



61413/NMRN Portsmouth Historic Dockyard – HMS Warrior Rewire

Electrical Rewire Specification

Volume 1 – General

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Volume 1 – General

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0	Stage 3	August 2022	Gary Wedlake	Lee Manser

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1 Particular Conditions For MEP Services Sub-Contracts

1.1 Scope

These Conditions shall apply where the Contract Works (hereinafter defined) are executed by a Contractor. They are without prejudice to and shall not take precedence over or vary the terms of any Contract or into which the Tenderer may enter or by which he may be bound relating to the Sub-Contract Works or any part of them. This is a 2 stage design and build contract. Refer to the ITT documentation for details.

Refer to all Pre-Construction Information issued with the tender documentation. All works shall be in accordance with the PCI requirements.

This specification shall be read in conjunction with preliminary documents issued by the Client. These documents will amplify programme requirements. The project is the complete electrical rewire and replacement of electrical equipment on HMS Warrior scheduled ancient monument on the National Register of Historic Vessels. The proposal is to close the vessel to visitors from 3rd January 2023 until 31st March 2023 for the works with visitor access at weekends only (upper deck only). Refer to NMRN prelims for full details.

1.2 Definitions

For the purpose of these Conditions:

- a) The “Employer” (under the Main-Contract) means the National Museum of the Royal Navy (NMRN);
- b) The “Contractor” means the Contractor with whom the Employer has signed a Contract;
- c) The “Contract” means the Contract signed between the Employer and the Contractor;
- d) The “Consulting Engineer/s” means chapman&sp;
- e) The “Project Manager” means National Museum of the Royal Navy Operations;
- f) The “Contract Works” or “Works” means the design, supply and installation, commissioning, final completion and handing over in good working order, of the installations;
- g) The “Specification” means the document issued herewith, together with any further general or detailed specifications or instructions issued as the Works proceed;
- h) The “Tender Documents” include the Specification, NMRN Data Protection Notice, NMRN Invitation to Tender, NMRN Terms and Conditions of Contract and any other documents referred to. All works shall be subject to agreement with Historic England;
- i) The Contractor’s proposal and “Installation Drawings” means the drawings prepared by the Contractor showing the Contractor’s detailed proposal for the execution of the Contract Work in accordance with the Terms and Conditions of the Contract;
- j) “Builder’s Work Drawings” means the drawings prepared by the Contractor to show all builder’s work requirements necessary to facilitate the proper execution of the Contract Works in accordance with the Terms and Conditions of the Contract. All drawings shall be sufficient to issue to Historic England for approval purposes and shall include sufficient detail to fully describe the works;
- k) “Statutory Requirements” means any law, regulation, decree, rule, code of practice or any other enactment having the force of law relating to the design and construction of buildings including but not limited to any law, regulation, decree, rule or any other enactment implemented to uphold the standards of public safety, health and construction.

1.3 Tenders Contract

Tenders are invited for the Contract Work. The Electrical Specification Volumes 1 and 2B shall be read in conjunction with NMRN Data Protection Privacy Notice, NMRN Invitation to Tender, NMRN Terms and Conditions of Contract and any other documents issued by National Museum of the Royal Navy with the tender.

1.4 Tendering

- a) The Specification is to be read together with all other Tender documentation and the Tenderer must, to the extent that can reasonably be ascertained or inferred from the Tender Documents, include anything not specifically stated therein but necessary for the satisfactory completion of the Contract Work. Any omissions or discrepancies from or in the Tender Documents shall be notified to the Consulting Engineers before the date for the submission of the Tenders and the Consulting Engineers shall resolve the matter(s) and notify all Tenderers.
- b) Alteration or qualification of the Tender may lead to disqualification of the Tenderer but the Tenderer may submit a separate explanatory document.
- c) No undertaking is given that the lowest or any Tender will be accepted and no payment will be made for the preparation of Tenders.

1.5 Details Of Tender

- a) The Tender shall be in the form of a lump sum and shall remain open for a period of 120 days from the date of tender.
- b) The Tender sum shall include any Customs and Import Duties.

1.6 Sub-Letting

Where the Tenderer proposes to sub-let portions of the Contract Work, he shall specify those portions and name the firms to whom he proposes to sub-let the same at the time of Tender.

1.7 Inspection Of Site

In amplification of the information in the Tender Documents, the Tenderer shall be deemed to have visited the site to satisfy himself as to the local conditions, access, and the extent and character of the Contract Work. No subsequent claim on the grounds of want of such inspection and visit will be entertained. The Contractor shall fully ascertain the full scope of the works by site visits during the tender period and shall make full allowance for such within the tender submitted.

1.8 Valuation Of Variations And Additional Works

- a) The Tenderer shall submit with his Tender a completed Schedule of Rates.
- b) Such Schedule shall include rates necessary for the proper valuation of variations and shall subsequently be used for that purpose.

1.9 Makes/Types Of Equipment

- a) Manufacturers' names/plant and equipment model numbers are included in specification.

The Tenderer shall include in his Tender for plant and equipment items supplied by the named manufacturers and include relevant details in the Technical Schedules.

Where the Tenderer quotes for a specific piece of equipment or apparatus supplied by a manufacturer named herein he shall guarantee the same as being free from defect in materials and workmanship and undertakes to inform the Consulting Engineer forthwith in writing if, in his view, the design of the equipment or apparatus is inadequate or unsuitable for use in the Contract Work.

- b) The Tender sum shall be based on the equipment and manufacturers detailed within this specification. The Tenderer may, at the time of Tendering, quote separately for makes/types of plant and equipment as alternatives to those named, provided such makes/types are of equivalent standard to those named and fulfil the requirements of the Specification.

In submitting alternative proposals, the Tenderer will be deemed to have allowed in his Tender for any consequential changes in electrical work, access, etc., occasioned thereby. Any change to other Contracts that are necessitated by Tenderer's selection of equipment which are not identified by the Tenderer in his Tender will be the Tenderer's financial responsibility.

The acceptance of alternatives will not relieve the Tenderer of his responsibilities in connection with the proper completion of the Contract Work.

The Employer shall retain the right for any cost savings resulting from alternatives to the named makes/types of equipment.

- c) The Tenderer shall be deemed to have obtained full particulars of all items of plant, equipment, etc., included in his Tender and to guarantee their satisfactory performance under specified extreme and all reasonable working conditions likely to be encountered.

1.10 Materials And Workmanship

- a) All materials supplied and work carried out shall be the best of their respective kinds and in accordance with the Specification and the terms of the Contract. Approval by the Consulting Engineer shall not release the Contractor from his obligations to comply with conditions of the Contract.
- b) All such materials and work shall comply with all Statutory Requirements, British Standards (where and if appropriate) and relevant International Codes of Practice (current editions) where available or such other alternative standards as detailed or specified in the Tender Documents.
- c) All external plant and equipment and their finishes shall be selected to suit the environmental conditions.
- d) No substitution for specified or approved materials will be permitted except in accordance with the terms of the Contract. The Contractor may at any time offer alternatives for approval that will realise a cost saving for the Employer.
- e) Where, in the opinion of the Contractor, any makes/types of materials or goods to be used in the Contract Work are not so suitable, he shall forthwith so inform the Consulting Engineer in writing.
- f) Materials and components shall be handled on site in such a manner as to avoid any damage or contamination. Manufacturers' handling and storage recommendations shall be adhered to.
- g) All items shall be stored clear of the ground, under cover, and protected in such a manner as to preserve their quality and condition to the standards required by the Specification.
- h) Storage facilities for materials, plant and equipment intended for internal use shall provide adequate protection. Protective delivery wrapping shall remain intact until materials and equipment are in a protected internal environment. Any materials not so protected may be rejected.

1.11 Deleterious Materials

The Contractor shall ensure that all materials incorporated in the Works shall comply with all National and Local Statutory Requirements.

The Contractor shall ensure that the materials and substances listed below and any other substances which are generally known to be hazardous to health are not under any circumstances incorporated into the Works:

- a) Substances publicised in the Building Research Establishment (BRE) Digests as being deleterious, to the durability of building's or parts thereof, or to the health and safety of individuals in the particular services in which they are used.
- b) Goods' materials and practices which (as a minimum standard) are not in accordance with relevant British Standards and Codes of Practice (or European equivalent standards).
- c) Goods, substances and materials which do not accord with the guidance contained in the publication Good Practice in the Selection of Construction Materials (Ove Arup & Partners).
- d) High alumina cement or concrete.
- e) Wood wool slab in permanent formwork to concrete or in structural elements.
- f) Calcium chloride in admixtures for use in reinforced concrete.
- g) Asbestos or asbestos containing products.
- h) Aggregates for use in reinforced concrete which does not comply with the requirements of BS EN 12620 and aggregates for use in concrete which do not comply with the provisions of BS EN 1992-1-1.
- i) Lead, lead paint or any other products 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 Requirements.
- j) Urea formaldehyde foam or materials which may release formaldehyde in quantities which may be hazardous with reference to the limits set from time to time by the relevant authorities within the United Arab Emirates with responsibility to ensure compliance with all applicable health and safety requirements.
- k) Silicate bricks or tiles.
- l) Vermiculite unless it is established as being fibre-free.
- m) Any of the products containing cadmium that are referred to in the Environmental Protection (Controls on Injurious Substances) (No. 2) Regulation.
- n) Any timber treated with pentachlorophenol.
- o) Insulation or products in which CFCs or HCFC refrigerants are used in their manufacture or application.
- p) Timber which is not obtained from a managed and regulated sustainable source.
- q) Slip bricks.
- r) Lightweight or air-entrained concrete blocks.
- s) Sand and gravels for use in cement based products from a source not certified as lignite free.
- t) Materials which are generally comprised of mineral fibres, either manmade or naturally occurring, which have a diameter of 3 microns or less, and a length of 200 microns or less or which contain any fibres not sealed or otherwise stabilised to ensure that fibre migration is prevented.
- u) Materials that emit Radon gas.
- v) Halon.

Additionally, the Contractor's attention is drawn to the requirement to reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

All adhesives and sealants used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) shall comply with the requirements of the following limits on Volatile Organic Compounds (VOC).

Speciality Applications	VOC Limit (G/L Less Water)
PVC Welding	510
CPVC Welding	490
ABS Welding	325
Plastic Cement Welding	250
Adhesive Primer for Plastic	550
Contact Adhesive	80
Special Purpose Contact Adhesive	250
Multipurpose Construction Adhesives	70

Sealant Primers	VOC Limit (G/L Less Water)
Architectural Non Porous	250
Architectural Porous	775
Other	750

Aerosol Adhesives	VOC Weight (G/L Less Water)
General purpose mist spray	65% VOCs by weight
General purpose web spray	55% VOCs by weight
Special purpose aerosol adhesives	70% VOCs by weight

1.12 Rejection Of Unsuitable Materials, Etc.

Subject to the terms of the Contract, any plant, materials, etc., and workmanship not complying with the Specification or the terms of the Contract which are in any way unsuitable may be rejected; and any faulty plant, materials or workmanship may be ordered to be replaced without extra cost to the Main-Contractor.

1.13 Statutory Requirements And Regulations

- a) The Contractor shall comply with all Statutory Requirements and with all local and national regulations and requirements etc. and shall be responsible for giving notice to the various Authorities and for payment of the relevant fees. Connection charges only will be reimbursed through the Contract.
- b) If the Contractor shall find any divergence between such Statutory Requirements or regulations and any of the Contract Documents, the Specification, these conditions or any Variation Instruction, he shall immediately give the Consulting Engineer written notice specifying the divergence(s).

1.14 Contractor Design

1.14.1 General

This Specification at the time of Tender, defines the technical performance requirements for the Electrical Rewire.

The Contractor shall be responsible for the full design of the Contract Works fully in accordance with the requirements of the Specification and ascertaining the full scope of the works during site visit.

The design shall be inclusive of, but not limited to, the following:

- a) Full design and co-ordination of the Electrical Rewire Contract Works;
- b) Selection of plant, equipment, components and materials to meet the specified requirements and performance or adjusted performance as determined by the Contractor's design;
- c) Checking of dimensions on site and preparation of Contractor's Proposal, Builder's Work, Installation and Fabrication Drawings and Details;
- d) Additional steelwork, brackets, hangers, anchors, clips, etc., for supporting all items forming the Installations and systems from the permitted fixings to the building structure including loads imposed on the structure. Only clamp type fixings to existing vessel steelwork will be permitted;
- e) Builder's work requirements including making good throughout, fire stopping including cable, duct and pipe sleeves, fire damper mounting frames, MEP equipment bases and fire stopping between sleeve and service and sleeve and structure;
- f) Weatherproofing to all services elements penetrating the external building fabric;
- g) Making all necessary applications and submissions to Utility Companies, the City Authorities, Fire Service, Insurers and obtaining written permits, consents and approvals;
- h) Fire stopping;
- i) Temporary works, facilities and provisions required during construction, commissioning and testing necessary to progress the Works in accordance with the construction programme and to meet the specified requirements;
- j) Design of test rigs and provision of instrumentation, as necessary, to carry out the specified commissioning and testing;
- k) Calculating cable types and sizes against electrical loads, locations and requirements of items selected for incorporation into the Works (including all volt drop calculations, short circuit calculations, cable sizing, containment sizing and final routing). Lighting design calculations;
- l) Sizing of containment systems;
- n) Full lighting design calculations.

The Contractors design shall take full account of the listed status of HMS Warrior which is a historic monument.

The Contractor shall retain responsibility for any design or selection activity passed on to specialist Sub-Contractors or Suppliers.

The Contractor's responsibilities shall also include:

- Attendance at meetings as may be required;

Preparation of Method Statements covering the whole of the Contract Works inclusive of, but not limited to, design proposals in keeping with historic monument status, avoidance of damage of any kind to the historic monument, method of working, refurbishment of historic lanterns, off and on-site testing, inspection, installation, setting-to-work and testing and commissioning.

1.14.2 Not Used

1.15 Contractor's Detailed Information And Drawings

1.15.1 General

The Contractor shall prepare detailed information, Contractor's proposal drawings, Installation and Builder's Work Drawings clearly showing his proposals and requirements for the execution of the Contract Works, and submit to the Consulting Engineer for approval.

The Contractor's schedule of information to be provided shall indicate the initial submission and final distribution dates to suit the Construction Programme. In establishing the issue dates the Contractor shall make allowances, where appropriate, for examination (or re-examination) by the Consulting Engineer, incorporating relevant comments, issue for distribution and procurement of materials.

1.15.2 Examination By The Consulting Engineer

Copies of documents submitted for examination by the Consulting Engineer will be returned to the Contractor marked up with any comments and stamped to indicate the action required by the Contractor in terms of an 'A', 'B', 'C', 'D', or 'E' action as follows:

'A' Action

Shall mean the document is acceptable. The Contractor shall arrange for its final issue and execute the Works in accordance with the document. Acceptance by the Consulting Engineer shall not relieve the Contractor of the Contractor's responsibilities under the contract.

'B' Action

Shall mean the document is acceptable subject to the comments made. The Contractor shall modify the document accordingly, arrange for its final issue within 10 days and execute the Works in accordance with the modified document.

'C' Action

Shall mean the document is not acceptable for reason of the comments made. The Contractor shall modify the document accordingly and re-submit the revised document within 7 days for further examination by the Consulting Engineer prior to executing the Works.

1.15.3 Drawings

The Contractor's proposal and Installation Drawings shall be as detailed below and shall fully describe the Contractor's design proposals and be presented in PDF and DWG format in addition to hard copy.

The number of copies required for initial submission to the Consulting Engineer and for final distribution issue shall be 3 sets.

The Contractor's proposal drawings and subsequently Installation Drawings shall fully describe the works based on site dimensions and include details of the actual plant and equipment items selected for incorporation into the Contract Works.

Additional drawings shall be provided as required to fully describe the works.

Engineering services layouts, routes and details shall be properly co-ordinated between the various services installations included in the Contract Works and shall be based on site measured dimensions.

Wiring diagrams shall cover both internal diagrams for items of electrical equipment and the interconnection between the items of equipment and components. All terminals and terminations shall be referenced and cable types clearly identified.

Builder's Work Drawings shall clearly show requirements necessary for the incorporation of the engineering services plant, equipment and installations. All fire-stopping and making good shall be included and fully detailed on the drawings.

1.15.4 Method Statement

The Contractor shall provide as part of his Tender an outline method statement for the Works which shall describe the major activities and procedures to be adopted in the execution of the Works.

The outline method statement shall, as a minimum requirement, address the following activities:

- a) Preparation and issue of Builder's Work and Installation Drawings including details of consideration to listed status, no damage to vessel and method of fixings to structure.
- b) Preparation and issue of Technical Submissions.
- c) Offsite prefabrication.
- d) Protection for materials and equipment delivered to site.
- e) Method of on site working to listed historic monument.
- f) Procedures for off and on-site setting-to-work, testing and commissioning including any demonstrations required by the Client body, the Consulting Engineer, Building Control and Utilities.
- g) Methodology of refurbishment of historic lanterns.
- h) Proposals for allowing visitor access to the vessel at weekend periods and other periods to be advised by the Client.
- i) Environmental control during construction, including any proposed beneficial use of final plant, equipment and installations.
- j) Preparation and issue of as-built drawings.
- ki) Preparation and issue of Operating and Maintenance Manuals.
- lj) Quality Assurance system.
- m) Proposals shall fully account for the review of the presence of asbestos and review of the Clients asbestos register.
- n) Proposals for maintaining a fully functional fire alarm system with remote indicator at a times during the works.
- o) Proposals for providing temporary lighting throughout the vessel at all times during the works.

Following appointment, the Contractor shall submit a series of detailed method statements expanding and enhancing upon activities covered in the outline method statement.

1.15.5 Plant And Equipment Details

Where required, details of plant and equipment proposed shall be submitted in schedule form accompanied by the suppliers' certified working drawings where appropriate.

The Contractor's submissions shall be made on the Technical Schedules where provision is included to incorporate 'offered' details against 'specified' requirements.

Where this provision is not included, the Contractor shall make his submission on a prepared schedule to a format similar to the Technical Schedule provided for the appropriate equipment/item.

The Contractor's submissions shall clearly state that the plant or equipment proposed complies in all respects with the specified requirements. Where the Contractor wishes the Consulting Engineer to consider alternatives or deviations to the specification, his submission must clearly detail each and every alternative or deviation proposed.

The Contractor shall only proceed with such proposals with the written consent of the Consulting Engineer.

1.15.6 Further Submittals

The Contractor shall submit their QC documents, submittals logs and procurement logs for inspection no less than monthly.

The Contractor shall keep up to date as-built drawings and submit these to the Consulting Engineer every two weeks.

1.16 Inspection

- a) The Contractor shall be responsible for satisfying himself that all plant, equipment and materials are in conformity with the requirements of the Specification and the Contract and shall, to the extent he deems necessary, inspect all such plant, equipment and materials at the manufacturers' works. He shall also make the necessary arrangements for works inspections of such plant, equipment or materials, jointly with the Consulting Engineers, or other representatives of the Employer.
- b) The Contractor shall furnish to the Consulting Engineers copies of works test certificates in respect of all plant, equipment and materials, showing compliance with tests to British or other Standards (where available and as applicable) and with any additional test specifically called for.
- c) Prior to concealment, the Contractor shall afford the Consulting Engineer the opportunity to inspect any completed parts or sections of the Works which are to be subsequently buried or otherwise concealed by thermal or acoustic insulation, building works or finishes.
- d) Subject to c) above the Contractor shall advise the Consulting Engineer when the Works are complete (in whole or in part) and ready for final inspection.
- e) The Contractor shall be responsible for inspecting and confirming suitability of all builder's work provided by the Main-Contractor in connection with the Contract Works. This shall include, but not be limited to, excavations for buried services including bedding materials, trenches, apertures through walls and slabs, built-in components, bases for plant and supports and anchor blocks.
- f) The Contractor shall confirm Requests for Inspection with a minimum of 24 hours' notice. Additionally, the Contractor shall submit every 7 days a 'look-ahead' programme of inspections for the next 14 days.

1.17 Packing, Storage And Protection

- a) All plant, equipment, apparatus, materials and parts shall be delivered to the Site in a new condition and properly packed and reasonably protected against damage due to adverse weather or other casualties, and, so far as practicable, shall be kept in their packing cases or under protective coverings until required for use.
- b) The Contractor's store shall be kept dust free and shall be subject to random inspections by the Consulting Engineer.
- c) The Contractor shall reasonably protect, encase, etc., as may be appropriate, all plant and equipment, instruments, pipework, insulation, etc., installed by him against damage due to building operations or other causes.
- d) During the progress of the Contract Work, all open ends of pipes, ducts, conduits, etc., shall be suitably capped to prevent the ingress of foreign matter.

1.18 Contractor's Staff

- a) The Contractor shall designate senior member(s) of his office staff to be the Contractor's Representative(s). Such representative(s) shall be an experienced Engineer(s) and shall be competent and duly authorised to co-ordinate the work in the Contractor's office, between his office and site and between the Contractor and his Suppliers and Sub-Contractors; also such Engineer(s) to maintain liaison with the Consulting Engineers and other parties, to attend progress meetings and generally to represent the Contractor on all aspects of his Contract.
- b) The Contractor shall, throughout the duration of the Contract, maintain an adequate drawing office with staff, for the timely preparation of all drawings required for the Contract, including as-built drawings.

- c) Any directions or instructions given to the Contractor's Representatives, shall be deemed to have been given to the Contractor.
- d) The Contractor shall provide skilled operatives for the purposes of running the installations as required for testing and commissioning purposes, to demonstrate the operation and performance of the installations as required by the Consulting Engineer and during the period specified for the Instruction of the Employer's personnel.
- e) In the event of any site staff being of the opinion that the Consulting Engineers are unsatisfactory or misconducting themselves, the Consulting Engineers may require their immediate removal from the site and their replacement with suitable substitutes.
- f) PROVIDED that such requirement of the Consulting Engineers as aforesaid shall not be made unreasonably.
- g) The Contractor shall arrange that a full set of white prints are kept on site showing the progress of the Contract Work. Such prints must be kept up-to-date and all conduit, cable, pipe and duct runs, positions of equipment and apparatus, etc., shall be recorded on the Drawings as they are installed. These prints shall be made available for inspection by the Consulting Engineer at any time upon request.
- h) The Contractor shall co-operate with the Consulting Engineers and Employer, providing direct and free access to members of his staff and shall include in his Tender to do so.
- i) The Contractor shall issue an organisation chart for approval by the Employer and Consulting Engineer. The chart shall be updated as often as necessary to reflect changes in staff, subject to site conditions and Project Manager's Instructions. All staff movements (gains/losses) shall be reported to the Project Manager.

1.19 Setting Out Of The Works

The Contractor shall set out the Contract Work and shall be responsible for the accuracy of the same, including the positioning of all mains, plant, accessories cable containment, cables etc.

All setting out shall be approved by the Project Manager prior to the start of work.

1.20 Not Used

1.21 Setting To Work Commissioning And Testing

- a) Subject to the terms of the Contract, the Contractor shall, as soon as practicable after the installations are in a state of physical completion, set to work, commission and test the same in accordance with the requirements of the Specification. In this clause the term "the Installations" shall be read to include the complete Contract Work or any part(s) thereof, which it may be required to commission, test and/or operate as separate entities.
- b) Where appropriate and where reasonably so required, the Contractor shall arrange for the testing/ commissioning of the installations jointly with other parts of the Contract Work.
- c) The Contractor shall include for the employment of an approved independent specialist company to undertake a survey of the power spectrum 3 months after Practical Completion to assess the need for power factor correction and/or Harmonic Filtration equipment. The specialist shall provide a report detailing the power spectrum nature and make recommendations of what actions are required to bring the power spectrum into line with a power factor of 0.95 or better. The specialist shall also provide a discrimination study and report.
- d) The Contractor shall provide all necessary skilled and unskilled labour and also all necessary equipment and instruments for carrying out the commissioning and testing.
- e) The Contractor shall make complete records of the tests as carried out and when the tests have been successfully completed, he shall provide to the Consulting Engineers test records and reports in a form to be agreed.

- f) The Contractor shall give the Consulting Engineers seven days' notice of their intention to demonstrate the commissioning of the installations or any part(s) thereof. The extent of such demonstrations shall be as necessary to satisfy the Consulting Engineers that the installations have been properly commissioned in accordance with the specified requirements, achieve the design intent and confirm the Contractor's recorded test results.
- g) Commissioning shall be carried out on a phased basis to suit the forward, aft and middle working sequences and shall take account of the public access.
- h) In cases where the installations are commissioned and tested portion by portion, the Contractor shall repeat the Specified procedures in regard to each portion of the installation and shall finally demonstrate that all portions of the installations already demonstrated individually or severally, are capable of satisfactory simultaneous operation. Only one portion of the three shall be the Contractor's working area.

1.22 Results Of Tests

If the test results show that the plant and equipment is not installed and/or functioning in a satisfactory manner or achieving the specified requirements the Contractor shall notify the Consulting . The notification shall be accompanied by a clear and detailed report describing the problem and/or how the installation was commissioned to achieve the optimum performance together with investigations carried out in order to ascertain the reason why the design value(s) could not be achieved. The Consulting Engineers shall decide whether this is due to incorrect or faulty work by the Contractor and if this is the case, the Contractor shall, when called upon, carry out such proper remedial measures and/or adjustments as may be required in accordance with the terms of the Contract.

1.23 Fuel And Electricity

Refer to the Main Contract Preliminaries.

1.24 Certificate(S)

When the commissioning, testing, etc., as described above and/or specified (and which processes are referred to herein as "the test procedures") have been completed, the Consulting Engineers shall provide to the Contractor a certificate to that effect. Where separate portions of the test procedures are completed at different times, separate certificates shall be issued subject to Clause 1.21 above.

1.25 Early Beneficial Operation

- a) Tests in sections shall be carried out in accordance with the phased programme.
- b) Where such operation is carried out, the Contractor shall fully maintain the installations or portion thereof and provide emergency call-out maintenance facilities provided. The Contractor shall ensure that emergency call-out maintenance works are only handled by competent technicians within their regular employment and who are fully familiar with all aspects of the installations.

1.26 Handover

Handover of the installations shall not take place nor Practical Completion granted until the all of the following minimum requirements have been met. The Project Manager and Consulting Engineer shall have the right to reject the Contractor's request to consider Handover if any of these items are incomplete or outstanding.

- a) Installations shall be complete to the Specification and approved by the Consulting Engineer.
- b) Approved Operating and Maintenance Manuals shall be in the possession of the Employer via the Main-Contractor.
- c) Approved Record Drawings shall be in the possession of the Employer via the Contractor.
- d) The Employer and Consulting Engineers shall have had the full and correct operation of all systems demonstrated to them - "Functionality Tests".

- e) The Employer's maintenance personnel shall have received adequate training in the use of the Installations.
- f) All tests and inspections required to satisfy all Statutory Requirements and the requirements of the City Authorities, Utilities, Fire Service and the IET Regulations BS7671 shall have been carried out and the properly completed test certificates incorporated in the relevant O&M Manuals.
- g) All keys, tools and spares shall have to be handed to the Employer.

1.27 Defects Liability

- a) Subject to the terms of the Contract the Defects Notification Period for the Contract Work shall be 12 calendar months from completion.
- b) Subject to the terms of the Contract, any defects, shrinkages or other faults (hereinafter referred to as "defects, etc.") which appear in the Contract Work during the Defects Notification Period and which are due to materials or workmanship not being in accordance with the Specification or the Contract, shall be specified in a Schedule of Defects which shall be delivered to the Contractor who shall make good the same within reasonable time of his receipt of the said schedule and entirely at his own cost.
- c) The Contractor shall indemnify the Employer against any damages or injury to the building, its contents and/or occupants arising as a result of such defects, etc., which the Contractor is liable to make good under sub-clause 1.27b) hereof.

PROVIDED that the Contractor shall not be liable under this clause for making good any defects etc., which have arisen as a result of fair wear and tear, or improper operation by the Employer, nor shall the Contractor be liable to indemnify the Employer against any damage or injury arising from such contingencies.
- d) If it is necessary for the Contractor to carry out any remedial measures in accordance with this clause, the provisions hereof shall be applied to the affected portion of the Contract Work for a period of six months from the satisfactory completion of such remedial measures: or for the remainder of the Defects Liability Period (see 1.27 a)) whichever is the longer.

1.28 Operating Instructions And As-Built Drawings

- a) The Contractor shall provide complete Operating and Maintenance instructions and as-built drawings for the safe and proper operation and maintenance of the Installations.
- b) The Contractor shall prepare complete paper based operating and maintenance instructions for the Installations consistent with the requirements of this specification.
- c) The Contractor shall prepare complete electronic operating and maintenance instructions for the Installations consistent with the requirements of this specification.
- d) Operating Instructions summarising information and instructions relating to the operation of equipment and systems serving all areas, cross referenced as necessary to the overall operating principles and instructions shall be provided.
- e) Within the same period, the Contractor shall prepare and supply to the Consulting Engineers, Record Drawings of the whole of the Contract Work as installed inter-related to the Operating and Maintenance Instructions.

1.29 Patent Rights

The Contractor shall be deemed to have included in the Tender sum for any charges payable in request of any patent rights, design, Sub-mark or name, or other protected rights in connection with any plant or equipment, material or method used in the Contract Work.

PROVIDED that if compliance with any variation order involves the Contractor in the payment of any such charges, then the amount of the same shall be added to the Contract sum in accordance with the provisions of the Contract.

1.30 Samples

The Contractor shall supply samples of materials (of all specified items) and/or workmanship so as to show that the said materials and/or workmanship are in accordance with the Specification and the terms of the Contract. Where they are so in accordance, such samples subsequently to be retained as Control Samples of the standard of the workmanship or material to be supplied, and any items not so complying may forthwith be rejected and shall be replaced without cost.

1.31 Instructing Employer's Staff

The Contractor shall allow in his Tender for the full-time services of suitably qualified staff, during working hours, prior to Practical Completion, for the purpose of instructing the Employer's staff in the operation of the installations. The details and duration of the services required for final training on completion are stated in Schedule No. 6.

After Practical Completion, the Contractor shall assume responsibility for running the whole of the Contract Works for a period of fourteen days and shall provide skilled supervision during this period allowing a smooth transition of maintenance responsibility to the Employer. During this period, the Contractor shall also be responsible for lubricating and maintaining all moving parts and for ongoing instruction of the Employer's maintenance staff in the proper operation of the Installations. This instruction shall include attendance from specialist suppliers and manufacturers, as necessary.

1.32 Disposal Of Spares

In cases where Specifications call for the provision of spares for the use of the Employer, the Contractor shall, prior to Practical Completion, hand over all such spares to the Employer properly packed and labelled and accompanied by a detailed schedule thereof.

Spares shall include:

- Minimum of 1 No. or 5% of each lamp type;
- All tools and equipment supplied by equipment manufacturers;

For major plant and equipment, spare parts shall not be provided except where these are supplied as a default by the manufacturer;

The Contractor shall obtain a receipt for all spares and tools handed to the Employer.

1.33 Maintenance

The Contractor shall provide full maintenance of all their equipment and systems up to the point where approved O&M Manuals and as-built drawings are handed over to the Employer, or the project is complete, whichever is the latest. If any maintenance option is taken up, this will commence from handover of the O&M Manuals or Practical Completion, whichever is later.

The Contractor shall provide a separate price with his Tender to provide independent performance audits on a monthly basis during the Defects Notification Period. The attendance allowance shall be 12 man-days. Attendance personnel shall be familiar with the project. Rectification of any defects noted during the audits shall be carried out by the Contractor in accordance with the Defects Liability clauses of the Contract and this Specification.

The Contractor shall, on request, provide reasonable assistance to the Employer in the making of Maintenance Contracts with the manufacturers of specialised items of plant and equipment as may be required.

1.34 Software And Protocol Third Party Availability

The Contractor shall obtain an undertaking in writing from all specialist Sub-Contractors and Manufacturers of firmware and software within equipment incorporated within the Contract, that the manufacturers of those systems shall undertake, in writing, to provide a complete package of documentation and all source code software, to enable a third party to write and maintain the software should the manufacturer of the system cease to Sub, withdraw the purchased product from the open market or no longer be responsible for the maintenance of the equipment.

This should take the form of an ESCROW agreement or similar approved method of software/source code purchaser protection.

1.35 Employer's Insurance Company

The Contractor shall afford access to and fully co-operate with the Insurance Company appointed by the Employer during inspection of any plant or parts of the Contract Works.

Additionally the Contractor shall provide such information regarding the Works as may be reasonably requested by the Insurance Company including, but not necessarily limited to, details of pressure system plant, components and materials.

1.36 Software Data Logic

- a) Any Computer System as defined below to be incorporated into the Works or to be used or supplied by others in relation to the Works shall comply with BS First Document-DISC PD2000-1 and BS Second Document-DISC 2000-2 (or equivalent standard approved in writing by the Consulting Engineer) and neither the performance nor functionality of any Computer System shall be affected by dates prior to, during and/or after the year 2000 and in particular but not by way of limitation:
 - 1. No value for current date will cause any interruption in operation of the Computer System.
 - 2. Date based functionality and performance of the Computer System must behave consistently for dates prior to, during and/or after the year 2000.
 - 3. In all interfaces and data storage of the Computer System, the century in any date must be specified either explicitly or by unambiguous algorithms or inferencing rules.
 - 4. The year 2000 must be recognised as a leap year and 29 February 2000 as a valid date by the Computer System.
- b) The Contractor shall ensure all equipment containing date-logic is tested at the manufacturers'/suppliers' works by forwarding the internal clock beyond the year 2005 in accordance with British Standard First Document DISC PD2000-1 and the Second Document-DISC PD2000-2. Additionally the tests shall be repeated after installation on the site on a random basis selected by the Consulting Engineer.
- c) All tests results shall be submitted to the Consulting Engineer who reserves the right to witness any of the Works or Site tests as above.
- d) "Computer System" shall mean any computer, data processing equipment media or part thereof, or system of data storage and retrieval, or communication system, network, protocol or part thereof, or storage device, microchip, integrated circuit, real-time clock system or similar device or any computer software (including but not limited to application software, operating systems, runtime environments or compilers) firmware or microcode.

1.37 Signage And Labelling

All signage on plant and equipment labelling referred to in the Specifications shall be in English.

2 Appendices

2.1 Appendix 1.A Operating And Maintenance Manuals (Paper)

2.1.1 Minimum Requirements Of Paper Operating And Maintenance Manuals

The Contractor shall prepare Operating and Maintenance Manuals containing the technical documentation required to provide for the safe and efficient operation and maintenance engineering services.

2.1.2 Definitions

The British Standard Glossary of refrigeration, heating, ventilating and air conditioning terms in BS 5643:1984 shall be used as guidance and the basis for defining terms in the technical documentation.

The following terminology shall apply:

- a) Equipment - Any engineering plant, machine or component.
- b) System - A basic concept of equipment or appliances, connected, associated or independent so as to form complex unity.
- c) Installation - A specific system placed in position and set up for use.
- d) Contractor - The organisation made responsible for providing the correct documentation (even though the organisation employs a specialist author to supply this or to carry out associated work).
- e) Specialist Author - The person or organisation that writes, collates and presents the information and produces the final operating and maintenance manuals (this could be the Contractor but may be either an independent organisation offering this service or in-house staff of the Contractor).
- f) Employer - The purchaser of the installation or installations or their assignee.

2.1.3 General Requirements

The manuals shall be specific to items incorporated in the Contract Works only.

The manuals shall be explicit in every detail necessary for all degrees of maintenance which shall be carried out by skilled and experienced but non-specialist maintenance personnel.

The O&M Manuals shall be fully co-ordinated with and integrated into the structure of all electrical systems with respect to system operation, fault alarming and maintenance.

2.1.4 Preparation Of The Manual

The Specialist Author shall write, assemble and complete the manual in accordance with the requirement of this specification.

2.1.5 Language

All documentation shall be in English. The text of descriptive sections shall be kept concise while at the same time ensuring completeness. Full support must be given to associated graphical material. The overall aim of the document shall be to provide clarity in conjunction with brevity on a 'need to know' basis.

All dimensions and units shall be in accordance with the 'System International' (SI).

2.1.6 Style

Jargon shall be avoided. All new terms shall be defined when first introduced. Where appropriate, terminology shall accord with BS 5643.

Abbreviations shall only be used if they have been defined or their meaning is clear from the text.

The imperative mode shall be used for instructions regarding operation, maintenance, disassembly, etc.

2.1.7 Illustrations And Drawings

Illustrations, drawings and diagrams incorporated in the manual shall be easily read in conjunction with the relevant text.

2.1.8 Indexing And Cross Referencing

All manuals shall have an alphabetical index or indexes. The index should follow the text and comply with BS ISO 999.

The indexing and cross-referencing included in other parts of the manual shall be arranged to provide easy access to any required information.

2.1.9 Paper Manuals - Presentation

Manuals shall comprise loose leaf, A4 pages on good quality paper that is strong enough to stand up to heavy usage and sufficiently opaque to avoid 'show through'. The paper shall be good quality high white with a weight of at least 120g/m². Loose leaf four-ring binders shall be used for binding. These shall be constructed from PVC covered heavyweight card. Dividers between sections shall be numbered with overlapping steps and shall be from white plastic.

An information sheet shall be provided in the front of the manual stating the name and address of the installation, the name and address of the Specialist Author, the Consulting Engineer and the Contractor.

Each section of the manual shall incorporate a sheet to record as a minimum the following with respect to revisions or modifications to the plant, systems and manuals:

- Date of revision or modification
- Description of revision or modification
- Revision or modification carried out by
- Revision or modification authorized and checked by
- O&M manual updated by (with date)

2.1.10 Copyright

The Employer shall have sole copyright to the Manuals and shall be able to reproduce any part of it for his own use.

2.1.11 Errors In The Documentation

The Specialist Author shall be responsible for the correction of any errors or omissions in the documentation provided to the Employer.

2.1.12 Programme

To ensure the Operating and Maintenance Manual is available when required, the following programme shall be followed:

Draft O&M Manuals - Submitted 3 Months Before Practical Completion

- 2 Copies - Consulting Engineer (Paper and Electronic)

- 1 Copy – Project Manager (Paper and Electronic)
- 1 Copy – Commissioning Specialist (Paper and Electronic)

Finalised O&M Manuals – Submitted for approval 2 weeks before Practical Completion

- 2 Copies – Consulting Engineer (Paper and Electronic)

Approved O&M Manuals – Submitted at Practical Completion

- 2 Copies – Employer (Paper and Electronic)
- 2 Copies – Consulting Engineer (Paper and Electronic)
- 1 Copy – Project Manager (Electronic)

2.1.13 Content

The content of the manual shall cover the following:

- The purpose of the installation
- Installation records
- Description of the installation/system
- How the installation is to be used
- How to keep the installation operational
- Maintenance schedules
- How the installation may be changed
- Disposal of the installation

The following describes section by section the required minimum content of the manuals.

2.2 Appendix 1.B – Operating And Maintenance Manuals (Electronic)

2.2.1 Minimum Requirements Of Electronic Operating And Maintenance Manuals Electronic Manuals – Presentation

A complete set of O&M manuals shall be made available electronically and DVD. The electronic manuals shall be replicas of the paper manuals including all relevant manufacturers' technical literature and all as-built drawings.

The electronic manual shall have a comprehensive integral search facility linked to contents, indexes and keywords including plant names and references. Extensive use shall be made of hyperlinks within the document and for access to external information such as manufacturer's web sites.

The entire structure and format of the electronic manuals shall be agreed in advance with the Consulting Engineers.

2.2.2 Employer's Facilities Management Requirements

The Contractor shall note that FSI Concept 500 will form the backbone of the Employer's CAFM system. The Sub-Contractor is required to provide O&M and as-built drawings information to an electronic specification that enables it to be uploaded to FSI Concept 500.

2.2.3 Preparation Of The Electronic Manual

The Sub-Contractor shall be responsible for ensuring that the manual is written, compiled and completed in accordance with the requirements of this specification.

2.2.4 Language

All text shall be in English. The text of descriptive sections shall be kept concise while at the same time ensuring completeness and avoiding possible ambiguity or misunderstanding. Full support must be given to associated graphics. The overall aim of the manual shall be to provide clarity in conjunction with brevity on a 'need to know' basis.

2.2.5 Style

Jargon shall be avoided. All new terms shall be defined when first introduced. Abbreviations shall only be used if they have been defined or their meaning is clear from the text, or are in general use within the building services industry. The imperative mode shall be used for instructions regarding operation, maintenance and disassembly.

2.2.6 Illustrations And Drawings

Illustrations, drawings and diagrams incorporated in the manual shall be easily read in conjunction with the relevant text.

2.2.7 Errors In The Manual

The Contractor shall be responsible for the correction of any errors or omissions in the manual, except where these are as a result of incorrect or out of date information that has been provided to the Sub-Contractor for the purpose of producing the manual.

2.2.8 User Ability

The manual supplier shall identify, from the Employer's Facility Managers, the intended maintenance strategy for the installations and the level of technical competence and user ability of the personnel likely to be employed. The manual supplier shall identify from the Employer's Facility Managers the level of technical competence the reader is assumed to have. As a general guide, the personnel expected to use the manual will be:

- Non-technical, such as property manager or caretaker, or

- Generally technical, with broad-based maintenance skills

2.2.9 Programme

Draft and final versions of Electronic Manuals shall be produced to the same programme as for Paper Manuals described elsewhere. The first draft shall contain all the information identified in this Specification with the exception of any information not available at that time (such as commissioning / test results).

2.2.10 Manual Content

The information included in the manual shall be in accordance with section 4 of the BSRIA Guide BG 2, Computer Based Operating and Maintenance Manuals.

2.2.11 Copyright

The copyright shall pass to the Employer on Practical Completion.

2.2.12 User Training

The manual supplier/software producer/specialist author shall provide a minimum of 7.5 hours of training on the software application for up to 5 Employer representatives.

The level of training provided shall be adequate to ensure the Employer representatives are fully conversant with the application's capabilities and operating procedures. The dates and venue for the training shall be agreed with the Employer.

2.2.13 Product Support

The manual supplier / software producer / specialist author shall provide the following product support:

- Email and telephone helpdesk support

The product support will be available during the hours of 0900 to 1700 seven days per week.

2.2.14 Software Upgrades

Software upgrades shall be included in the annual software license fee.

2.2.15 Software Compatibility

The software application shall be fully compatible with Microsoft operating systems (XP and later).

2.2.16 Delivery Media

The software application shall be provided on DVD-ROM.

2.2.17 Labelling

All disks and other forms of delivery media associated with the manual shall be clearly labelled with the following:

- A heading stating "O&M Manual" and disc number if there is more than one disc
- Details of the site / buildings and systems covered by the manual
- The issue number of the manual and the date of release

In addition to the requirements detailed above, draft versions of the manual shall clearly display the word 'DRAFT'.

2.2.18 Virus Free Certification

A certificate shall be provided stating that all delivery media are free from all known computer viruses. The statement must include:

- The name and version number of the virus scanning software used
- The date and version number of virus data file(s) used, which must be the latest release at the time of the scan
- The date that the virus scan was performed and the name of the operator

2.2.19 Back-Up Copies

The manual supplier shall retain a copy of all the delivered media for at least one year after approval. If requested by the Employer during this period, the supplier will provide additional copies subject to a charge.

2.2.20 Scanning Of Information

Information that must be scanned in order to incorporate it into the manual shall meet the following requirements:

- The image size of the document being scanned shall be maintained in the scanned image.
- All scanned information shall be saved as a PDF image file.
- Scanned literature shall be in the form of a PDF original image file (or equivalent), with hidden text to enable the scanned information to be fully searchable.
- A minimum setting of 200 x 200 dpi shall be applied to all scanned information. If this resolution is found to compromise the legibility of any document or drawing, a resolution of 300 x 300 dpi shall be applied to ensure a presentable standard is maintained.
- If the information being scanned contains colour, scanner settings should be set accordingly to ensure the colour is maintained.

2.2.21 Drawing Files

All drawing files shall be provided in PDF format.

In addition drawings shall be provided in native CAD format. The CAD format shall be the latest release of AutoCAD at the time of Handover unless agreed otherwise in writing by the Consulting Engineer and shall be fully accessible to enable subsequent revisions to be made. All x-reference data shall be bound into each drawing. When a drawing standard other than BS 1192 – Collaborative production of architectural, engineering and construction information. Code of practice

2.2.22 Pdf Based Manuals

2.2.22.1 General Requirements

The manual shall comprise one or more PDF documents and shall satisfy each of the requirements detailed below:

- All fonts that are used must be embedded within the PDF file;
- The use of custom half tones, bitmap pattern fills and bitmap fonts shall be avoided;
- Bookmarks shall be provided for each item in the table of contents for the manual;
- All AutoCAD drawings and those in other formats shall be converted to a PDF image file;
- Where manuals are made up from multiple PDF documents, or make use of information contained in other PDF documents, the catalogue facility shall be used to provide a full text index;

- Manuals that are too large to be contained on a single CD shall be provided on a DVD to maintain the integrity of links within the manual;
- Manuals provided on DVD shall be in a specific DVD format agreed with the Employer;
- Any files that cannot be incorporated into the PDF document(s), but which contain information that forms part of the O&M manual, shall be fully accessible by active links in the manual. The links shall automatically open the files in their native application, or an alternative viewing application;
- Links shall be provided between topics, procedures, systems and equipment within the manual;
- The DVD containing the manual shall include the current release of Adobe Acrobat Reader software, with the ability to auto-run once the disc is inserted into a PC.

2.2.22.2 Security

The option to use an open password shall be required to open the manual.

The option to use a security password shall be required to protect the manual.

Where a security password is required, as a minimum it shall cover the following security options:

- Printing (to prevent unauthorised individuals from making a hard copy);
- Changes to the manual (to prevent unauthorised alterations to the manual content);
- Changing annotations or form fields (to prevent alterations to attached notes);
- Selecting text or graphics (to prevent cutting and pasting of words and graphics).

2.2.22.3 Front Cover

A front cover shall be provided at the start of the PDF document(s) and will have the title: Operation and Maintenance Manual. It shall also provide:

- Details of the site and buildings covered;
- A general description of the systems covered such as mechanical services;
- The issue number and date;
- Copyright details.

2.3 Not Used

2.4 Appendix 1.D – As-Built Record Drawings

The Contractor shall prepare As Fitted Record Drawings (Record Drawings) covering the whole of the Contract Works.

2.4.1 General Requirements

The Record Drawings shall be specific to items incorporated in the Works only.

The Record drawings shall accurately reflect the actual installation.

The Record Drawings shall be to the International 'A' size series and shall be capable of being clearly read when reduced to A3 size.

All drawings are to be suitable for microfilming and are to be prepared in accordance with the current edition of BS 5536.

All dimensions and units shall be in accordance with BS EN ISO 80000-1.

The drawing title block shall be fully completed and shall contain the following sections:

- Drawing Title;
- Scale;
- Sub-Contractor name and address;
- Drawing Number;
- Drawn By, Checked By and Date (of Practical Completion).

In addition, the drawings shall be clearly marked to indicate their status as “Record Drawings”.

Any significant residual health and safety risks shall be clearly identified in the notes column.

Plant and equipment shall be identified with precisely the same reference and title that is used to physically label the item and shall be consistent with the O&M manuals.

2.4.2 Drawings Required

Drawings required shall be as follows:

2.4.2.1 General Arrangements

Plans, elevations and sections as appropriate, are required for all areas incorporating a part of the Contractor’s Scope of Works. The components provided by the Contractor being clearly delineated by the use of thicker lines, shading, etc., to emphasize the subject of the Drawing.

Particular attention should be given to indicating, by dimension, the exact location of all concealed works and services.

2.4.2.2 Schematics And Circuit Diagrams

Accurate representation in schematic form of all plant items and equipment in a particular system, sub-system, plant room, electrical panel, etc., clearly showing their functional relationship to each other and the systems mode of operation.

2.4.2.3 Detailed Drawings

Detailed plans, elevations and sections are required for all areas indicating the full scope of the contract works including equipment and accessory locations, cable routes, containment routes and type etc. These should be at a scale as necessary to clearly and accurately illustrate the installation, and in any case to a scale of not less than 1:50.

2.4.2.4 Manufacturers’ Detailed Drawings

Detail Drawings of all major plant items, switchgear, internal wiring, control panels, etc. These Drawings must be specific to the equipment supplied to this Project.

2.4.2.5 Style

Abbreviations shall only be used if they have been defined or their meaning is clear from a symbols sheet or similar.

2.4.2.6 Indexing And Cross Referencing

Drawings shall be accurately cross-referred to each other.

2.4.2.7 Paper Drawings – Presentation

Record Drawings shall be Xeroxed on good quality paper strong enough to stand up to heavy usage. The paper shall be high white with a weight of at least 120g/m². Each drawing shall be neatly folded so that the title block can be easily read without unfolding. Each drawing shall then be inserted in an individual punched plastic holder and inserted in a loose leaf four-ring binder constructed from PVC covered heavyweight card. The binders shall match those used for the Operating and Maintenance Manuals.

An index shall be inserted at the front of each binder showing the full set of drawings and identifying those drawings contained in each volume where necessary.

The Contractor shall issue to the Employer one full copy of the Record Drawings on full size polyester negatives suitable for making high quality reproductions.

The Contractor shall include A4 reduced copies of all record drawings in the O&M manuals.

2.4.2.8 Electronic Drawings - Presentation

A complete set of Record Drawings shall be made available on the O&M CD/DVD in native CAD and PDF formats. The native CAD format shall be AutoCAD and the latest release at the time of Handover unless agreed otherwise in writing by the Consulting Engineer.

2.4.2.9 Copyright

The Employer shall have copyright to the Record Drawings and shall be able to reproduce any part of them for his own use.

2.4.2.10 Errors In The Documentation

The Contractor shall be responsible for the correction of any errors or omissions in the Record Drawings provided to the Employer.

2.4.2.11 Programme

To ensure the Record Drawings are available when required, the following programme shall be followed:

Draft As-Built Drawings – Submitted 2 months before Practical Completion

- 2 Copies – Consulting Engineer (Paper and Electronic)
- 1 Copy – Project Manager (Paper and Electronic)
- 1 Copy – Commissioning Specialist (Paper and Electronic)

Finalised As-Built Drawings – Submitted for approval 2 weeks before Practical Completion

- 2 Copies – Consulting Engineer (Paper and Electronic).

Approved As-Built Drawings – Submitted at Practical Completion

- 2 Copies – Employer (Paper and Electronic)
- 2 Copies – Consulting Engineer (Paper and Electronic)
- 1 Copy – Project Manager (Electronic)

2.5 Appendix 1.E – Building Log Book

2.5.1 Introduction

This Appendix is intended to provide guidelines on the minimum requirements for the Building Log Book as required by Approved Document L2, 2002.

The Approved Document requires “that the owner or occupier of the Building is provided with a manual giving detail of the installer’s plant and controls, their method of operation to ensure systems operate efficiently and what routine maintenance is required to maintain that efficiency and other details that collectively enable energy consumption to be monitored and submitted”.

The Building Log Book is required to be comprehensive in its content, whilst being targeted at and written in a manner suited to ‘non-technical’ persons, enabling the building owner or occupier to achieve the intent of the Approved Document. The Log Book should cross refer to other available Log Books.

2.5.2 Presentation

A systematic, consistent approach to the presentation of the Building Log Book is essential.

The Log Book must be specific to items incorporated in the works only.

Whether the Log Book is specified as being provided in hard or electronic format it must be comprehensively cross-referenced so as to enable any question relating to any part, plant or system to be quickly and simply addressed within the manuals.

2.5.3 Format

The format of the document will be as outlined in Appendix 1A - Minimum Requirements of Operating and Maintenance Manuals.

2.5.4 Structure And Scope

The following list is intended to:

1. Identify the major components of the Building Log Book.
2. Outline the minimum level of information to be contained within the Building Log Book.

Section 1 – Description

The document should provide a:

A detailed description of installations, their intended use in built flexibility and design philosophy including block diagrams.

Section 2 – Description Of The Installed Services Systems

The following information should be provided for each system:

General Description Of System

In clear, simple language and logical sequence, a brief outline of the purpose of each system and plant, the areas served by the plant, and its various modes and times of operation. Where there are a number of Sub-systems whose functions are interdependent then the purpose and mode of operation of each shall be described, together with its inter relationship to other Sub-systems and to the system as a whole.

To simplify the text and to identify individual machines and equipment, the description is to be supplemented by functional block diagrams cross referenced to system location diagrams and physical layout diagrams, together with schematic diagrams, drawings or photographs as appropriate, sufficient to enable all units to be physically identified.

Design Conditions

- A schedule or appropriate drawing defining the design conditions to be achieved within individual spaces or zones served by each of the installed systems.
- A schedule or appropriate diagrams or schematics outlining the design of a system and defining the anticipated conditions of water and/or air onto or leaving an item of plant or equipment against variations in external or internal conditions.

Section 3 – Operation Of The Installation

Principles For Building Operation

Instructions on how to operate the building and installed systems to achieve the specified performance and levels of energy consumption.

Information provided should address the effect of the building on plant or room response times, pre-heat times, night set back conditions, thermal flywheel effect etc.

Principles For System Operation

The following should be provided for each system:

System Performance Data

Data in summary form, stating the principal design and performance characteristics of the system including:

- Installed capacities of the installed plant (input power and output rating).
- Modes of operation and control;
- Performance capability in different operation modes (e.g. output).
- Working conditions and limitations (e.g. ambient temperature).
- Hazards and safety precautions relating to operating methods, environment and equipment.

System Operation

Information and instructions necessary for the safe and efficient operation of the system in all modes for which the system has been designed/selected. Location, with plans, is to be included for all principal control services. This to include:

Operating Principles

- Modes of operating, with related and acceptable operating ranges together with all operational limitations;
- Modes of control (e.g. hand semi-automatic, BEMS).
- Location, purpose and effect of each control available to the operator.

Operating Instructions

- Procedures and operation to enable changeover between all modes of operation and for normal and emergency shutdown, including isolation of the power supply and, where necessary, immobilisation of any plant or equipment.
- Operational and environment factors which may give rise to hazards, with appropriate safety precautions to be taken;
- Operation limits and precautions necessary to ensure safe working;
- Operational checks of system necessary to ensure safe working and in achieve the specified performance.

Emergency System Operation

Information on the areas or the services installation provided with emergency back by standby generator or battery including:

Smoke Clearance Plant

- Control systems
- Fire Alarms
- Computer Equipment

System Performance Maintenance

Details of all recommended periodic checks and tests that should be undertaken on a day to day basis ensure that the rated performance is being maintained for each Sub-system and for the system as a whole.

Section 4 – Flexibility Of The Installed Services Installations

Outline description of the inherent flexibility within the building services systems installed that are available to the building owner/occupier. This should include but not limited to the following:

1. The capability of a system or systems to handled localised variations in loads without the need for rebalancing, rezoning or more extensive alteration.
2. The implications of portioning of perimeter or internal areas on terminal unit output and control system operation etc. in single and multi-tenancy areas.
3. The availability of spare capacity on the building system for owner or tenants use, together with positions on the system where connections can be made to make use of the spare capacity. This should include resultant implications on a system including the need for system re-commissioning, any necessary modifications to the automatic control installation, prevention of dirt microbiological contamination etc.,

4. Location of zones within the building identified as “tenant riser” or “soft spots” and the requirements and implications of installing services in these zones.
5. Location of zones within the building for tenants’ plant and any restrictions in use e.g. planning constraints and load bearing capability of the structure.
6. Requirements for incorporating single tenancy or multi tenancy occupation within the building on a floor by floor or group of floor basis including the associated requirement on the automatic control system, energy metering etc.,

Section 5 - Energy Monitoring

A general description of the installed energy meters and Sub-meters identifying with the use of appropriate diagrams (as GIL64 Metering Energy Use in New Non Domestic Buildings).

Location, type and function of the installed meter:

1. What the meter is measuring
2. The purpose of the measurement
3. Instructions on the use and method of reading the meter.
4. Interfacing with the building management systems and any inter relationship on building control.
5. Instructions on using the energy meters to indicate the performance/operating efficiency of the building or tenancy compared where appropriate to suitable benchmarks.
6. Instructions for maintaining, calibrating the installed meters.

Section 6 – Test Reports

Copies of summary test reports for the building:

1. Confirming that the services equipment has been satisfactorily commissioned.
2. The results of the air permeability test on the building.

Section 7 – Disposal

Information and instructions detailing:

- Any dangers or hazards likely to arise during the disposal of specific items of plant or equipment together with necessary precautions and safety measures.

Section 8 – Health And Safety

Necessary documentation relating to the following as a minimum:

1. COSHH Requirements
2. Material Safety Data Sheets
3. Residual Risk Assessments
4. Recommendations for personnel Safety and Safety of the Building.
5. Names, addresses, telephone and fax numbers and email address of the appropriate contacts in event of:
 - Fire
 - Theft
 - Burglary
 - Gas failure/leaks

- Water failure/leaks
 - Electricity failure
6. Names, addresses, telephone and fax numbers and email addresses of an appropriate contact in event of system or plant failure e.g. automatic controls, chillers, boilers.
 7. Details of any hazard situation pertinent to the installation and precautions to be taken together with appropriate hazard location drawings.
 8. Details of the location of firefighting equipment, hydrants, hose reels, rising mains together with appropriate location drawings.
 9. Details of location of emergency isolation facilities together with an appropriate location drawings:
 - Gas main cock
 - Water main stop cock external and internal

Schedule No. 3 – Installation And Builder’s Work Drawings

The Contractor shall provide Contractor’s Proposals, Installation and Builder’s Work Drawings, diagrams, etc., in accordance with the following: see also Clause 1.15 of the Particular Conditions.

Description	Scale	Number Of Copies Of Each Drawing		
		For Each Submission	For Distribution	Type Of Copies
Floor Plans with Co-ordinated Services Layouts	1:50	Electronic Issue	Electronic Issue	Electronic
Plant Rooms, Toilet Areas, Services Void Details, etc.	1:20	Electronic Issue	Electronic Issue	Electronic
Component Details, Hangers, Supports, etc.	(a)	Electronic Issue	Electronic Issue	Electronic
Diagrammatic Arrangements, Schematics, Wiring Diagrams, etc.	NTS	Electronic Issue	Electronic Issue	Electronic
Builder’s Work Drawings.	(a)	Electronic Issue	Electronic Issue	Electronic

- a) Scale to be sufficient to indicate intent clearly.
- b) Drawings and documents shall be provided as hard copies supported by electronic files.
- c) All drawings shall be prepared on the current version of AutoCAD™ and Model format.

Schedule No. 6 – Instructing Employer’s Staff

The Contractor shall provide the full-time services of suitably qualified staff during working hours. On completion of works provide client training as follows: See also Clause 1.31 of the Particular Conditions.

Nature Of Instruction Required	Number Of Working Days
Instruction of Employer’s Staff:	
Electrical Installations:	Two
Low voltage distribution	Two
Fire alarm systems	Two
Other ELV and specialist systems	Two