



Rotunda Hospital Dublin - BMS Upgrade

Mechanical and Public Health Services' Specification

Specification

Mechanical Specification **Section A: Preliminaries**

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1 Introduction

- A. This specification covers the design, supply, installation and commissioning of the upgrade of the BEMS and automatic controls installation for the mechanical and electrical engineering services at Rotunda Hospital Dublin.
- B. The existing BMS system within the hospital is at the end of its useful life and is to be subject to a complete upgrade.
- C. This upgrade project represents the first phase in a multi-year programme to establish a campus wide BMS platform across Rotunda Hospital. The current scope focuses on critical infrastructure in existing departments, including the Theatre, Delivery Suite and NICU, with the express intent that the upgraded system can be seamlessly scaled and integrated with future developments.
- D. A major new build is planned for 2029, which will house critical hospital infrastructure and include a BMS installation. As such, the upgraded BMS must be interoperable and interface-ready with the BMS solution to be delivered as part of the 2029 development (the "CCW BMS").
- E. The upgraded system must, therefore, be scalable, future-proof, and designed with long-term integration and expansion in mind. The contractor must ensure that all components, software, and infrastructure installed now can serve as a foundation for future phases, minimizing disruption, duplication of effort, or costly retrofits in the next five years. The methodology for future expansion is to be set out in writing to the client and design team.
- F. The contractor selected for this project will be responsible for performing a thorough site survey to assess the condition of the existing system, identify necessary upgrades, and provide a detailed pricing proposal based on the assessment. A survey of the existing system including a points list, screen shots and photographs has been included within the tender documentation for information only. This information is to be considered indicative. The appointed contractor will be required to complete their own extensive survey of the hospital BMS system to identify the upgrade works required which will inform the design of the proposed system.
- G. Key deliverables of the project will include the installation of upgraded equipment and field devices, integration of communication networks, energy monitoring enhancements, and full system commissioning. The contractor will also be tasked with conducting functional and performance testing to ensure seamless integration with existing hospital systems, including but not limited to HVAC, lighting, energy meters, and emergency generator controls.
- H. The successful contractor will be required to meet all relevant industry and safety standards, regulations, and best practices throughout the execution of the project, and provide all

necessary documentation for the BMS system, including system schematics, configuration settings, and operation manuals.

- I. This upgrade will enhance the operational efficiency, sustainability, and reliability of the BMS, supporting the hospital's ongoing commitment to providing a safe and comfortable environment for patients, staff, and visitors.
- J. The BEMS Specialist Contractor will be permitted to retain and reuse existing controllers / services where practical and feasible. The retention of any services must be agreed in writing in advance of the upgrade works with the client and design team.
- K. The BEMS system is to be by Siemens, Honeywell or an equal and approved system.
- L. The ICT network supporting the BEMS system must be standalone. No connection will be permitted to the HSE ICT network. The system must provide remote access capability to the Estates team. Critical alarms shall also be communicated to the estates team via email and text message. The BEMS contractor will be responsible for providing the standalone ICT network.
- M. The BEMS contractor will be the main contractor responsible for providing all works required for the upgrade works including any builderswork, mechanical and electrical works required to complete the upgrade. This includes the modification of existing services and installation of new field devices, dampers, pockets, sensors, meters and valves etc. required to control and monitor the existing plant.
- N. The only exception to the above will be the provision of fire stopping. The hospital will ensure fire stopping is provided by a separate specialist. The BEMS contractor will be required to identify areas requiring fire stopping and provide a set of drawings identifying where opes will be formed in advance of the completion of any works. All fire stopping details are to be agreed with the fire stopping contractor in advance of any installation works.
- O. All tendering contractors must attend site for a site inspection as part of the tender process. Any tendering contractors that fail to do so will be excluded from tendering.
- P. The BEMS Specialist Contractor must demonstrate previous experience within a critical healthcare environment and working in a live environment. The existing BEMS and M&E systems must be maintained live through the duration of the BEMS upgrade works. Out of hours works are to be included as required to achieve this.
- Q. The key functions of the BMS that require assessment, repair, and/or upgrade include but are not limited to the following equipment below with their associated systems:
 - Control and monitoring of hot water boilers.
 - Control and monitoring of hot water services.
 - Control of pump sets.
 - Monitoring of gas and electric meters.
 - Control and monitoring of air handling units (AHUs).
 - Control and monitoring of fans.
 - Control and monitoring of DX units.
 - Integration with control panels in the theatre.
 - Integration with generator controls.
 - Control and monitoring of lighting systems.

R. Each of these functions is critical for maintaining the proper operation of the Theatre, Delivery Suite, and NICU departments, which are high-priority areas requiring precise environmental control.

A. The Engineering Services works specification document is formatted as follows:

- a. Section A Preliminaries;
- b. Section B Systems Description – Systems Description – Building Energy Management System (BEMS).

2 Procurement & Tender Process

A. The evaluation of contractors shall be based on MEAT (Most Economically Advantageous Tender) criteria, not lowest price alone.

3 Contractors Obligations

A. The contractor has a degree of design and / or co-ordination responsibility identified within the sections listed below. The contractor confirms that this has been included for in the tender:

- a. Collateral Warranties;
- b. Appendix D Responsibilities Under Contract Design.

B. Provide the following documentation prior to handover:

- a. Approved operating and maintenance (O&M) manuals for all engineering systems;
- b. Approved record drawings for all engineering systems;

4 Project Particulars

4.1 Project, Employer and Design Team

- a. Employer: Rotunda Hospital Dublin
- b. Services Engineer: O Connor Sutton Cronin M&E Ltd.

B. The term Employer's Representative (ER) is used throughout this specification. The duties of the ER will be carried out by OCSC.

5 Tender and Contract Documents

5.1 Documentation

A. Bring to the attention of the ER any comments, discrepancies or divergences that may knowingly affect the Engineering Services installations.

5.2 Preliminary Health and Safety Plan

A. Refer to the project preliminary health & safety plan.

B. Submit a statement with the tender describing any additional significant and unavoidable risks that may arise as a result of carrying out the Engineering Services works and the organisation measures and resources proposed to safeguard the health and safety of operatives and any other person who may be affected by the Engineering Services works. This statement shall include, but not be limited to, the following information from the tenderer:

- a. Company health and safety policy document, including risk assessment and method statements;
- b. Records of staff training and training policy;
- c. Records of similar projects (size / complexity) recently completed.

6 Site Context / Existing Buildings

6.1 Site Context / Existing Buildings

- A. The BEMS upgrade works are located at Rotunda Hospital, Dublin 1.

6.2 Existing Utility / Engineering Services

- A. There are live services present throughout the site. The contractor must survey areas in advance of works to ensure no unintentional contact is made with live services.

6.3 Survey

- A. Ascertain the nature of the site and all local conditions and restrictions likely to affect the tender and the execution of the Engineering Services works. No claims for additional costs shall be accepted for lack of knowledge in this regard.
- B. Before commencing work, carry out an examination and full survey of the site, buildings, structure and services affected by the Engineering Services works.

6.4 Method Statements

- A. Establish a method of installation with the ER to ensure the works proceed without hindrance and produce method statements as requested.

7 Description of the Engineering Services Works

7.1 Engineering Services Works

- A. Supply, install, test and commission the Engineering Services' installations covered in the documentation.
- B. The Engineering Services installations covered comprise:
 - a. Automatic controls installations and building energy management system;
 - b. Associated mechanical installation works;
 - c. Associated electrical installation works;
 - d. Associated builders works;

7.2 Works by Others and Co-Ordination of Trades

- A. Liaise with the fire stopping contractor to ensure coordination of fire stopping details and engineering installation details. These details must be agreed prior to the commencement of works on site. The fire stopping contractor will be appointed separately by the Rotunda Hospital.

7.3 Software

- A. On behalf of the end user, obtain 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 application software is written in compliance with the following:
 - BS 7649: Guide to the design and preparation of documentation for users of application software;
 - BS 7830: Guide to the design and preparation of on-screen documentation for users of application software.
- B. Provide documentation in the following formats:
 - Drawings in AutoCAD / Revit 2018 or later;
 - Documents, schedules, O&M manuals, etc. in Microsoft Office (Word and Excel).

8 The Contract / Subcontract

8.1 The Contract

- A. The Form of Contract shall be agreed with the Rotunda Hospital.

8.2 Contractor Design Portions and Performance Specified Works

- A. Refer to Appendix D: Responsibilities Under Contractor Design.

8.3 Collateral Warranties

- A. If design work is to be undertaken by the contractor, collateral warranties are required. These are generally required by all trade / sub-contractors providing design in conjunction with the contractor's designed portion. Within the tender submission, trade / sub-contractors shall provide a copy of a standard collateral warranty acceptable to their insurers. Any queries refer to the ER.

9 Tendering / Sub-Subletting / Supply (Subcontract Tendering)

9.1 Schedule of Rates

- A. Provide a fully quantified schedule of rates, within one week of request, amounting to the total tender sum and broken down in a format agreed with the ER.
- B. The schedule of rates shall include all items and materials included in the tender, together with their rates, extended and totalled. Price the preliminaries separately. Such totals shall agree with the contract sum and subtotals shall agree with the priced breakdown of the tender.

9.2 Variations to the Engineering Services Works

- A. Submit details of the cost implications of any variations to the Engineering Services works. These details should be broken down and submitted in a format in accordance with the schedule of rates submitted.

9.3 Selection of Manufacturers/Suppliers

- A. Section B of accompanying specification detail the types and performance of plant and equipment on which the drawings and specification have been prepared. The tender must be based on these.
 - a. Specific manufacturers, suppliers and/or installers of products are not identified in line with tendering procedure and the Form of Contract.
 - b. Meet or exceed the design criteria
 - c. Comply with any stated HTM, Irish, British or European Standard (or other equivalent recognised standards)
 - d. Any constructional, cost, programme, maintenance or other differences are identified
 - e. Select products that comply in all respects with this specification and, as and when requested, demonstrate such compliance.
- B. Alternative equipment or performance criteria that would involve significant changes to other work will not be considered.
- C. The acceptance of any alternatives shall be at the discretion of the ER, who is not bound to accept any alternatives. Any approval given by the Architect/Engineer in this respect shall not relieve the Contractor from his responsibility for the performance and quality of his proposed substitutions.
- D. All equipment / field devices must be available off the shelf in the Republic of Ireland. This is essential to ensure there is no disruption to the hospital in the event of a component defect or failure.

9.4 Proposals for Annual Maintenance Contract

- A. The first two years annual maintenance is to be included in the tender return.

9.5 Subcontracting

- A. Where it is proposed to sublet any portion(s) of the Engineering Services' works a list must be submitted with the tender defining such portion(s) and giving, for each, the names and addresses of the proposed companies.
- B. Refer to Appendix I: Schedule of Sub-contract Works.

10 Provision, Content and use of Documentation

10.1 Definitions

- A. Refer to Appendix A: Definitions.

10.2 Symbols

- A. Ensure the notation on all the documents produced follows the same conventions as the tender documentation. Agree additional notation with the ER before preparing any documents.

10.3 References to NSAI / BSI / CEN / DIN Documents

- A. References to NSAI / BSI / CEN / DIN documents are to those versions and amendments listed in the latest NSAI / BSI / CEN / DIN and any subsequent versions and amendments current at the date of this specification.

10.4 Site Based Services Co-ordinators and Drawing Production

- A. Provide full-time on-site team of services coordinator, Engineers and Revit / CAD technicians for the production of all project services drawings as detailed herein this section.
- B. Incorporate details provided by others into the co-ordination / installation drawings making due allowance for all building elements, structure and other services, or provide all necessary details, drawings, schedules, etc. required to enable the co-ordination drawings to be prepared by others.
- C. The BEMS Specialist Contractor shall be the Lead Coordinator and is required at the onset of the project to provide installation drawings with detailed plans, sections, and/or elevations to ensure full coordination of all the services incorporating architectural and structural elements for prior to commence of all works.

10.5 Drawings Schedule

- A. Prepare a schedule of all proposed drawings and agree the schedule with the ER.

10.6 Drawing Format

- A. All drawings should be based on the latest issue of the architectural, structural and services' engineering models / drawings and any other drawings or information relating to the works.
- B. The format of the drawings shall also be in accordance with the following:
 - a. All drawings shall bear the project name and the contract reference;
 - b. Drawings shall be cross referenced for ease of interpretation;
 - c. All dimensions shall be in SI format;
 - d. Drawings shall be numbered / referenced in accordance with the Employer's Information Requirements.

10.7 Document Numbering / Registration System

- A. Agree with the ER the document numbering / registration system to be used before preparing any documents.

10.8 Documents to be Provided

- A. Prepare a schedule of all proposed drawings and agree the schedule with the ER. Revise and update the drawing schedule as necessary on a monthly basis taking into account any revision that may take place.
- B. Produce drawings and other information details of the works that the ER may reasonably require.
- C. Issue all manufacturers' drawings, details and specification sheets to the ER for comment prior to manufacture.
- D. Where drawings are subject to revision, show the full extent of such revision on the drawings by 'clouding' and noting the revision.
- E. Note: Failure to submit documentation (in particular installation, coordination, shop & fabrication drawings) in a timely fashion related to the programme shall not relieve the contractor of any contractual responsibilities. Progress of the works without the issue and comment on such documentation is entirely at the contractor's risk.
- F. Prior to submission to the ER for review, be completely satisfied that:
 - a. Suitably detailed information is provided;
 - b. Schedules have been incorporated;
 - c. All information has been properly co-ordinated;
 - d. All information is checked and approved using the contractors own quality assurance systems;
 - e. The information is issued timeously.
- G. Accompany all documentation submitted with an issue sheet indicating that it has been checked.

10.9 Builder's Work Information

- A. For definitions, refer to Appendix A: Definitions.
- B. Provide builder's work documentation (schedules and drawings) in a timely manner.
- C. The BEMS Specialist Contractor shall include for all buildersworks required to complete the installation. The only exception to this is fire stopping which will be provided by others.
- D. This may require detailed site survey work to ascertain the exact conditions on site.
- E. Submit the documentation to, and obtain approval from, the ER before any structural work requiring holes or other modification is executed.
- F. Where appropriate, mark on site the actual locations of the following:
 - a. Holes through walls, partitions, floors, etc.;
 - b. Chases in walls, floors, etc.;
 - c. Pockets cast in concrete;
 - d. Inserts and any built in sleeves or similar items.
- G. Holes may not be cut in steelwork, reinforced or pre-cast concrete without written permission from the client.

10.10 Installation Drawings

- A. For definitions, refer to Appendix A: Definitions.
- B. Provide installation drawings in a timely manner.

- C. Submit to the ER, installation drawings of all the systems for review before they are fabricated. Unless otherwise agreed in writing, no work may start on site until the relevant installation drawings have been inspected by the ER.
- D. Where revisions take place to the works under the authority of the ER's Instruction, by written agreement with the ER or when revised architectural or structural drawings are issued, modify the installation drawings accordingly and re-issue for construction purposes any such modified drawings. The issue of revised installation drawings shall be in accordance with the agreed programme.

10.11 Examination of Drawings / Information

- A. Review the tender/ contract drawings and specification information with ER prior to starting on site.
- B. The ER will examine and make comments on, but not approve, one copy of the proposed installation drawings submitted. Comments will be made for compliance with the design intent, appearance, clashes with structure, etc. Each drawing will be dated and signed by the ER to show that it has been inspected and returned.
- C. Such examination and comments shall not relieve of any responsibility and obligations for design and documentation, correctness of the document / drawing or its suitability for purpose under this contract.
- D. Allow two weeks for this process.
- E. Be responsible for any omission, errors or discrepancies in the documentation and other particulars supplied to the ER, whether or not the ER has commented on such information.

O'CONNOR SUTTON CRONIN (M&E) LIMITED	
Checked By _____	Date Checked _____
Copy to Design File ☐	Project Ref _____
COMMENTS AND STATUS	
☐ 1. Incorporate Comments, Revise and Resubmit ☐ 2. Incorporate Comments and Issue ☐ 3. No Comments	

10.12 Technical Literature

- A. Keep copies of the following on site, readily accessible for reference by all supervisory personnel:
 - Manufacturers' current literature relating to all products used in the Engineering Services works
 - Relevant NSAI / BS codes of practice
 - Up to date contract, installation, co-ordination and builders work drawings.

10.13 Maintenance Instructions and Guarantees

- A. Obtain and retain copies delivered with components and equipment, register with manufacturer as necessary and hand over to the ER as part of the O&M manuals.
- B. Notify the ER of telephone numbers for all emergency maintenance call-out services after practical completion.

- C. Note the appointed contractor must be able to call out to site for emergency situations within a 3 hour period from notification by the Rotunda Hospital.

11 Management of the Engineering Services Works

11.1 Responsibilities – Works Designed by The Employer

- A. Be responsible to the ER for:
 - a. The detailed design activities listed in Appendix D: Responsibilities Under Contractor Design;
 - b. Those activities normally undertaken through the custom and best practice of the industry.

11.2 Existing Services

- A. During the construction of the Engineering Services' works, ensure any existing utility services are identified and only redundant services are removed. If in doubt, issue a technical query requesting clarification from the ER. Allow at least two weeks for clarifications of all such requests.
- B. Allow for any reinstatement works as necessary to ensure existing services are re-fixed and secured as required.

11.3 Co-Ordination

- A. Agree the principles of co-ordination with the ER.
- B. The BEMS Specialist Contractor is required as part of this scope of works to act as the lead co-ordinator for all works.
- C. The Contractor shall be the lead co-ordinator and is required at the onset of the project to provide installation drawings with detailed plans, sections, and/or elevations to ensure full co-ordination of all the services incorporating architectural and structural elements for prior to commence of all works.
- D. Notwithstanding, the complete Scope of Works is detailed in the contract specification and the contractor shall ensure that the offer reflects full compliance with the drawings and specification.
- E. Attend meetings as required to ensure the co-ordination of all Engineering Services' works.
- F. In addition, convene meetings as required to ensure the co-ordination of all engineering service works.
- G. Incorporate details provided by others into the co-ordination / installation drawings making due allowance for all building elements, structure and other services, or provide all necessary details, drawings, schedules, etc. required to enable the co-ordination drawings to be prepared by others.
- H. Ensure suitability, compatibility, correct location and integration within the Engineering Services' works to meet the requirements of this specification and those works being provided and installed by others.
- I. Identify at an early stage, and report prior to works commencing, any conflict in the positioning between the Engineering Services, the structure and/or architectural elements. In particular co-ordinate the services and suspended ceiling supports in the ceiling and floor voids to ascertain if structural tolerances have been exceeded, and services voids reduced, and take on-site dimensions. Advise the ER of any proposed corrective action to resolve any conflicts. Any necessary remedial works shall be carried out at no additional expense to this contract.

11.4 Programme / Progress

- A. Provide detailed Engineering Services works programmes as soon as possible and before starting work on site. Due allowance shall be made for the following:

- a. Responses to technical queries (TQ) / requests for information (RFI);
 - b. Approval of samples by the design team;
 - c. Ordering and installation periods;
 - d. The completion of installation drawings, etc.
 - e. Work resulting from instructions issued;
 - f. Concurrent work by other trades;
 - g. Any temporary works necessary for the completion of the Engineering Services' works;
 - h. Pre-commissioning, commissioning and performance testing of the Engineering Services installations;
 - i. Preparation and provision of the record drawings and O&M manuals;
 - j. Lead in periods for equipment.
- B. Provide a separate detailed commissioning programme for agreement with the ER.
- C. Prepare a detailed programme of documents to be provided including approval of plant and equipment details to suit the overall programme.
- D. Monitor progress of all documents to be provided (layout, co-ordination, installation, etc.). Ensure suitable procedures are in place to ensure these production drawings are co-ordinated and issued well in advance of the proposed date for the works to be carried out.
- E. Submit, not more than two weeks after request from the ER, the following schedules:
- a. Drawing Schedule
 - b. Procurement Schedule

11.5 Method Statements

- A. Method statements shall be submitted at least two weeks prior to any of the planned activities on site, describing the health and safety considerations and detailing all procedures for the following:
- a. All planned activities impacting on the Employer's equipment and operational activities and/or requiring downtime of services serving Employer's areas, e.g. power, water, drainage, etc., including but not limited to:
 - b. Stripping out of the existing redundant services;
 - c. Testing and commissioning activities for all the Engineering Services installations
 - d. Connection to the existing site services
 - e. Resourcing and design duties for all other parts of the Engineering Services works
 - f. Static testing, commissioning and performance testing of all systems detailing all procedures and accompanied by relevant risk assessments
 - g. Management of the sustainability issues required within the project
 - h. Maintenance during the defects liability period (see Section 16)
- B. Method statements for other parts of the Engineering Services' works may be submitted at the same time.
- C. Preliminary method statements for all of the above should be submitted with the tender return.

11.6 Technical Information and Queries

- A. If clarification on any technical issue is required, complete and submit a technical query request to the ER. Ensure only technical queries relating to issues not covered in the documentation are submitted.
- B. Ensure the technical query sheets are raised at least two weeks prior to the requirement for a response and the planned activity.
- C. Prepare a schedule to record the progress of technical queries and ensure it is kept up to date. A common referencing system shall be put in place for all technical queries. Each query shall have the following information:
 - a. Unique reference;
 - b. Brief description of query;
 - c. Date raised;
 - d. Date required.

11.7 Monitoring

- A. Ensure the Engineering Services' works programme is kept up-to-date and redraft, without delay, if any circumstances arise that affect the progress of the works.
- B. Maintain on site an up to date set of installation drawings for the purpose of progressive marking up of alterations and variations especially before any work is hidden from view. Ensure that the installation drawings, which shall form the basis for the record drawings, are available for inspection by the ER at any time.
- C. Provide Engineering Services' works site progress reports to the ER every two weeks. These reports shall include, but not limited to, the following:
 - a. Date of order and delivery of all equipment;
 - b. Programmed percent progress and actual percent progress for each activity monitored against the contract programme;
 - c. Up-to-date schedule of information required giving dates required and received. This should indicate realistic dates and identify critical path items;
 - d. Copy of defects (snagging) lists verifying that inspections are being carried out by the engineer-in-charge;
 - e. List of variations instructed and potential variations giving cost and potential cost of each.

11.8 Inspection and Measurement of Work

- A. Provide all necessary assistance to enable the ER to examine or measure the Engineering Services' works.

11.9 Covering Up

- A. Give not less than one week's notice to the ER of when any item or section of the Engineering Services works, which are to be covered or concealed, are ready for inspection and / or testing.
- B. Ensure no item or section of the Engineering Services works is covered, concealed or insulated until such notice has been given or until it has been inspected and approved, and/or a satisfactory test has been witnessed.
- C. Works to be concealed should be identified on the Preliminary Inspection Plan prepared by the Assigned Certifier and timely invitation/notice given in accordance with the Inspection Notification Framework.

11.10 Ordering

- A. Place all orders for plant, equipment and materials, as required, to maintain the necessary progress of the Engineering Services' works and provide copies of such orders within one week of request.
- B. Over and above the requirement of inspections, make due allowance for all necessary visits and contacts with manufacturers, suppliers and others in order to obtain equipment for the Engineering Services works in support of the programme.
- C. Bring any discrepancies to the attention of the ER in sufficient time so as not to jeopardise the programme of the Engineering Services works and to allow any instructions to be issued and implemented.
- D. Before placing orders, be satisfied that all orders fulfil the requirements of the contract documentation. This shall include, but not be limited to:
 - a. Performance criteria and required duty;
 - b. Compatibility between items of plant used in combination;
 - c. Dimensional co-ordination between items of plant and equipment and the building fabric;
 - d. Satisfactory long term operation in the environment in which they are to be installed.
- E. No claims, whatsoever, shall be accepted as a result of failure to be properly satisfied to these items.

11.11 Staff

- A. Tenderers shall submit their proposed Management Chart for the project to include their on-site and off-site/head office teams for the project. Tenderer shall submit a Bar Chart setting out precise periods when proposed personnel committed to the project and when they are on site during the works.
- B. The tenderer shall provide curriculum vitae (CVs) detailing qualifications and experience, with the tender documents for each staff member proposed for the management of this contract. The ER and Design team reserve the right to reject personnel proposed.
- C. In order to ensure constant management and supervision of the Engineering Services' works for the duration of the contract, appoint one (or one mechanical and one electrical engineer available on a full time basis.
- D. They shall:
 - a. Be full time payroll member of staff;
 - b. Be independent of any subcontractors;
 - c. Be suitably qualified to at least Associate Member of CIBSE;
 - d. Not be a site operative;
 - e. Be present on site from commencement of services first fix until completion of handover and handover documentation;
 - f. Communicate at all levels;
 - g. Attend regular project meetings;
 - h. Plan the Engineering Services works, programme and resourcing;
 - i. Co-ordinate the execution of all Engineering Services installations;
 - j. Co-ordinate and progress timeously the various items of builder's work relating to the Engineering Services works;

- k. Ensure information is timeously exchanged with the various parties ;
 - l. Maintain an accurate knowledge of M&E contract sums including any variations on a rolling basis;
 - m. Ensure compliance with Employer's requirements and specification;
 - n. Ensure drawings and any other submittals are fully checked prior to issue to ER for comment;
 - o. Carry out regular inspections to ensure compliance with this specification and good workmanship;
 - p. Prepare defects lists for all Engineering Services works for submittal to the ER;
 - q. Provide a programme of Engineering Services works to rectify any defects or items of non-compliance;
 - r. Ensure any defects are addressed and rectified timeously;
 - s. Operate a sign-off system to record the progress and completion of all key elements;
 - t. Co-ordinate and manage all commissioning including specialist commissioning subcontractors;
 - u. Ensure all installations are commissioned at the proper time and to the full satisfaction of the ER;
- E. Give maximum possible notice to the ER before changing the engineer-in-charge / co-ordinator.

11.12 Completion and Documentation Checklist

- A. A summary checklist for the completion and hand-over documentation is provided within Appendix E. Ensure this checklist has been reviewed and that all activities and documentation stated have been issued prior to practical completion.

11.13 Photographs

- A. Provide progress photographs taken at weekly intervals during the progress of the Engineering Services works using a digital type camera unit. Record all images at the following locations in digital format.
- B. Provide photographic details of all Engineering Services, which are concealed within the building, before final concealment.
- C. The photographs shall be submitted to the ER in hard copy or JPEG type electronic format and issued on CD ROM type format or USB flash drive.
- D. Issue the progress photographs to the ER within one week of being taken.

12 Quality Standards / Control

12.1 Dimensions

- A. Where installations are dependent on-site dimensions, ensure these are available before proceeding with the Engineering Services works.
- B. Thoroughly check that dimensions are correct and that construction is practicable. Do not take dimensions by scaling from drawings. Where dimensions are indicated on the drawings check these on site, as appropriate, to ensure construction and manufacturing tolerances can be accommodated.
- C. Do not order or manufacture equipment, using dimensions indicated on the drawings, documents, schedules or specification.

- D. Bring to the attention of the ER any comments, discrepancies or divergences that will / may affect the Engineering Services installations.

12.2 Setting Out

- A. Ensure all items of plant and equipment can be installed in the available space and that there is adequate access to admit all plant to its position.
- B. Install all work so as to be accessible for operation, maintenance and repair. Deviations from the drawings may be made to accomplish this, but no change shall be made without the written approval of the ER. Obtain approval for access door locations from the ER before installation work commences.
- C. Ensure the systems are set out to take into account building configuration, other services and any particular architectural and structural requirements, e.g. structural details for fixings, fire rated walls, cavity barrier locations, etc.
- D. Provide and keep up-to-date all setting out dimensions for the Engineering Services works in accordance with the approved installation and builder's work drawings. Before proceeding with the Engineering Services works check the accuracy of all setting out dimensions and obtain approval.
- E. Amend any errors arising from inaccurate setting out or lack of site co-ordination at no additional expense to this contract.
- F. Ensure uniform and tidy arrangements of wall, floor and ceiling mounted equipment. Arrangements shall:
 - a. Be neat and symmetrical (especially when items of equipment that are erected on the same wall or ceiling, or that are visually close to each other) obtained by horizontal and vertical alignment through the centre lines and not the edges of the equipment;
 - b. Take full account of, and be symmetrical to, any architectural requirements such as wall, floor or ceiling tiles by ensuring items, for example, line up with the centres of ceiling tiles, etc.
- G. For this purpose the mounting instructions stated in this specification or on the design drawings may be varied slightly with approval from the ER.

12.3 Site Modifications

- A. Do not make site modifications to assemblies without authorisation from the ER.
- B. Where site modifications to assemblies are authorised ensure they are in accordance with manufacturer's certified drawings and requirements. Ensure modifications made comply with any type test certificate obtained for the arrangement of components.

12.4 Standards and Regulations

- A. Provide all materials and works in accordance with the appropriate British standard, code of practice or, where no British standard or code of practice is applicable, the Agreement Certificate for the particular item.
- B. Supply plant and equipment to achieve the specified design conditions and to provide stable control.
- C. Ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.
- D. Comply with all statutory obligations arising from current legislation and regulations, together with other requirements, including, but not limited to, the following:

E. Statutory obligations (where applicable):

- a. Irish building regulations and current amendments;
- b. Safety Health and Welfare at Work Regulations;
- c. Local Authority Bye-Laws, Regulations and Notices;
- d. Any other relevant safety regulations;
- e. Any other statutory authority regulations, specifications and requirements;
- f. Any other utility company regulations, specifications and requirements.

F. Other requirements:

- a. Irish, EN and British standard specifications and standard codes of practice;
- b. National Rules for Electrical Installations IS 10101:2020.
- c. BS 7671: Requirements for electrical installations. IEE Wiring Regulations;
- d. **IS EN** 50110-1: Operation of electrical installations. Minimum requirements;
- e. **IS EN** 50110-2: Operation of electrical installations. National annexes;
- f. CIBSE guides to good / current practice and technical memoranda;
- g. BESA ductwork specification standards DW141, DW151, DW172;
- h. CIBSE commissioning codes;
- i. BSRIA commissioning guides;
- j. BSRIA technical and application guides;
- k. Insurance company requirements;
- l. Notify all authorities in accordance with their regulations and obtain any required approvals for the installation in writing;

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

- a. CIBSE guides;
- b. CIBSE codes of practice;
- c. Institute of Plumbing Data Handbook;
- d. CIBSE technical reports;
- e. CIBSE technical memoranda;
- f. BSRIA application guides.

H. All electrical equipment and work shall comply with the National Rules for Electrical Installations IS 10101:2020.

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

12.5 Quality of Products

A. All materials supplied and work carried out shall be the best of their respective kinds and shall also be to the approval of the ER. The ER may order the removal of any equipment, materials or workmanship that he has not approved.

B. All electrical equipment and works shall comply with National Rules for Electrical Installations IS 10101:2020.

- C. All materials, products, equipment and workmanship shall be to the approval of the ER.
- D. Made good or replace any materials, products, equipment and workmanship that do not comply with this specification and/or have not been approved by the ER, at no additional expense to this contract;
- E. All products supplied to site shall be CE marked as appropriate.

12.6 Equipment Duties and Ratings

- A. The duties and ratings of all items of plant and equipment listed in the specification and/or indicated on the drawings are the "worst case", verify that all items of plant and equipment and all materials supplied meet the specified criteria, conditions and duties, ratings, etc.

12.7 Suitability of Materials and Products

- A. Note: Wherever possible, materials shall be resourced from a sustainable source and identified as such.
- B. Only use materials and products which:
 - a. Are new unless specified otherwise;
 - b. Are suitable for the services and conditions of use normally expected to apply after installation is complete;
 - c. Are able to withstand the testing and commissioning conditions specified;
 - d. Do not initiate mould growth, support vermin or bacterial life, contain animal hair or crocidolite;
 - e. Do not involve the use of CFC's at any stage of manufacture, installation or subsequent operation;
 - f. Are free from objectionable odours at the normal or maximum operating conditions;
 - g. Do not suffer deterioration at the specified or maximum operating conditions;
 - h. Are capable of being applied to a base material without causing damage to, or deterioration of, the base material;
 - i. Are not a fire hazard and do not evolve dense or toxic fumes when subjected to excessive heat, such as a fire;
 - j. Do not contain any of the materials to be excluded from use listed below.
- C. Whenever possible ensure products are manufactured and/or stocked under one of the following:
 - a. Kite mark scheme;
 - b. CE approval scheme;
 - c. BSI safety mark scheme;
 - d. From firms of assessed capability to **IS EN** ISO 9000;
 - e. From stockists of assessed capability to **IS EN** ISO 9000.

12.8 Materials to be Excluded from Use

- A. No materials generally known at the time of tender to be deleterious to health, safety or the integrity of the building are to be used in, or incorporated into, any temporary or permanent part of the Engineering Services works.
- B. Check with the manufacturers and suppliers of products and materials that products do not contain any such deleterious materials. If any specified product contains such material request an alternative specification of product, manufacturer or supplier.

- C. Ensure all efforts are made and use the best information available to ensure these substances are not incorporated into the Engineering Services works either directly or within products, whether or not specifically specified. If unable to comply with this requirement, inform the ER in writing allowing sufficient time for consultation to be held and alternatives considered.
- D. The following materials shall be specifically excluded from all items of the Engineering Services works whatsoever:
- a. Materials in which chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC) or HFA's have been used as blowing agents
 - b. Chlorofluorocarbons (CFC) and hydrochlorofluorocarbons (HCFC) based refrigerants
 - c. Asbestos or asbestos-containing products
 - d. Lead or any materials containing lead which may be ingested, inhaled or absorbed except where copper alloy fittings containing lead are specifically required in drinking water pipework by any relevant statutory requirement
 - e. Lead where the metal or its corrosive products may be directly ingested, inhaled or absorbed. Applications such as roofing, flashings, rainwater Goods and copper alloy fittings containing lead which are specifically required are acceptable, until equal or better alternatives are available
 - f. Lead-based paints and primers
 - g. Urea formaldehyde foam or materials which may release formaldehyde in quantities [which may be hazardous with reference to the limits set by the Health and Safety Authority]
 - h. Polyurethane or polyisocyanate foam
 - i. Polychlorinated biphenyls or any goods and/or materials containing the same
 - j. Extruded polystyrene other than low ozone depletion materials
 - k. Pentachlorophenol, lindane or tributyltin (TBT) oxide
 - l. Pitch polymer dpc
 - m. Materials which are generally composed of mineral fibres either man-made or naturally occurring which have a diameter of 3 microns or less and a length of 220/200 microns or less or which may contain any fibres not sealed, encapsulated or otherwise stabilised to ensure fibre migration is prevented. Products that may contain fibres include insulation, fire protection and air filters
 - n. Substances and materials not in accordance with British standards or codes of practice or other good building practice and techniques, or which are generally known at the time of use to be deleterious to health and safety or to the durability of the building and/or other structures and/or plant and machinery therein in the particular circumstances in which they are used and having regard to the Building Research Establishment Digest and the publication 'Good practice in the selection of construction materials' sponsored by the British Property Federation or British Council of Offices
 - o. Substances not in accordance with British standards or codes of practice where such exist or such other equivalent European standards or requirements applicable at the time of specification unless the same are notified to the Employer at the time of specification and agreed by the Employer in writing
- E. Notify the ER, in writing, as soon as reasonably practicable of any material designated by the building Research Establishment Digest, British standards or codes of practice as deleterious at any time during the Engineering Services works.

12.9 Samples

- A. Provide samples of the following:
 - a. All items that are exposed.
- B. Ensure all samples are available for inspection at site and held on site for future reference, where appropriate.

12.10 Inspection and Test Information

- A. Inspection records, test records and test certificates shall include, but not be limited to, the following:
 - a. Project title;
 - b. Specific location in the Engineering Services works, including plant identification, system and section under inspection / test;
 - c. Details of the element, item, batch or lot, including manufacturer's reference number;
 - d. Details, nature and number of inspections / tests;
 - e. Date, time and duration of inspection / test;
 - f. Weather conditions during the test, where applicable;
 - g. Instruments used, serial numbers and calibration dates, where applicable;
 - h. Number and type of deficiencies found, where applicable;
 - i. Any corrective action taken, where applicable;
 - j. Itemised readings for all tests, where applicable;
 - k. Name and signature of those inspecting / testing / witnessing test;
 - l. Other relevant particulars.
- B. Maintain records of all specified inspections and tests performed including third party and works test certificates on site.
- C. Submit copies of records within one week of request. on completion of the Engineering Services works, include copies in the O&M manuals.

12.11 Inspections and Tests – On/Off Site

- A. Ensure all materials, equipment, etc. meet the requirements of this specification and carry out any inspections, as necessary, prior to site inspections by the ER.
- B. All installations offered up for inspection must be substantially complete. The ER will not prepare extensive defects lists. If significant defects exist, correct defects and re-offer the systems for inspection when defects are substantially complete.
- C. If any part of the Engineering Services works is shown to be defective or not conforming to this specification make good at no additional expense to this contract. Note the ER will reject any defective parts by written notice indicating the area of dispute.
- D. Submit inspection and test schedules for those parts of the Engineering Services works:
 - a. That are required in this specification;
 - b. That are required to substantiate conformity with this specification;
 - c. For which records are required to be maintained.
- E. Should any alternative item be proposed that does not carry appropriate certification, ensure independent testing is carried out to confirm compliance at no additional expense to this contract.

- F. Provide all necessary facilities to enable tests to be witnessed and inspections carried out either on site or at manufacturer's works
- G. Provide method statements, supported by risk assessments, detailing the procedures for carrying out on-site tests.
- H. Agree in advance procedures for inspections and testing including periods of notice with the ER.
- I. Where a test indicates non-compliance with this specification, immediately submit details of the non-compliance and proposals for corrective action and repeat the procedure until satisfactory results are obtained.
- J. Arrange access to the manufacturer's, or other, off-site premises for personnel who are required to be in attendance when any inspections and/or tests are carried out.
- K. Carry out all tests required by legislation under the direction of a 'competent' person.
- L. Note: Attendance or otherwise of the supervisory personnel during specified inspections or tests will not reduce the obligations or restrictions of the contract.

12.12 Testing and Commissioning of Services

- A. Employ a specialist commissioning manager to supervise the whole of the inspection and testing of the Engineering Services works. The commissioning manager shall:
 - a. Commissionability and design/installation reviews;
 - b. Input to main works/construction programme;
 - c. Input during installation stages;
 - d. Management of commissioning, performance testing and handover/post-hand-over stages.
- B. Employ a specialist commissioning engineering company to undertake the commissioning of all systems comprising the Engineering Services works. Provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.
- C. Agree with the ER a programme for inspection, testing, pre-commissioning checks, setting to work, commissioning and performance testing and allow for all costs incurred.
- D. Provide method statements, supported by risk assessments, detailing all commissioning, demonstration and instruction procedures.
- E. Give at least two weeks written notice to the ER before each (or series of) test, inspection, commissioning or demonstration procedure is carried out, stating any requirements for the attendance and co-operation of others.
- F. Demonstration to the ER that test instruments and equipment are accurate.
- G. The ER will only witness test proceedings, confirm recorded results and determine if the specified requirements have been satisfied.

The Contractor shall provide all electricity and water for testing and commissioning at no additional expense to this contract. The Tenderer shall provide all gas and fuel oil necessary for the testing and commissioning at no additional expense to this contract. Notify and programme all testing and commissioning requirement for gas, fuel oil, electricity and water in a timely manner. In the event that repeat testing and commissioning is carried out in order to comply with programmed contract schedule, this shall all be carried out at no additional expense to the contract.

- H. The systems must be "de-snagged" to the satisfaction of the ER prior to any testing and/or commissioning.

- I. Test all equipment, material and systems as detailed in this specification. If an inspection or test fails, repeat the procedure, until satisfactory results are obtained at no additional expense to this contract.
- J. Complete all tests before any paint, cladding or similar materials are applied or before services are concealed.
- K. Following satisfactory completion of testing and when the Engineering Services installations are in a safe and satisfactory condition, ensure the following requirements apply prior to commissioning:
 - a. The installations are complete and in a satisfactory and safe condition (e.g. all fans, pumps, etc. have been tested for operation, polarity, phase sequence and impedance, etc.);
 - b. All systems are cleaned, flushed out and treated;
 - c. Systems are protected from harmful external and internal elements;
 - d. Notices are displayed stating their condition ('completion' indicates that the bulk of the snagging has been offered to the ER and that remedial work has been completed);
 - e. Set to work, regulate and adjust all systems, as necessary, to meet the specified design requirements.
- L. Provide all necessary instruments and recorders to monitor systems during commissioning and performance testing.
- M. All test equipment shall be subject to a quality assurance procedure complying with the following:
 - IS EN 30012-1, BS 5781-1, ISO 10012-1: Quality assurance requirements for measuring equipment. Metrological confirmation system for measuring equipment.
- N. 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 ER.
- O. Maintain on site full records of all commissioning and performance testing, cross referenced to system components and, on completion of the Engineering Services works, includes a copy in the O&M manuals.
- P. Provide the following information before any system is offered for final acceptance:
 - a. A written statement to the ER confirming that each installation has been correctly tested and commissioned and that the performance requirements can be achieved;
 - b. All certification documents for approval by the ER;
 - c. A logbook and record all hours run.
- Q. Provide the following commissioning information for agreement with the ER at an early stage to ensure sufficient time is available for commissioning the system prior to practical completion:
 - a. A separate and detailed commissioning programme;
 - b. A separate and detailed commissioning specification describing in detail the technical requirements with which the service has to comply;
 - c. A logic diagram;
 - d. Full commissioning method statements detailing all procedures;
 - e. Risk assessments describing health and safety considerations.
- R. Make due allowance for the following in the commissioning programme:

- a. Availability of related services;
 - b. Access required for controls, etc.
 - c. Commissioning, demonstration and instruction procedures;
 - d. Provision of written notice before each (or series of) test, inspection, commissioning or demonstration procedures are to be carried out, not less than two weeks' notice to the ER;
 - e. Demonstration to the ER that test instruments and equipment are accurate.
- S. The commissioning specification shall include, but not be limited to, the following information:
- a. Scope of works, i.e. details of the systems to be commissioned, their functions and duration of operation, and an explanation of their inter-relationship with other engineering systems;
 - b. Technical specification of the commissioning work, i.e. the relevant standards to be complied with, the instruments to be used, the tolerances for test results, and the witnessing and reporting procedures required;
 - c. Design data relevant to commissioning such as flow rates, temperatures, operating pressures, plant capacities, control logic statements, plan schematics, fault levels.
- T. It is recommended that the commissioning specification is included with the associated scope, materials and workmanship requirements for each engineering service.
- U. At least two weeks will be required prior to practical completion for performance testing after the systems have been fully commissioned.

12.13 Operational Demonstration

- A. Provide a written statement to the ER confirming that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.
- B. Demonstrate to the ER that all system components are operating correctly and the complete building services works will function in accordance with the specified performance requirements. Carry out performance testing in both summer and winter conditions to allow for the full load testing of the system(s) over an appropriate period of time to be agreed with the ER.

12.14 Outstanding Acceptance Tests

- A. Any items that have failed their acceptance tests, or where such tests are delayed by the Employer, are to be listed and dates agreed, during the defects liability period when reasonable demands for consumer requirements are available.

12.15 Systems Used Before Practical Completion

- A. Systems may not, without the prior written approval of the ER, be used prior to practical completion.
- B. Systems to be used before practical completion must have all defective consumable elements (including lamps and tubes) replaced by new elements not more than one week prior to practical completion.
- C. No system shall be put into use prior to handover, except for testing and commissioning, without a written instruction from the ER. In such a case, operate the designated parts of the Engineering Services works, provided that such operation is practicable and does not prejudice any responsibility or obligation.
- D. If instructed by the ER, provide adjustment to the contract sum, to take account of the following:
 - a. Comprehensive insurance including indirect loss for any plant being operated;

- b. Re-installment of the installation to 'as new' condition prior to handover to the Employer;
- c. Defects liability period to commence on handover.

12.16 Operation of Systems Before the Production of Record Drawings and/or Operation and Maintenance (O&M) Manuals

- A. In the event that the record drawings and/or O&M manuals are not available when the Engineering Services works would, in the opinion of the ER, otherwise qualify for practical completion, provide attendance 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, at no additional expense to this contract.
- B. Failure to provide this service satisfactorily shall entitle the Employer to make separate arrangements and recover the full cost through the contract.

12.17 Inspection by Employer's Insurance Company

- A. Provide all detailed drawings, etc. of the equipment to enable the insurance company to approve design before manufacture, if requested by the ER.
- B. Agree a programme for inspection and certification of specified equipment.
- C. Inform the ER when equipment is to be ready for examination.
- D. Arrange for the attendance of the insurance company's engineer / surveyor at each stage of manufacture and installation and provide all necessary access and facilities for inspecting and testing as may be required.
- E. The Employer will place an order with the insurance company. Details and nature of the order will be provided to all interested parties on request.
- F. Where indicated in this specification, the installations will be inspected by a 'competent' person acting for the Employer's insurance company appointed under the provisions of the Factories Act or other relevant legislation.
- G. Ensure the installations concerned satisfy the insurance company's requirements in all respects.
- H. Pay for all insurance company charges for examination and approval of drawing, inspection of works during construction and inspection and certification of the completed work.
- I. No plant subject to 'inspection' will be accepted on behalf of the Employer until a satisfactory certificate has been received by the Employer from the insurance company.

12.18 Cleaning on Completion of the Engineering Services Works

- A. Remove from site all debris, dirt and redundant items created by the Engineering Services works.
- B. Ensure all non-hazardous material is properly disposed of at a tip approved by the relevant waste regulation authority.
- C. Clean the installation thoroughly, removing all splashes, deposits, temporary markings, coverings and rubbish. Leave the site in a fit condition for occupation and use.

12.19 Disposal of Materials

- A. Ensure adequate waste facilities are provided to ensure all waste is sorted out on site appropriately, segregated and disposed of for recycling / reclamation where possible.
- B. Ensure that chemicals, solvents and other liquids are disposed of safely and are only discharged to drain in compliance with Environment Agency, local statutory and local authority requirements.
- C. Ensure all onsite materials and activities are carried out to avoid any damage to local wildlife, plant life and/or habitats.

13 Security / Safety / Protection

13.1 Safety, Health and Welfare at Work Regulations

- A. Comply with the requirements of the regulations by:
 - a. Adhering to the rules of the project specific Health and Safety Plan;
 - b. Reporting accidents, injuries or dangerous occurrences to the ER;
 - c. Providing appropriate input to the health and safety plan and file, including risk assessments;
 - d. Providing information on the Engineering Services works that might affect the health and/or safety of any person;
 - e. Providing all information necessary to the PSCS.

13.2 Safety

- A. Comply with all safety regulations and Health and Safety Authority (HSA) Guidance Notes, including Safety Health and Welfare at Work (Construction) regulations, Control of Substances Hazardous to Health (COSHH) Regulations, Electricity at Work Regulations.

13.3 Delivery

- A. Provide adequate and safe protection for all materials and products during transport to site.
- B. Deliver all ductwork, pipework, tubes, conduit, trunking and associated equipment with open ends effectively plugged, capped or sealed.

13.4 Handling

- A. Offload and transport all materials and products as recommended by the manufacturers.

13.5 Storage

- A. Ensure all plant, materials, etc. are adequately protected against weather and other damage, arising from any cause, at all times.
- B. Store all materials and products as recommended by the manufacturers.
- C. Provide sufficient, safe and secure storage for all materials and products.
- D. Provide suitable racks for storage of conduits, pipes and similar materials to prevent distortion.
- E. Ensure existing items to be re-use, either on the works or elsewhere, are adequately protected.
- F. In so far as is practicable, keep all plant, materials, fittings, accessories and sundry items in their packing cases until required for use. If this is not possible, store in clean bins or bagged and stowed in racks and maintained under suitable weatherproof protective covers.

13.6 Protection of Installed Engineering Services Works

- A. Provide adequate and safe protection for all materials and products after installation. Check regularly the protection provided after installation of equipment and correct if inadequate.
- B. Ensure all items are protected against ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building works and operations of others.
- C. Protect during erection all easily damaged materials with hardboard covers or heavy duty polythene sheet. Such items include but are not limited to:
 - a. Control panels;
 - b. Motor control centres;
 - c. Switchboards;

d. Gauge glasses.

- D. Cover all plant items with polythene sheeting except when being worked upon.
- E. Any existing defects shall be reported to the ER before work commences in each area to show to the satisfaction of the ER that the damage has not been caused during the contract period. Otherwise rectify the damage at no additional expense to this contract.
- F. Repair or replace material, plant or equipment where deterioration or damage has occurred during the contract period prior to handover, whether caused by the contractor or not, at no additional expense to this contract.

13.7 Identification

- A. Where appropriate, ensure materials, plant and equipment bear the brand name, serial / batch number and any other data required to identify their nature in relation to the Engineering Services works.
- B. All identification shall be in accordance with BS 1710.

13.8 Rotating Plant

- A. Immediately prior to practical completion adjust, ease and lubricate moving parts as necessary to ensure easy and efficient operation.
- B. Ensure, whenever necessary, temporary supplies are provided to enable all motive plant items to be run at regular intervals to avoid damage or deterioration.
- C. Ensure rotating plant is hand-turned periodically if temporary supplies are not available.

13.9 Maintenance of Existing Services

- A. Fully maintain all existing services to existing premises during the progress of the Engineering Services works unless the ER has given agreement, in writing, which specific services do not need to be maintained.
- B. Provide any additional work and materials necessary to maintain these services at all times during the duration of the contract.
- C. Any existing services disturbed by the Engineering Services works are to be reinstated fully in accordance with the standards of quality defined in this specification and to the satisfaction of the ER.
- D. Make all connections to existing services out of normal working hours.

14 Specific Limitations on Method/Sequence/Timing

14.1 Ordering of Materials and Products

- A. Ensure procurement details of materials are incorporated into the programme.
- B. To avoid delays, submit details of alternative manufacturers or types of materials / products to the ER in time to comply with the agreed programme.
- C. Order all materials / products necessary for the completion of the Engineering Services works immediately after receipt of comments received and/or instructions to proceed.
- D. No delay to practical completion, or completion of any part thereof, caused by delays in ordering will be accepted.

15 Facilities / Attendance / Special Attendances

- A. The Contractor will provide their own on temporary site facilities, offices and storage.
- B. Should the sub-contractor require special attendances, these should be clearly stated in Summary of Prices and Form of Tender accompanying this document.

16 Operation and Maintenance (O&M) of the Finished Building

16.1 Submission of Record Documents

- A. To satisfy the provisions of the Health and Safety at Work Act, the Employer will not accept handover of the installations until full and adequate information concerning the installations is in the possession of the building operating and maintenance staff. This will include, but not be limited to, health and safety files, record drawings and O&M manuals.
- B. Provide record documents prior, and as a prerequisite, to practical completion to the satisfaction of the ER.
- C. Prepare O&M manuals in draft as the Engineering Services works progress and make suitable arrangements where the Engineering Services works are subject to partial / sectional possession / completion.
- D. Submit draft record documents to the ER for comment two weeks prior to commissioning.
- E. Prepare temporary O&M manuals with provisional record drawings and preliminary performance data available two weeks prior to the commencement of commissioning to enable Employer's staff to familiarise themselves with the installations. These should be of the same format as the final O&M manuals with temporary insertions for items that cannot be finalised until the installations are commissioned and performance tested.
- F. For issue requirements refer to Appendix E.

16.2 Record Documentation

- A. Provide:
 - a. Record drawings and schedules (including drawing(s) for all external utilities serving this development and in the vicinity of this development)
 - b. Plantroom and switch room drawings, schematics and schedules
 - c. O&M manuals (see Appendix B)
 - d. Log book for all maintenance work, meter readings, etc.
- B. Maintain and provide, as required throughout the execution of the Engineering Services works, complete and accurate records are being maintained and that the record documentation is being progressively compiled as the works progress.
- C. Advise the ER of future access requirements to drain points, air points and other manual devices.

16.3 Record Drawings and Schedules

- A. Prepare record drawings and schedules from the as-Installed drawings maintained on site. Endorse all such documentation 'Record'. Where agreed with the ER certain detailed information may be provided in schedule form.
- B. Provide reduced scale copies for inclusion in the O&M manuals.

16.4 Operating and Maintenance (O&M) Manual Specialist

- A. Employ a specialist to prepare the O&M manuals

16.5 Operating and Maintenance (O&M) Manuals

- A. Agree the format and contents with the ER. the format shall be consistent for all O&M manuals produced.
- B. Advice on assembling O&M manuals is provided in the following BSRIA publications:
 - a. Application Guide AG 1/87.1 "O&M Manuals for Building Services Installations"

- b. Application Guide AG 7/97 "The CDM Regulations Health and Safety File"
 - c. Technical Note TN 15/95 "Handover Information for Building Services"
 - C. Ensure the O&M manuals for each discipline follow the same general format and together provide a 'site specific' set of documents (see Appendix B: Operation and Maintenance (O&M) Manuals).
 - D. Ensure the O&M manuals are produced timeously and of a suitable standard for comment.
- 16.6 Presentation of Operating and Maintenance Manuals
- A. Agree the format and contents with the ER.
 - B. Encase the O&M 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.
- 16.7 Recommended Spare Parts and Tools
- A. Submit to the ER, at least four weeks before practical completion, a schedule of all spare parts, tools and portable instruments as called for in this specification and any others that should be obtained and kept in stock by the Employer for maintenance of the Engineering Services installations.
 - B. State against each item the manufacturer's current price, including packaging and delivery to site.
 - C. Identify those items that are additional to those specified for inclusion in individual work sections.
 - D. Submit to the ER, within one week of request, a quotation priced in detail for the initial supply to the Employer these additional spare parts, tools and portable instruments and include for the following:
 - a. Checking that each item is suitable for the intended application
 - b. Checking receipt, marking and numbering in accordance with the schedule
 - c. Referencing to the main plant and equipment listed in the O&M manuals
 - d. Protecting, painting, greasing, packing, etc. to prevent deterioration during storage
 - e. Providing suitable means of storing and securing these items
- 16.8 Digital Safety and Facilities Guide
- A. Preparation of the DSFG shall be in accordance with:
 - a. BS 4884, Parts 1 & 2 Specifications for Electrical Manuals;
 - b. BSRIA Guides BG 2/2004 and BG 1/2007;
 - c. Technical Note TN 1/84. Guidelines for building services operating and maintenance manuals;
 - d. BSRIA Application Guide 1/87. Operating and maintenance manuals for building services installations;
 - e. BSRIA Technical Note TN 12/86. Fault finding procedures in the building services industry.
- 16.9 Training of Employer's Staff / Operational Tuition
- A. Before practical completion explain and demonstrate the purpose, function and operation of the installations including all items and procedures listed in the O&M manual to the Employer's maintenance staff.

- B. Allow for 2 working days of tuition prior to practical completion for 3 of the Employer's personnel, by a suitably qualified engineer.
- C. The contractor shall include for 1 day of support for 4 weeks post PC and a total of 100 hours of support within the first year to the Rotunda Hospital technical services team. Hours are to be confirmed by the Rotunda Hospital at their discretion. This is to provide any training or assistance deemed necessary.
- D. Also allow for 1 day per week for weeks post PC.
- E. This tuition shall cover the safe day-to-day running and maintenance of all installed Engineering Services installations and shall include the following on-site training and instruction:
 - a. Familiarisation of the handover documentation
 - b. Operation of the building control system
 - c. Routine maintenance procedures
- F. Specifically with respect to the controls, monitoring and/or BMS installations also provide the following initial training at the controls supplier's works prior to commissioning the installed system:
 - a. 'Hands on' experience of equipment and software similar to the installation
 - b. 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
 - c. All appropriate reference and training manuals
- G. Ensure all specialist suppliers attend such instruction as may be required by the ER.

16.10 Reading of Meters

- A. Record readings of all water, gas, and electricity meters immediately on completion of the Engineering Services works and forward to the ER.

16.11 Obligations During Defects Liability Period

- A. Defects arising from failures arising out of improper operation by the Employer or fair wear and tear will not be liable for rectification under this contract.
- B. Carry out all planned preventative maintenance on all Engineering Services works during this period, including:
 - a. Testing in compliance with statutory requirements
 - b. Routine maintenance inspections in accordance with the O&M manuals
 - c. Replacement of all 'consumables' at no additional expense to this contract
 - d. Recording of all maintenance work carried out
 - e. Monitoring and recording of all energy consumption through this period
 - f. Interpretation of the energy consumption to demonstrate correct operation of the plant
- C. Prepare and submit records of failures or malfunctions of any part of the Engineering Services works during the defects liability period, together with details of remedial action taken, subsequent re-testing and the results.
- D. Notify the ER of damage, failures or malfunctions to the Engineering Services works caused by incorrect operation of the installations, vandalism or other actions by a third party.

- E. Rectify all defects due to materials or workmanship or other faults that occur, including those notified by the Employer or ER, during the defects liability period with the minimum of delay and at no additional expense to this contract.
- F. Inform the ER in writing when all defects are finally rectified so that an inspection may be carried out prior to the issue of a final certificate.

16.12 Handover

- A. To be read in conjunction with Appendix E.
- B. Notwithstanding the requirements of other clauses in this specification, provide the following documents at handover to the Employer:
 - a. O&M manuals;
 - b. As installed documentation;
 - c. List of consultants, contractors, clerk of works, site engineers employed;
 - d. Terms of any maintenance service contracts available for plant and contracts, together with their appropriate call-out numbers;
 - e. Insurance inspection dates and renewal dates;
 - f. Insurance inspection certificates.
- C. The following response times to notification of defects shall be achieved:
 - Emergency: 2 hours
 - Urgent: 24 hours
 - Substantial: 7 days
- D. On completion of the Engineering Services works, maintain a full-time presence until all Engineering Services works defects are resolved to the satisfaction of the ER.

Appendix A: Definitions

General

- A. The definitions of technical terms associated with the Engineering Services installations are those included in:
- a. BS 6100-1-5: Glossary of building and civil engineering terms. General and miscellaneous. Operations; associated plant and equipment;
 - b. All IS and EN standards;
 - c. National Rules for Electrical Installations IS 10101:2020;
 - d. BS 6100-3: Glossary of building and civil engineering terms. Services;
 - e. IOP and BSRIA technical publications
 - f. Loss Prevention Council: Rules for automatic sprinkler installations;
 - g. BS 7671: Requirements for Electrical Installations (as amended);
 - h. Irish standards, including codes of practice;
 - i. British standards, including codes of practice;
 - j. Associated statutory acts;
 - k. Irish building regulations;

Plant

- A. Includes boiler rooms.

Builder's Work / Access Duct

- A. An enclosed space specifically intended for the distribution of services, with direct access for personnel. Generally of walk-way or crawl-way type.

Trench

- A. A covered horizontal service space in the floor or ground with access from above.

Cavity

- A. A space enclosed within the elements of a building within which services are installed, e.g.: the space between ceiling and floor above. See building regulations.

Service Area

- A. Area within a building with limited finishes such as loading bays, car parks, etc.

System

- A. All equipment, accessories, controls, supports and ancillary items, including supply, installation, connection, testing, commissioning and setting to work necessary for each section of the Engineering Services installations to function.
- B. Include, in each system, all necessary offsets, bends, tapers, transformation pieces, additional lengths, etc. whether or not shown explicitly on the drawings. Ensure a satisfactory inter-relationship with other systems, the work of other trades and other building elements.

Engineering Services

- A. All mechanical, public health and electrical services and systems as defined in this specification.

Concealed Services

- A. Installations within ducts, trenches or cavities.

Exposed Services

- A. Installations outdoors, within plantrooms and 'service' areas or unprotected within occupied areas.

Specification

- A. Refers to all sections as listed in the introduction.

Sketch Drawing

- A. 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 works within the project as a whole.

Tender Documentation

- A. Drawings and other documents as appropriate to the agreed procurement method prepared to enable those tendering to interpret the design for the Engineering Services works and to submit a tender for executing all or any part of the Engineering Services works.
- B. Not all items or matters referred to in this specification are indicated on the tender drawings nor are all items detailed on the tender drawings described in this specification.

Tender Drawing

- A. Drawing produced for the purpose of obtaining competitive tenders.
- B. The tender drawings shall comprise an agreed set of drawings to suit the complexity of the project and which comply with the specific drawing definitions included in this appendix.

Contract Documentation

- A. Drawings and other documents as appropriate to the agreed procurement method prepared to enable co-ordinated and installation drawings and documentation to be produced.
- B. Note: Not all items or matters referred to in this specification are indicated on the contract drawings nor are all items detailed on the contract drawings described in this specification.

Contract Drawing

- A. Drawing produced for the purpose to enable co-ordinated and installation drawings to be produced.
- B. The contract drawings shall comprise an agreed set of drawings to suit the complexity of the project, and which comply with the specific drawing definitions included in this appendix.

Subcontract Documentation

- A. Documentation, including drawings and specifications, on which sections, or the whole, of the contract for the Engineering Services works are based.

Builder's Work Information

- A. Drawings and/or schedules, appropriate to the stage of design development, prepared at a scale of 1:50 showing the requirements for architectural and/or structural provisions necessary to facilitate the Engineering Services and allow their integration into the project. Such information includes the position and sizes of all access covers, panels and doors required in the building fabric for proper access for and to plant for installation, maintenance and inspection.
- B. Drawing, appropriate to the stage of design development, indicating requirements for the following:
 - a. Details of holes in concrete block work, etc. Include for drilling and/or plugging walls, floors, ceilings, etc.
 - b. Requirements for foundations, bases, and supporting structures for plant and equipment
 - c. Cable trenches and drainage of trenches
 - d. Frames and supports, etc. for fixing of services.

Design stage definition

- A. Drawing showing provisions required to accommodate services that significantly affect the design of the building structure, fabric and external works. Also showing the positions required (drawings

and schedules) to enable work to be carried out by a building trade and to be costed at design stage e.g.: plant bases, major openings and major supporting structures for plant and equipment.

- B. This will be based on preliminary, non-manufacturer specific plant selection.

Post contract / installation stage definition

- A. Drawing showing requirements for the building Engineering Services works necessary to facilitate the installation of the services based on the installation drawings.
- B. A fully dimensioned drawing based on installation drawings showing requirements (both size and position of builder's work) for all building works necessary to facilitate the installation of the Engineering Services works, other than where it is appropriate to mark out on site.
- C. The main features are:
- a. Fully dimensioned showing size and position of builder's work.
 - b. Penetrations whose sizes are 150mm x 150mm or 150mm $\varnothing$ or greater.
 - c. Any specialist builder's work below that size must also be detailed if requested by the ER.

Schematic Drawing

- A. Line diagram defining the interconnection of components in a complex system.
- B. The main features are:
- a. Not drawn to scale;
 - b. Two dimensional / isometric drawing indicating the distribution of systems between building levels and zones / areas;
 - c. Include all major functional components e.g. plant, pumps, fans, terminals, switchgear, etc.
 - d. May include other components such as valves, dampers, etc., if not indicated on the layout;
 - e. May be labelled with appropriate pipe, duct and cable sizes, if not indicated on the layout;
 - f. Reference major components to assist with cross-referencing with other drawings and documentation;
 - g. Should eventually (although not necessarily at tender stage) include all data essential to testing and commissioning including volumetric flow rates, design total pressure losses at equipment, locations of dampers, valves and flow measuring stations, electrical fault levels, current ratings, short circuit capacities and tripping times.

Layout Drawing

- A. Drawing not indicating the precise position of services but showing the intended locations of plant and service routes to indicate the design intent and spatial arrangement of services.
- B. Drawing to enable production of co-ordination drawings or installation drawings without major re-routing of the services.
- C. The main features are:
- a. Convey the full design intent and spatial arrangement of services;
 - b. Arrange the services to indicate a feasible installation but do not indicate the precise position of services (see installation / co-ordination drawing);
 - c. Indicate space available for major service routing in both horizontal and vertical planes;
 - d. Plan layouts at 1:100 or 1:200; plant areas at 1:50 with cross sections;
 - e. Pipework is single line; ductwork is either single or double line; cables are single line.

Co-Ordination Drawing

- A. Drawing showing all the information necessary to enable installation of the Engineering Services works by showing the inter-relationships of all services and their relation to the structure, building fabric and architectural details.
- B. Note: The intent is that all elements of the installation can be considered by the ER for spatial relationship, appearance and operation prior to installation.
- C. The main features are:
 - a. Show all plant, equipment and cable / pipe / duct runs, etc.
 - b. Include full details of all plant together with cable / conduit / pipe / duct sizes, wiring drawings, schematic and inter-connection diagrams / drawings
 - c. Spatially co-ordinate with no physical clashes when installed at the scaled-off positions shown on the drawing. In areas where tolerances are minimal, dimensions should be provided
 - d. Allow for the designer's specified and/or approved alternative plant and equipment – show the plant and equipment in their true proposed location, use exact dimensions based on manufacturers' certified drawings and/or specific details where appropriate and confirm that layout with these specific dimensions is acceptable
 - e. Show the heights of the main items of plant
 - f. Allow for all services at their widest point. Insulation, standard fitting dimensions and joint widths shall therefore have been allowed for on the drawing
 - g. Indicate positions of fixing points and supports where they have significance to structural design
 - h. Co-ordinate to demonstrate the installation sequence
 - i. Allow for installation details and all supports and fixings
 - j. Allow for space for installation, working, commissioning, maintenance and replacement of plant and equipment in accordance with the relevant manufacturers' and health & safety requirements
 - k. Allow for any access or withdrawal zones required by the manufacturer
 - l. Show large scale details of points where many services are in close proximity to each other, where there is limited space to install them or where the integration and connection of these services requires clarification (e.g.: ceiling voids, risers, etc.)
 - m. Produce on Revit / CAD, compatible with the latest version of the software as agreed for the project.
 - n. Plan layouts at 1:50. Cross-sections at 1:50 or 1:20 for congested areas. plantroom layouts, cross sections and elevations at 1:20
 - o. Show all setting out dimensions and dimensions of the system components
 - p. Show critical dimensions in areas where tolerances are minimal
- D. Support by individual services layouts where these are desirable for clarity and/or requested by ER.
- E. Where sprinkler drawings are to be provided the installation drawings must be prepared by an approved Loss Prevention Council installer and must be sufficiently detailed for Loss Prevention Council approval.

Installation Drawing

- A. Drawing developed from the tender showing all specified plant and equipment in its true proposed location for the execution of the works. Ensure such drawings and details relate, where relevant, to builder's work information, and to all architectural, structural and other drawings.
- B. Note: Where co-ordination drawings have not been prepared in advance, responsibility for spatial co-ordination should be allocated to the 'lead' installing contractor who should be named in the tender documents. All installation requirements should then be produced taking into account the needs of co-ordination.
- C. The installation drawings shall be in such detail as to enable the works to be installed.
- D. The main features are as for co-ordinated drawing, plus:
 - a. Dimensions showing distribution of all internal and external services including plans and elevations of positions and sizes for all cable trunking and/or conduits, together with dimensions for positions and sizes of all accessories, thermostats, switches and co-ordination details
 - b. Detailed dimensioned plant and switch room drawings, plans and sections to a min. scale of 1:20
 - c. Detailed dimensioned exposed services in public areas drawings, plans and elevations to a minimum scale of 1:20
 - d. Large scale sections through ducts, cavities and trenches showing arrangement of works and co-ordination details
 - e. Detailed dimensioned drawings of all fabricated steelwork, brackets, fixings, supports, gantries, ladders, platforms, and all other items of a similar nature
 - f. Clearances between walls, ceilings, floors, structural elements and services provided by others.
 - g. Detailed dimensioned drawings where the positioning of the services is considered to be important enough not to leave to the tradesmen on site
 - h. All connections to equipment.
 - i. Methods of support hangers and any other large-scale details necessary for the satisfactory installation of the systems
- E. Equipment layouts shall show the exact method of installation and clearly illustrate components to be used in making all connections. All equipment and accessories shall be individually referenced in a schedule (See Section D). These references shall also appear on all drawings, schematics and submittals. Following installation these references shall be applied to each device on site.
- F. The installation drawings shall include details of all local co-ordination with equipment, control panels, access points and architectural finished surfaces. The intent is that all elements of the installation can be considered by the ER for spatial relationship, appearance and operation prior to installation.

Installation Wiring Diagram

- A. Drawing showing the interconnection of electric components, panels, etc. in accordance with the design intent indicated on the schematic drawings and incorporating the details provided on manufacturers' certified drawings.
- B. Composite circuit and layout diagrams for the electrical wiring of plant, etc. Shall detail all circuitry within control panel, racks and fire alarm panels together with all interconnecting wiring from the main point of supply onwards and all terminal markings. The required sizes and types of all

cables shall be indicated on the diagrams together with ratings of such items as fuses, switches and controls. The composite diagrams shall subsequently form part of the set of as-installed and record drawings.

Specialist Drawing

- A. Drawing supplied by a specialist supplier appointed to undertake design duties in relation to a specific aspect of the project (e.g. sprinkler installation).
- B. Generic term for those drawings supplied by a specialist appointed to undertake design duties in relation to a specific aspect of the project, e.g. sprinkler installation.

Shop / Fabrication Drawing

- A. Drawing prepared by a fabricator or supplier which is unique to that project, showing details of individual components and how they are to be fabricated and assembled. Examples include suppliers' drawings for ductwork, pre-fabricated pipework, sprinkler systems, control and switchgear panels associated internal wiring.

Manufacturers' Drawing

- A. Drawing provided by a manufacturer or supplier to indicate a typical representation of the product, components or plant items to be supplied.

Manufacturers' Certified Drawing

- A. Drawing provided by a manufacturer or supplier to indicate details of the product, components or plant items and which the manufacturer or supplier guarantees the supplied equipment will comply with.
- B. Drawings indicate physical dimensions of items of plant / equipment, schematic arrangements for components and full detailed electrical wiring diagrams.

Equipment Drawing

- A. Drawing detailing dimensions, fixings, connections and all relevant details of an item of equipment.
- B. Such drawings are to be specific to the Engineering Services works of this project. All references to optional features, other equipment of a range, etc. shall be deleted or the original drawings redrawn to comply with this requirement.
- C. The main features are:
 - a. Accurate representation with correct dimensions and all connections precisely located;
 - b. Conforms to the specific description given in the tender, quoting the relevant reference;
 - c. Shows the item in its entirety with no extraneous or alternative parts included.

Controls Logic Diagram

- A. Diagram, drawing and/or schematic showing all control components and instruments showing the layout with each item uniquely identified together with description of the controls operation and details of the associated interlocking.

Controls Wiring / Connection Diagram

- A. Diagram, drawing, or schedule detailing all power and control wiring and control pipework connections between control panels, motors, control components, instruments and any other items requiring electrical connections.
- B. The main features are:
 - a. Maximum electrical loading for each supply cable;
 - b. Cable termination facilities;
 - c. Cable identification and all terminal numbers.

Switchgear, Starter and Control Instrumentation Panel Drawing

- A. Drawing showing the construction and internal wiring of the starters, panels and/or other devices.

Progress Drawing

- A. Drawing to be maintained on site recording all changes from the initial contract drawings to facilitate easy and accurate preparation of the record drawings and to ensure these drawings are in all respects, a true record of the installation.

As-Installed Documentation

- A. Drawings, diagrams and schedules, etc. retained on site to record the progress of and any site modifications to the Engineering Services works including any changes to software.

Plantroom and Switch room Documentation

- A. Drawings, schedules and schematics, etc. prepared from as-Installed drawings showing the specific information relating to plant and equipment areas.

Commissioning Specification

- A. The document that describes in detail the technical requirements with which the commissioning service has to comply.
- B. The commissioning specification shall include the following information:
 - a. Scope of works – details of the systems to be commissioned, their functions, duration of operation and an explanation of their inter-relationship with other Engineering Services systems
 - b. Technical specification of the commissioning work, i.e. the relevant standards to be complied with, the instruments to be used, the tolerances for test results, and the witnessing and reporting procedures required
 - c. Design data relevant to commissioning such as flow rates, temperatures, operating pressures, plant capacities, illumination levels and glare indices, control logic statements, plan schematics, fault levels, noise ratings, etc.
 - d. Set of schematic drawings, together with a set of either detailed design drawings or co-ordination drawings each with clearly marked details of volumetric flow rates, design total pressures, design total pressure losses at equipment, pipe and duct sizes, locations of dampers, valves and flow measuring stations, electrical fault levels, current ratings, short circuit capacities and tripping times
 - e. System preparation details, i.e. the requirements for, and methods by which systems shall be prepared ready for commissioning. This shall include flushing and cleaning details in the case of water systems
- C. It is recommended that the commissioning specification is included with the associated scope, materials and workmanship requirements for each service.

Record Documentation

- A. Drawings, diagrams and schedules, etc. prepared from as-installed documentation showing the work as finally executed, including:
 - a. Schematic / diagrammatic arrangements, wiring diagrams, etc. (NTS);
 - b. Equipment schedules (NTS);
 - c. Plantrooms, switch rooms, service subways, trenches, ducts and other congested areas (1:20);
 - d. General arrangements, plans and sections (1:50);
 - e. Manufacturer drawings (1:10).

B. The main features are:

- a. Exact positions of all plant and apparatus;
- b. Exact distribution routes and sizes of all services;
- c. Exact routes, invert levels, disposition, depth, sizes, types and dates of installation of all underground services;
- d. Location, including level if buried, of utility service connections, including those provided by the appropriate utilities undertaker, indicating points of origin and termination, size and material of service, pressure and/or other relevant information;
- e. Exact locations of any other service or obstruction in the routes of underground services;
- f. Exact positions and reference numbers of all accessories including sensors, detectors, sounders, break glass units, speakers, etc.

C. 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.

Record Drawing

A. Ensure record documents:

- a. Clearly record the arrangements of the various sections of the Engineering Services works as actually installed
- b. Locate and identity of each room or space housing plant, machinery or apparatus
- c. Show all plant, equipment and pipe / cable / conduit routes, together with full details of plant / cable / pipe / duct sizes and schematic diagrams as appropriate
- d. Make it possible to comprehend the extent and purpose of the Engineering Services works and the method of operation thereof
- e. Set out the extent to which maintenance and servicing is required and how, in detail, it should be executed
- f. Provide sufficient, readily accessibly and proper information to enable spares and replacements to be ordered

B. Dimensioned plans and sections of plantrooms, service subways, trenches, ducts and other congested areas where in the opinion of the ER smaller scale drawings cannot provide an adequate record. Indicate the location, identity, size and details of each piece of apparatus.

C. 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. Include any items forming an integral part of the Engineering Services works provided by others (such as plenum ceilings, builders' work shafts, chimneys, etc.).

D. Identification of all terminals / cables, etc. by size / type and duty / rating as recorded from the approved commissioning results.

E. 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.

F. 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.

- G. 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 Engineering Services works.
- H. Details to show inter-connections between the Engineering Services works and equipment or systems provided by others to which wiring and connections are carried out as part of the Engineering Services works.
- I. Details of the principles of application of automatic controls and instrumentation.
- J. Logic flow diagrams for each individual control or monitoring specification and for each Engineering Services system to illustrate the logical basis of the software design.
- K. Schedules setting out details of all initial values of user-defined variables, text statements for alarm messages, etc.
- L. Drawing showing the building and services installation as-installed at the date of practical completion.
- M. Manufacturers' drawings of equipment indicating:
 - a. General arrangement and assembly of component parts which may require servicing;
 - b. Internal wiring diagrams together with sufficient physical arrangement details to locate and identify component parts;
 - c. Schedules as required to locate, reference and provide details of ratings and duty of all items incorporated into the Engineering Services works together with all fixed and variable equipment settings established during commissioning.
- N. For each programmable control item, schedules indicating:
 - a. 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, alarm priority, control specification reference and any other such parameters as are applicable;
 - b. Each spare input and output point including reference, type of input / output and space for future entry of appropriate parameters as listed above.
- O. The main features are:
 - a. Accurate locations and arrangements of all plant and apparatus;
 - b. Locations of all the systems and components installed including pumps, fans;
 - c. valves, strainers, terminals, electrical switchgear, distribution and components;
 - d. The sizes, types and routes of all cables and containment systems;
 - e. Routes of all main sub-main cables and of all electrical trunking, tray and ladder support systems to be identified at regular intervals and changes of direction
 - f. The exact routes and invert levels and the sizes, types and dates of installation of all underground services;
 - g. The locations of any other services or obstructions in the routes of underground pipework and cables;
 - h. Reference numbers or letters, for the controls plant items of any parts thereof, corresponding to the lettering, numbering or any identification fixed to plant or equipment;
 - i. The positions and reference numbers of all detectors, sounders, break glass units, speakers, etc.

- j. Positions of access points for operating and maintenance purposes;
- k. Scale of not less than that of the installation drawings;
- l. Not dimensioned unless the inclusion of a dimension is considered necessary for location;

Appendix B: Operation and Maintenance (O&M) Manuals

- A. The O&M manual shall be one cohesive document. It must include, but is not limited to, the following:

Title Page

- A. The following shall be included:
- Project title;
 - Revision / modification sheet.

List of Contents

- A. Overall index sheet should detail total no of sections / volumes included and identify the contents within each.

Introduction

- A. Use and application of the O&M manual. Short description detailing the scope and purpose of the manual identifying for whom the manual is intended.

Contacts

- B. The following shall be included:
- Company name, address, telephone and facsimile numbers, website address, contact names and email address for the following:
 - Employer;
 - Design team;
 - M&E contractors;
 - Other trade / sub-contractors;
 - M&E consultants;
 - Manufacturers and suppliers.

Drawings

- A. The following shall be included:
- A schedule of all Engineering Services record drawings
 - An A3 size reduced copy of all record drawings and schedules, together with an index
 - An A3 size reduced copy of all plantroom and switch room drawings, schematics and schedules
 - An A4/A3 size legend for all colour-coded services
 - Schematic drawings of each system, indicating principal items of plant, equipment, valves, etc.

Description of Services

- A. A full description of each of the installed systems and items of equipment, written to ensure that the Employer's staff fully understands the facilities provided. Include written explanation of the following:
- Scope
 - Function
 - Mode of operation

- d. Control sequences
- e. Starting up
- f. Shutting down
- g. Emergency procedures
- h. Summer and winter operation
- i. Capacities
- j. Most economic mode of operation
- k. General design parameters
- l. Step-by-step normal associated operating conditions
- m. System capacities (based on commissioning results)
- n. Restrictions of the systems
- o. Manufacturer's information concerning correct operation, etc.
- p. Reference to record drawings

Product Data Sheet

- A. Product data sheet detailing the following:
 - a. Component
 - b. Make of equipment
 - c. Manufacturer and supplier (address)
 - d. Telephone and facsimile Nos.

Manufacturer Schedules

- A. Schedule of all manufacturers and suppliers indicating:
 - a. Company name
 - b. Contact(s)
 - c. Company address, telephone number, facsimile number and email address(es)
 - d. Company website address
 - e. Equipment schedule reference number

Manufacturers Data

- A. The following shall be included:
 - a. Product (manufacturers) data for all aspects of the M&E services installation is to be included in this section of the manual
 - b. Instructions and manufacturers' technical literature for all items of plant and equipment assembled specifically for the project, including detailed drawings, electrical circuit details and operating and maintenance instructions (exclude irrelevant data)
 - c. A copy of all manufacturers' guarantees or warranties, together with all maintenance agreements

Equipment Schedules

- A. The following shall be included:

- a. System by system schedules of plant, equipment, valves, distribution boards, etc., stating their locations, duties and performance figures. Ensure each item has a unique code number cross-referenced to the record drawings, schematic drawings and schedules
- b. List of all functional components of the systems and equipment listed in the equipment schedules. The list shall include:
 - c. System number / details
 - d. Unit number / details
 - e. Manufacturers model and/or reference numbers
 - f. Manufacturers serial number
 - g. Manufactures drawing number
 - h. Nameplate details
 - i. Duties
 - j. Original order numbers of every item of plant and equipment together with the catalogue list and order acknowledgement numbers
 - k. Copy of all manufacturers' guarantees or warranties, together with all maintenance agreements

Test Result Data

- A. The following shall be included:
 - a. 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.

Commissioning Data

- A. The following shall be included:
 - a. All commissioning data including method statements.
 - b. Schedules of all fixed and variable equipment settings established during commissioning

Relevant Authorities Data

- A. The following shall be included:
 - a. Copies of insurance & inspecting authority certificates and reports.

Energy Monitoring

- A. The following shall be included:
 - a. Details of energy monitoring procedures that should be carried out to assess the building operation and performance

Recommended Maintenance

- A. The following shall be included:
 - a. Details of procedures to maintain plant in safe working conditions
 - b. Provide a detailed schedule of all recommended maintenance (planned preventative maintenance schedule) that is to be carried out within the following periods:
 - c. Daily
 - d. Weekly

- e. Monthly
- f. Three monthly
- g. Six monthly
- h. Annually
- i. Bi-annually
- j. Five yearly
- k. Ten yearly
- l. Procedures for seasonal changeovers and/or precautions necessary for the care of apparatus subject to seasonal disuse
- m. Detailed recommendations for the preventative maintenance procedures and frequency that should be adopted by the Employer to ensure the most efficient operation of the systems
- n. Details of lubrication systems and lubrication schedules for all lubricated items
- o. Details of regular tests to be carried out (e.g.: water cooling towers, etc.)
- p. Details of procedures to maintain plant in safe working conditions
- q. Details of the disposal requirements for all items in the Engineering Services works
- r. A list of normal consumable items with relevant data for re-ordering supplies
- s. Procedures for fault finding
- t. Emergency procedures, including telephone numbers for emergency services
- u. Back-up copies of any system software
- v. Documentation of the procedures for updating and/or modifying software operating systems and control programmes
- w. Instructions for the creation of control procedure routines and graphic diagrams
- x. Details of the software revision for all programmes provided
- y. Two back-up copies of all software items, as commissioned
- z. Copies of relevant HSE / CIBSE / IEE guidance notes, etc.
- aa. Relevant health and safety information including CDM regulation information and any COSHH certificates
- bb. Contractual and legal information including, but not limited to, the following:
- cc. Details of local and public authority consents
- dd. Details of design team, consultants, installers
- ee. Start date for installation
- ff. Date of practical completion
- gg. Expiry date for the defects liability period
- hh. Details of warranties for plant and systems including expiry dates, addresses and telephone numbers.

Safety

- A. Provide details of recommended first aid material to be kept on site. Provide details of first aid procedures that can be carried out prior to hospital treatment.

Fault Finding and Emergencies

- A. The following shall be included:
 - a. For each service discipline provide a written description / flow chart of all precautionary requirements and the procedure for rectification of the works
 - b. An explanation of equipment fault messages
 - c. Procedures for fault finding
 - d. Emergency procedures, including telephone numbers for emergency services

Spare Parts Schedule

- A. The following shall be included:
 - a. The recommended spare parts list for all services is to be submitted prior to handover.

Tools

- A. The following shall be included:
 - a. Provide a list of essential maintenance tools and any specialist tools or equipment that should be stored on site
 - b. A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and that may involve extended deliveries when replacements are required at some future date
 - c. A list of any special tools needed for maintenance cross-referenced to the relevant item

Software

- A. The following shall be included:
 - a. Two back-up copies of all software items, as commissioned
 - b. Documentation of the procedures for updating and/or modifying software operating systems and control programmes
 - c. Instructions for the creation of control procedure routines and graphic diagrams
 - d. Details of the software revision for all programmes provided

Reference Documentation

- A. The following shall be included:
 - a. Copies of relevant HSE, CIBSE, IEE, BSRIA, etc. guidance documents
 - b. Relevant health and safety information including CDM regulation information and any COSHH certificates
 - c. Contractual and legal information including, but not limited to, the following:
 - d. Details of local and public authority consents
 - e. Details of design team, consultants, installers
 - f. Start date for installation
 - g. Date of practical completion

- h. Expiry date for the defects liability period
- i. Details of warranties for plant and systems including expiry dates, addresses and telephone numbers

Appendix D: Responsibilities Under Contractor Design

- A. The following elements require some Contractor Design. For all these packages, the contractor shall complete the system design of the systems and manufacture, supply, install, test and commission in accordance with this specification.

Package	Element is by the contractor	Details/design information required
	Brackets, Supports and Fixings	
	Buildersworks	
	Controls and Building BEMS including control / ELV cable selection	
	Final circuit configuration and earthing	

- B. Where the Contractor / Sub-Contractor / Specialist Contractor has a design responsibility, they shall:
- Comply with the obligations as designers under the Safety, Health and Welfare at Work (Construction) Regulations.
 - Be responsible to the Employer for the following:
 - Completion of design and detailing of the work
 - Production of detailed and complete production information including, as appropriate, fabrication/installation drawings, design calculations, specifications, etc.
 - Provide drawings and other information as specified showing such details of the work as the ER may reasonably require
 - Liaise with the ER, planning supervisor and others, as necessary, to help ensure co-ordination of the work with other related building elements and services based on the drawings, this specification and other information provided.
 - Request additional information as necessary from the ER and provide information as necessary in time to meet the programme.
 - Submit sufficient copies of the design/production information to the ER for comment, make any necessary amendments and re-submit for further comment unless the ER confirms that this is not necessary.
- C. Review by the ER shall not relieve any responsibility for the suitability and correctness of the designs and obligations.
- D. Incorporate any comments and make any necessary amendments without delay, re-submit for further checking and comment, and incorporate any necessary amendments unless and until it is confirmed that re-submission is not required.
- E. Note: If submitted design/production information differs from the requirements of the contract documents, each difference shall be the subject of a request for substitution of variation supported by all relevant information.
- F. Note: If any amendment by the ER is considered to involve a variation and has not been acknowledged as one by the ER, notify the ER without delay and within one week. Do not proceed with ordering, fabrication or fixing until instructed by the ER.
- G. Note: Claims for the additional expense of such work may not be allowed if they are made after the work has been carried out.

Appendix E: Completion and Documentation Checklist

Completion of Mechanical Services

- A. Activities specific to completion of mechanical services include:
 - a. Commissioning of mechanical control systems
 - b. Commissioning of electrical systems
 - c. Commissioning of mechanical systems
 - d. Submission of operation and maintenance (O&M) manuals for approval
 - e. Submission of record drawings for approval
 - f. Function testing and demonstration of all mechanical services systems and controls to the ER and commissioning engineer
 - g. Employer tuition and demonstration of mechanical services systems, including controls
 - h. Clearance certificates after removal of hazardous materials, e.g. asbestos (if appropriate)
 - i. Labelling of all equipment, valves, pipework, ductwork, etc.
 - j. Labelling of all panels, cables and equipment
- B. All of the above activities must be completed, accepted and documented prior to practical completion.

Check List of Required Documentation for Mechanical Services

- A. Required documentation for mechanical services includes:
 - a. Approved operating and maintenance (O&M) manuals
 - b. Approved record drawings
 - c. Commissioning data sheets for all systems
 - d. Clearance certificates for clearance of hazardous materials (where appropriate)

Completion of Electrical Services

- A. Activities specific to completion of electrical services:
 - a. Inspection and testing of electrical installation in accordance with the requirements of the National Rules for Electrical Installations IS 10101:2020, BS 7671: Requirements for electrical installations, IEE Wiring Regulations (as amended), including the following:
 - b. Continuity of protective conductors
 - c. Continuity of ring final circuit conductors
 - d. Insulation resistance
 - e. Site applied insulation (where applicable)
 - f. Protection by separation of circuits
 - g. Protection against contact by a barrier or enclosure provided during erection
 - h. Insulation of non-conducting floors and walls (where applicable)
 - i. Verification of polarity
 - j. Earth fault loop impedance
 - k. Earth electrode resistance
 - l. Operation of residual current operated devices

- m. Provision of all associated testing and signed completion certificates
- n. Completion of all distribution boards with blanking plates on unused ways
- o. Distribution board breaker identification
- p. Completion of all mains and supplementary earth bonding works
- q. Labelling of distribution boards, isolators, equipment, etc.
- r. Submission of electrical operating and maintenance (O&M) manuals
- s. Submission of electrical record drawings
- t. Function testing and demonstration of all electrical services systems to the ER and commissioning engineer

Check List of Required Documentation for Electrical Services

- A. Required documentation for electrical services includes:
 - a. Approved operating and maintenance (O&M) manuals
 - b. Approved electrical record drawings
 - c. National Rules for Electrical Installations IS 10101:2020 standard certificates of testing and completion of electrical systems
 - d. Results of earth loop impedance tests carried out as part of earth and supplementary bonding rationalisation process

Appendix H: Schedule of Alternative Equipment and Materials

- A. Where the specification permits, submit a schedule of alternative manufacturers, suppliers and / or installers with the tender return. If the contractor has no alternatives, state "None" with the tender return here.
- B. Complete the following is a List of Manufacturers / Suppliers, together with brand names etc. for materials to be used in the Works to comply with the Drawings and Specifications.
- C. Supply only:

Item Ref.	Materials / Equipment	Manufacturer / Supplier	Specific Model / Catalogue References
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Appendix I: Schedule of Sub-contract Works

- A. Where the specification permits, submit a schedule of sub-contracted works otherwise state "None" with the tender return here.
- B. Confirm that No Other Work will be Sub-Let except that as listed in the schedule below.
- C. Supply and fix:

Item Ref.	Specialist System / Trade	Sub-contracted To
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Appendix J: Schedule of Information Required

- A. Submit a schedule of information required with the tender return otherwise state "None" with the tender return here.

Item Ref.	Service / System	Information Required
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		