements listed in clause 4.2.

TABLE B DESIGN & DRAWING PRODUCTION ACTIVITIES

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
B1	Verify and develop the Consultant's design detailed within the tender documents, to a form agreed with the CA/EA.		✓		
B2	Prepare proposals for the installations for the agreement of the CA/EA. Investigate the options available and describe the performance that can be achieved.		✓		
B3	Design and detail the installations as part of the overall co-coordinated building design allowing for every stage of the design to be brought to a successful conclusion by the process of repeated refinement until it is clear that the Installation and Coordination Drawings can be completed.		✓		
B4	Provide copies of calculations if requested by the CA/EA.		✓		
B5	Provide copies of any risk assessments undertaken in compliance with the requirements of Regulation 13 of the Construction (Design and Management) Regulations 1994.		✓		
B6	If appropriate, negotiate and agree all details with regulatory bodies as necessary.		✓		Where the Contractor's proposals modify or add to the Consultant's tender information.
B7	If appropriate, negotiate and agree all details with the		✓		Where the Contractor's proposals modify or add to the

TABLE B DESIGN & DRAWING PRODUCTION ACTIVITIES

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
	Statutory Authorities as necessary.				Consultant's tender information.
B8	If appropriate, meet with Building Control and provide the CA/EA with written confirmation of the various stages including detailed Building Control Approval for the installations proposed, prior to construction.		✓		Where the Contractor's proposals modify or add to the Consultant's tender information.
B9	Modify the design and/or an installation, should the installation not meet the specification and/or agreed proposals, Statutory requirements, etc.		✓		
B10	Production of Drawings				See Preliminaries for definitions and BRSIA BG6/2014 for example drawings.
	Sketch Drawings	✓			Tender drawings provided to indicate the design intent and the performance to be achieved.
	Schematic Drawings		✓		
	Detailed Design Drawings		✓		
	Coordination Drawings		✓		Services co-ordination is to be managed by the Mechanical Contractor (see Preliminaries clause 5.0).
	Installation Drawings		✓		Co-ordination of the Installation Drawings is to be managed by the Mechanical Contractor (see Preliminaries clause 5.0).
	Installation Wiring Diagrams		✓		
	Manufacturer's Drawings		✓		

TABLE B DESIGN & DRAWING PRODUCTION ACTIVITIES

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
	Manufacturer's Certified Drawings		✓		
	As-installed Drawings		✓		To be marked up on site as the work proceeds.
	Record Drawings				
	Builders Work Drawings		✓		Co-ordination of the Builders Work Drawings is to be managed by the Mechanical Contractor (see Preliminaries clauses 4.4 & 5.0).
	Specialist Drawings		✓		
B11	Spatial Co-ordination (i.e. overall responsibility for resolving difficult spatial clashes).		✓		Process to be managed by the Mechanical Contractor (see Preliminaries clause 5.0)
B12	Confirmation of plant or system sizing.		✓		
B13	On-site Co-ordination.		✓		Process to be managed by the Mechanical Contractor (see Preliminaries clause 5.0).
B14	System Compatibility. Confirm the compatibility of plant/equipment specified for use within the same system or where an interface is required between systems.		✓		

Allocation of Commissioning Responsibilities

TABLE D SPECIFYING SYSTEM COMMISSIONING ACTIVITIES

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
Design					
D1	Ensure that the selected systems will meet the employer's brief and that their commissioning requirements are compatible with any project restraint concerning sectional handover/phasing.	✓	✓		The contractor is responsible for those services, systems or work elements design by them and/or specialist sub-contractors appointed by them.
D2	Identify and incorporate into system designs the essential components and features necessary to enable the proper preparation and commissioning of building services.	✓	✓		Note as D1.
D3	Review all designs to ensure that systems can be properly prepared, and are commissionable.	✓	✓		Note as D1.
D4	Prepare the commissioning specification.	✓	✓		Note as D1.
Management					
D5	a) Produce a commissioning method statement and logic diagram for integration into the building contractor's construction and finishes programmes.		✓		
	b) Produce a "commissioning plan" as required by Part L2 of the Building Regulations.		✓		It is for the Contractor is to demonstrate to the local Building Control office that the person(s) providing this report are suitably qualified. See Preliminaries clause 11.4.
D6	Produce a flushing, chemical cleaning and water treatment method statement, logic diagram and programme for integration into the building		✓		

TABLE D SPECIFYING SYSTEM COMMISSIONING ACTIVITIES

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
	contractor's construction, commissioning and finishes programmes.				
D7	Attend commissioning meetings as necessary OR Arrange and chair commissioning meetings as necessary.		✓		Give notice to MFLLP of when these meetings are taking place. MFLLP will only attend meetings as and when they feel necessary.
D8	Comment on the adequacy of systems for commissioning as detailed on specialists' drawings and manufacturers' shop drawings prior to actual manufacture at works. Ensure comments are incorporated into finished products.		✓		
D9	Carry out site inspections, to ensure that the commissioning facilities are being installed. Check compliance with specified guides and standards.		✓		
D10	Monitor the on-going progress of the procurement, manufacture, installation and commissioning of all plant items.		✓		
D11	Assess the effects of any anticipated delays to the services installation and the completion of interfaces with the building works critical to the commissioning programme. Formulate strategies to overcome potential delays.		✓		
D12	Establish an agreed set of pro forma documentation relating to the commissioning and testing of plant and systems.		✓		Issue to MFLLP for comments.

TABLE D SPECIFYING SYSTEM COMMISSIONING ACTIVITIES

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
D13	Approve the proposed set of instruments of the commissioning and testing works.		✓		
D14	Ensure that the instrumentation is periodically calibrated as necessary and records retained.		✓		
D15	Witness the flushing, cleaning and treatment of systems in accordance with the specification.	✓	✓		Contractor is to be fully satisfied with the pre-commissioning cleaning before inviting MFLLP to witness.
D16	Witness pre-commissioning activities in accordance with the specification.	✓			
D17	a) Commission all systems to methods, logic and programme (see 9.4) and record results.		✓		
	b) Witness specified demonstration of system commissioning results.	✓	✓		Contractor is to be fully satisfied with the commissioning results before inviting MFLLP to witness.
D18	Witness and record the specified demonstration and testing of plant items and systems in accordance with the specification.	✓	✓		Contractor is to be fully satisfied with the commissioning results before inviting MFLLP to witness.
D19	Establish procedures to allow the demonstration of normal emergency, shutdown and standby mode operation of plant and systems.		✓	✓	"Other" = manufacturers or suppliers of plant items.
D20	Witness demonstration of same (D19) to specified requirements.	✓	✓		Contractor is to be fully satisfied with the demonstration results before inviting MFLLP to witness.
D21	Demonstrate the partial load testing of plant to the		✓		

TABLE D SPECIFYING SYSTEM COMMISSIONING ACTIVITIES

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
	employer and designer in accordance with the specification.				
D22	Witness the operation of the BMS on site to the specified requirements.	✓	✓	✓	"Other" = BMS Specialist Designer. Contractor is to be fully satisfied that the performance of the BMS meets the requirements of the contract documents before inviting MFLLP to witness.
D23	Witness the functional testing of all safety interlocks in accordance with the commissioning specification.	✓	✓		Contractor is to be fully satisfied with the commissioning results before inviting MFLLP to witness.
D24	Witness the demonstration of acoustic tests, if any, in accordance with the specification.	✓	✓		Contractor is to be fully satisfied with the commissioning results before inviting MFLLP to witness.
D25	Witness the operation of plant and systems for specified periods of time to prove plant reliability.	✓	✓		
D26	a) Produce commissioning report detailing the results of the commissioning and commenting on the performance of systems		✓		
	b) Produce a "commissioning report" as required by Part L2 of the Building Regulations for submission to the local Building Control office.		✓		It is for the Contractor is to demonstrate to the local Building Control office that the person(s) providing this report are suitably qualified. See Preliminaries clause 11.4.
D27	Ensure that all plant settings are recorded, including appropriate reference to plant items. The records should be incorporated within the		✓		

TABLE D SPECIFYING SYSTEM COMMISSIONING ACTIVITIES

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
	operating and maintenance manuals.				

Table taken from BSRIA Technical Note TN 21/97 "Allocation of Design Responsibilities for Building Engineering Services"

Production of Handover Information

TABLE E PRODUCTION OF HANDOVER INFORMATION

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
E1	Define the scope and content of operating and maintenance manuals appropriate to the size of project, the employer's operating and maintenance strategy and the technical capability of the maintenance staff.	✓			
E2	Define the requirement for record drawings appropriate to the employer's operating and maintenance strategy.	✓			
E3	Advise on the need for a specialist author for production of operating and maintenance manuals.	✓			
E4	Advise on the need for a separate survey of installed systems to facilitate production of record drawings.	✓			This survey will only be required if the Contractor has failed in their duty to fully record the installed services as the work proceeds and before it is covered up. The cost of this survey, if required, will be recovered through the Contract.
E5	Prepare a specification for operating and maintenance manuals. Specify the section headings and required technical content.	✓			See Preliminaries for details of the level of information required.

TABLE E PRODUCTION OF HANDOVER INFORMATION

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
E6	Prepare a specification for record drawings. Specify content, form of delivery and the method of production of the drawings to be produced.	✓			See Preliminaries for details of the level of information required.
E7	Define what level of documentation, commissioning results and other information must be available prior to practical completion and handover. Take into account possible implications of phased handover and partial possession.	✓			In order to comply with the CDM Regulations the Contractor is to ensure that complete O&M information and Record Drawings are available to the employer prior to Practical Completion. See Preliminaries for further information.
E8	Produce operation and maintenance manuals in accordance with the specified requirements.		✓		
E9	Ensure that information needed for inclusion in the operating and maintenance manuals is obtained as the works progress. Identify individual sources of information.		✓		
E10	Establish target dates for when information must be available to the author of the operating and maintenance manuals. Advise on timescales for production of maintenance information relative to key dates i.e. installation start date, setting to work, start dates for testing and commissioning and handover dates.		✓		
E11	Monitor the programme for production of operating and maintenance manuals and adjust dates to allow for progress of the project.		✓		

TABLE E PRODUCTION OF HANDOVER INFORMATION

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
E12	Receive, inspect and comment on the contents of the operating and maintenance manuals in order to confirm general compliance with the specified requirements.	✓	✓		The Contractor is to inspect and comment on the manuals where produced by others on their behalf prior to submission to MFLLP. The Contractor is to ensure that drafts of the O&M manual(s) are available for comment at least 8 weeks prior to Practical Completion.
E13	Modify and update operating details to reflect commissioning results.		✓		
E14	Accept the completed operating and maintenance manuals on behalf of the employer.	✓			
E15	Identify key dates and intervals at which draft record drawings will be inspected.		✓		Contractor is to provide schedule of dates for the release of this information.
E16	Modify the record drawings as the works progress so that all alterations from the installation drawings are recorded as work proceeds.		✓		Contractor is to ensure that the As-installed Drawings are maintained on site and updated as the work proceeds. The As-installed Drawings are to be made available for inspection when requested by the CA/EA.
E17	Receive, inspect and comment on the Record Drawings in order to confirm general compliance with the specified requirements.	✓	✓		The Contractor is to inspect and comment on the record drawings where produced by others on their behalf prior to submission to MFLLP.
E18	Accept the completed record drawings on behalf of the employer.	✓			
E.19	Prior to handover, make recommendations for the commencement and carrying out of operation and		✓		When stated in the preliminaries the Contractor is to provide a priced proposal for the maintenance of the installed services during the period concurrent with the

TABLE E PRODUCTION OF HANDOVER INFORMATION

Design Activity		Responsibility			Comments
		MFLLP	**Cont'r**	**Other**	
	maintenance during and after the Defects Liability Period.				Defects Liability Period within their contract price.
E20	Provide the employer with a log-book as required by statute under Part L2 of the Building Regulations.		✓		

Table taken from BSRIA Technical Note TN 21/97 "Allocation of Design Responsibilities for Building Engineering Services"