Meath Heat Pump

Bundle 8

Volume A.2.3 Specification

Part 2 of 4: General Responsibilities

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www.semplemckillop.com

Belfast T +44 (0)28 9033 1700 | Monaghan T +353 (0)42 974 9570 | Liverpool T +44 (0)15 1353 7014 | London T +44 (0)20 3328 5088
E admin@semplemckillop.com info@semplemckillop.com

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A10 PROJECT PARTICULARS

110.000 THE PROJECT

Particulars of the project as a whole are given in Main Contract Preliminaries.

130.000 CONTRACT ADMINISTRATOR:

The term Contract Administrator (CA) is used throughout this specification and his duties will be carried out by:

- Building Services Engineers: Semple & McKillop Consulting Engineers
- The Employer: LMETB

170.000 CONTRACTOR:

The term Subcontractor is used throughout this specification and is deemed to be synonymous with the term Sub-trader and the like which may be used elsewhere within the Contract Documentation.

180.000 THE CONTRACT:

This document has been prepared using the Common Arrangement of Sections and this Subcontract comprises the following:

- Mechanical Services Installations
- Public Health Service Installations
- Automatic Controls Installations
- Building Management System Installations

The Engineering Services Installations covered by this Subcontract comprise:

- Mechanical Services Installations
- Public Health Service Installations
- Automatic Controls Installations
- Building Management System Installations

190.000 MAIN CONTRACTOR:

Under this project the Main Contractor shall be the Principal Contractor for the works and as such shall be fully responsible for all the works on site including but not limited to the full Health & Safety requirements, site security, site management, progress and other contractors required to complete the works.

A11 TENDER AND CONTRACT DOCUMENTS

110.000 THE TENDER DRAWINGS

The tender drawings are as listed in Part 1: Particular Mechanical Specification.

140.000 THE PRE-TENDER HEALTH AND SAFETY PLAN

Details of the Pre-tender health and safety plan are included in the Contract Preliminaries.

160.000 CONFLICT

If conflict occurs within Tender Documentation and no requests for clarification are received then it shall be deemed that the most financially onerous is included within the Tender Return.

170.000 TENDER CLARIFICATIONS

The contractor shall take note the engineer shall issue correspondences and clarifications for technical related issues up to 10 working days before tender return date. The contractor shall ensure all technical related requests are forwarded to the Engineer in writing and in advance of the aforementioned deadline. All matters received after this date will not be responded to or answered.

180.000 ADDITIONAL DETAILS:

Additional details relevant to the Subcontract

The contractor shall provide a list of contact numbers at contract commencing and update these numbers upon any immediate changes to all parties. The contact details shall be held by the main contractor.

190.000 SITE VISIT:

Before tendering, ascertain the nature of the sites, access thereto and all local conditions and restrictions likely to affect the execution of the Subcontract Works. Site visit may be made by the Subcontractor with prior agreement through the main contractor. It should be noted that should a Tenderer fail to visit the site and later claim against lack of knowledge of existing services, buildings or any other item that could have been ascertained by a site visit the claim shall not be accepted.

A13 DESCRIPTION OF THE WORKS

110.010 THE CONTRACT WORK

The overall contract works are described in the Contract Preliminaries document.

150.000A WORK BY OTHERS AND CO-ORDINATION OF TRADES

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

250.000 PLANT OPERATING CONDITIONS

Ensure all plant items are suitable for operation in the environment in which they are to be located.

Ensure all plant, motors, starters and ancillary equipment etc. are suitable for operation at full capacity under the following conditions:

- Height above sea level not exceeding 1000m.
- Air cooling at an average temperature over 24 hours not exceeding 35^{O}C dry bulb.
- Maximum conditions of 40^{O}C dry bulb and 50 per cent relative humidity.
- Supply voltage approximately sinusoidal

260.000 ROOM TERMINAL LOCATIONS

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

Agree, with CA, which terminals are subject to final positioning onsite.

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

Mounting heights indicated in tender documents are for tender purposes only. Confirm mounting heights with the CA before commencing work on site.

270.000 ELECTROMAGNETIC COMPATIBILITY

Ensure that all equipment and systems are installed to provide electromagnetic compatibility within the system and with any other systems installed in the same area. Ensure all systems and buildings are assessed for protection to, and that such protection meets the requirements of IS EN 62305.

280.000 PERFORMANCE CHARACTERISTIC DETAILS

Details of the equipment as selected for inclusion into the Works shall include information as listed in Part 5: Equipment Schedule.

290.000 SOFTWARE

Obtain on behalf of the end user all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights.

Ensure that the end user is properly registered with the software supplier for support and appropriate updating.

Ensure that application software is written in compliance with BS 7649.

A30 TENDERING & CONTRACT OBLIGATIONS

110.100 MECHANICAL SERVICES OBLIGATIONS AND RESPONSIBILITIES

Detailed installation design and final location of drain and vent points and pipework gradients.

Design of adequate provision for movement of services and systems due to thermal expansion and contraction, hydraulic pressures and building movement.

Detailed design and location of expansion anchors and guide locations including:

- Fixing details.
- Load and thrust calculations.

Calculate system water capacities and quantities of chemical additives based on the final equipment selection and co-ordinated working and installation drawings.

Design and install all necessary temporary facilities for flushing, commissioning, etc

Undertake the final sizing, selection and determination of final locations of commissioning sets including any proportioning of mains losses, etc based on the final equipment selection and co-ordinated working and installation drawings.

Final selection of system(s) pressurisation units and expansion vessels based on the final equipment selection and co-ordinated installation drawings.

Final sizing of sections of ductwork between terminal units and diffusers to ensure the specified acoustic criteria and duct velocities.

Final selection and location of control dampers, control valves, etc to achieve the specified function and to suit the characteristics of items served and final system configurations based on the final equipment selection, co-ordinated working and installation drawings. To include required access requirements.

Final design of flues to include the incorporation of the requirements of the respective manufacture, building control, environmental health officer and current legislation

Final detailing and confirmation of the location and sizes of duct connections to external louvres.

Design and selection of sound attenuation equipment to satisfy the particular performance requirements of the specification and the spatial allowances based on final equipment selection and final co-ordinated working and installation drawings.

Final selection of all anti-vibration mountings to suit the particular application of the mounts.

Undertake the redesign of the final acoustic requirements associated with approved alternative equipment or materials which subsequently varies the Works in any way whatsoever.

110.200 AUTOMATIC CONTROLS / BMS OBLIGATIONS AND RESPONSIBILITIES

Detailed design of automatic controls systems insofar as it is required to meet with the operational, functional and spatial requirements of the specification.

Check the full compatibility of the plant and equipment with the controls system and specified function.

Prepare:

- Detailed BMS point schedules.
- Wiring schematics.
- Control panel labelling details.
- Equipment schedules for the complete Works.

Design and incorporation of all interfaces (including relays or other devices or modifications to hardware and/or software).

Undertake the dimensioning and final installation details of automatic control panels to suit the detailed requirements of the agreed supplier of the controls equipment including provision of safe operating and maintenance clearances and ensuring acceptable cable entries/exits in the final location.

Agree final locations of:

- Test points.
- Control sensors.
- Detectors.
- Thermostats.

110.300 EXISTING SERVICES OBLIGATIONS AND RESPONSIBILITIES

Relating to modification to or removal of existing services as detailed in Part 1: Particular Specification:

Prepare method statement(s) for the removal of the stated existing services including:

- Risk assessments
- Permit to work
- Temporary works
- Method of removal

Prepare method statement(s) for the maintenance of existing services as required prior to commencement of works.

Maintain existing services as required during the duration of the contract including the provision of any additional work and materials necessary.

Determine and define any physical site restrictions, constraints and hazards which may affect the undertaking of visual inspections, including health and safety matters, prior to commencement of the Works.

Assess the general condition of existing services as required, based on visual inspection, indicating any faults or defects found and recommend where further specialist investigation is required. Prepare a report prior to commencement of works.

Undertake an assessment relating to the prevention and control of legionella as required.

Advise on the requirement for any urgent works or required action as a result of non-compliance and any parts of the services installation found to be potentially hazardous.

Identify special training and other requirements that should be satisfied before commencement of the Works.

110.400 COMMISSIONING OBLIGATIONS AND RESPONSIBILITIES

Undertake the testing, commissioning, regulation and setting to work of the Works.

Design all necessary facilities required for setting to work commissioning and testing of the completed installations.

Appoint an independent specialist responsible for the testing and commissioning for the following operations:

- water flow and system pressure balancing
- air flow and system pressure balancing
- boiler combustion setting
- pipework sterilisation

Ensure that the commissioning requirements are compatible with any project restraints concerning sectional handover/ phasing.

Provide a report signed, by a competent person confirming, prior to installation that all system designs can be commissioned.

Incorporate into the systems design the essential components and features necessary to enable the proper preparation and commissioning of the building services.

Prepare flushing, chemical cleaning and water treatment method statements, logic diagrams and programme prior to commencement of Works.

Establish procedures with all parties to allow the demonstration of normal, emergency, shutdown and standby mode operation of plant and systems.

See Section A32: 131.000 for additional details.

110.500 HANDOVER OBLIGATIONS AND RESPONSIBILITIES

Prepare log book(s) in accordance with the requirements of the specification and Building Regulations

Prepare operation and maintenance manuals in accordance with the specified requirements of Section A37.

Ensure that information needed for inclusion in the operating and maintenance manuals is obtained as the works progress. Identify individual sources of information.

Produce record drawings.

Modify the record drawings as the works progress so that all alterations from the installation drawings are recorded as the work proceeds

Modify and update operating details to reflect commissioning results.

Record all water, gas and electricity meters on completion of the works.

Prepare planned preventative maintenance schedules for 12 months from practical completion.

Fully operate and maintain the installations in accordance with the Employer's normal occupational requirements prior to practical completion

110.600 DEFECTS PERIOD OBLIGATIONS AND RESPONSIBLITIES

Fine tuning activities as requested by CA during defects period including:

- Assess the need for fine tuning of the Works and prepare statement.
- Prepare programme in advance and agree with CA.
- Arrange for the relevant parties to be retained and appointed to provide input to fine tuning activities.
- Planning with regard to the health and safety of occupants and such that any disturbance to them is minimised.
- Attend meetings to deal with issues arising from fine-tuning of the Works.
- Carry out visits to undertake fine tuning of the Works
- Record all plant and system settings following any fine tuning activities.

Respond to emergency call-outs regarding break-downs and malfunctioning systems from Employer or CA.

Carry out maintenance of BMS as detailed in Section A30: 480.000.

Carry out full servicing of all equipment & systems at end of defects period.

130.000 EXCLUSIONS

If the Contractor cannot tender for any part(s) of the work as defined in the tender documents, he must inform the CA as soon as possible, defining the relevant part(s) and stating the reasons for his inability to tender.

330.000 A SCHEDULE OF RATES

An unpriced schedule of rates is included with the tender documents. A fully priced copy must be submitted with the Tender.

400.000 SELECTION OF MANUFACTURERS/SUPPLIERS

Where manufacturers, suppliers or installers of products are NOT identified by name select products that comply in all respects with the specification and, as and when requested, demonstrate such compliance by completing the blank section in the relevant Equipment Schedule.

Where manufacturers, suppliers or installers of products are identified by name, or names, but reference is made to "Or approved" equivalent alternatives may be selected and shall be submitted to the CA for approval.

420.000 TECHNICAL INFORMATION

Technical information relating to the Contractor's tender must be submitted two weeks prior to execution of the Contract.

Submittal of technical information for proposed products/equipment/plant shall be in the form of a completed equipment schedule in the format found in Part 5: Equipment Schedule accompanied by supporting manufacturer's technical literature.

If the Contractor submits numerous submissions of non-compliant products/equipment/plant, consultants' costs associated with assessment of non-compliant items shall be deducted from monies due.

480.000 BMS MAINTENANCE

Perform BMS maintenance in accordance with the relevant sections of BMS Maintenance Guide, BG 4/2003, BSRIA.

Ensure that the maintenance provided covers:

- Software upgrades.
- Data backup and archiving.
- Documentation upkeep.
- Emergency call out.
- Check operation of field controllers and communication networks.
- Check control, alarm and data logging functions.
- Checking of sensors for satisfactory accuracy.
- Proper operation of actuators.
- Assessment of plant control actions and rectification of poor performance.
- Check correct operation of occupant controllers.
- That necessary upgrades/changes to maintain the required functionality of any gateways are carried out.

A31 PROVISION, CONTENT AND USE OF DOCUMENTS

120.100 INTERPRETATION OF THE TENDER DOCUMENTATION

Should there be any doubt about the precise meaning of any item for any reason whatsoever, the tenderer must inform the office of issue of the tender documents in writing in order that the correct meaning may be given.

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

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

120.200 CONTINUITY OF THE WORKS

No undertaking is given that the works will necessarily be able to proceed continuously.

No claim will be allowed for discontinuity of work due to the necessity to confirm to the contract programme.

150.000 TENDER DRAWINGS

Tender drawings means mechanical drawings listed in the Document issue sheet and the full contract tender drawings as listed in the main Contract Preliminaries.

The tender drawings show the general arrangement of the Engineering Services to be provided and the inter-relationship of the Works with work to be installed by others.

160.000 DRAWINGS

Sketch drawings, schematic drawings, detailed design drawings, co-ordination drawings, installation drawings, installation wiring diagrams, shop drawings, manufacturer's drawings, manufacturer's certified drawings, record drawings, builder's work drawings are as defined in the BSRIA TN 21/97 Appendix A.

Following the issue of Contract drawings, all drawings will be issued in electronic format and it will be the Contractor’s responsibility to produce hard copies as required. A set of full size hard copy drawings should be available on site at all times.

161.000 SKETCH DRAWINGS

Line diagrams and layouts indicating basic proposals, location of main items of plant, routes of main pipes, air ducts and cable runs in such detail as to illustrate the incorporation of the Engineering Services within the Project as a whole.

162.000 SCHEMATIC DRAWING

A line diagram describing the interconnection of components in a complex system. The main features of a schematic drawing are as follows:

- A two dimensional layout drawing with divisions to show the distribution of the system between building levels. Or an isometric style layout indicating the distribution of systems across individual floor levels. The drawing is not necessarily constructed to scale.
- Include all functional components which make up the system, i.e. plant items, pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components.
- Include symbols and line conventions in accordance with legend.
- Label the drawing with appropriate pipe, duct and cable sizes where these are not shown elsewhere.
- Identify the major components indicated on the schematic drawing so that their whereabouts in specification and on other drawings can be easily determined.
- Commissioning specification: 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.

163.000 DETAILED DESIGN DRAWING

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

- Plan layouts to a scale of at least 1:100.
- Plant areas to a scale of at least 1:50 and accompanied by cross-sections.
- The drawing will not indicate the precise position of services, but it should be feasible to install the services within the general routes indicated. It should be possible to produce co-ordination drawings or installation drawings without major re-routeing of the services.
- Represent pipework by single line layouts.
- Represent ductwork by either double or single line layouts as required to ensure that the routes indicated are feasible.
- Symbols and line conventions in accordance with legend.
- Indicate on the drawing the space available for major service routing in both horizontal and vertical planes.

164.000 CO-ORDINATION DRAWING

A drawing showing the inter-relationship of two or more engineering services and their relation to the structure and building fabric. The main features of a co-ordination drawing are as follows:

- Plan layouts to a scale of at least 1:50, accompanied by cross-sections to a scale of at least 1:20 for all congested areas.
- A spatially co-ordinated drawing, i.e. no physical clashes between the system components when installed at the scaled-off positions shown on the drawing. Provide dimensions in areas where tolerances are minimal.
- Make allowance for the service at its widest point for spaces between pipe and duct runs. Allow for insulation, standard fitting dimensions and joint widths on the drawing.
- Make allowance for those plant items specified by the designer and identified in the design specification.
- Make allowance for installation working space and space to facilitate commissioning and maintenance.
- Indicate positions of main fixing points and supports where they have significance to the structural design.
- Arrange the services so that it is possible to demonstrate a feasible sequence of installation.
- Support the drawing with individual services drawings for clarity.
- Plantroom layouts to a scale of at least 1:20, accompanied by cross-sections and elevations to a scale of at least 1:20.

165.000 INSTALLATION DRAWING:

A drawing based on the detailed drawing or co-ordination drawing with the primary purpose of defining that information needed by the tradesmen on site to install the works. The main features of installation drawings should be as follows:

- Plan layouts to a scale of at least 1:50, accompanied by cross-sections to a scale of at least 1:20 for all congested areas.
- A spatially co-ordinated drawing, i.e. no physical clashes between the system components when installed at the scaled-off positions shown on the drawing.
- Make allowance for inclusion of all supports and fixings necessary to install the works.
- Make allowance for the service at its widest point for spaces between pipe and duct runs. Allow for insulation, standard fitting dimensions and joint widths on the drawing.
- Make allowance for installation details provided from shop drawings.
- Make allowance for installation working space; space to facilitate commissioning and space to allow on-going operation and maintenance in accordance with the relevant health and safety requirements.
- Make allowance for plant and equipment including those which are chosen as alternatives to the designers specified option.
- Provide dimensions where the positioning of services is considered to be important enough not to leave to the tradesmen onsite.
- Plantroom layouts to a scale of at least 1:20, accompanied by cross-sections and elevations to a scale of at least 1:20.

166.000 INSTALLATION WIRING DIAGRAM

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

Indicate the following; maximum electrical loading for each supply cable; cable termination facilities; and cable identification and all terminal numbers.

167.000 SHOP DRAWINGS

Drawing prepared by a fabricator or supplier unique to the project. Including supplier's drawings for ductwork, pre-fabricated pipework, sprinkler systems, control and switchgear panels and associated internal wiring.

168.000 MANUFACTURER'S DRAWING

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

169.000 MANUFACTURER'S CERTIFIED DRAWING

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

170.100 RECORD & AS-INSTALLED DRAWINGS

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

- Provide a record of the locations of all the systems and components installed including pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components.
- Use a scale not less than that of the installation drawings.
- Have marked on the drawings the positions of access points for operating and maintenance purposes.
- The drawings should not be dimensioned unless the inclusion of a dimension is considered necessary for location.

171.000 BUILDER'S WORK DRAWING

Installation stage drawing to show requirements for building works necessary to facilitate the installation of the engineering services (other than where it is appropriate to mark out on site). e.g. master plan of service access hatch requirement.

183.000 PLANTROOM SCHEDULES AND SCHEMATICS

Schematic drawings of circuit layouts showing identification and duties of equipment, numbers and locations, controls and circuits.

Valve schedules in the form of printed sheets showing the number, type, location, application/service and symbol, and normal operating position of each valve.

First aid instructions for treatment of persons after electric shock.

Location of main incoming gas valve serving gas meter.

Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.

All other items required under Statutory or other regulations.

190.000 EXAMINATION OF DRAWINGS/INFORMATION

The CA will examine the propositions submitted for compliance, in principle, with the design intent. Such an examination shall not relieve the originator of such documents of his responsibilities and obligations under the contract.

310.000 DESIGN AND PRODUCTION INFORMATION

Complete the design and detailing of the work and provide complete production information (including, as appropriate, fabrication/installation drawings, design calculations, specifications, etc.) based on the drawings, this specification and other information provided, liaising with the CA, PSDP and others as necessary to help ensure co-ordination of the work with related building elements and services

Request additional information as necessary from the CA and provide information as necessary in time to meet the programme

Make any necessary amendments without delay. Unless and until it is confirmed that resubmission is not required, resubmit for further checking and comment, and incorporate any necessary amendments all as before.

Should any amendment required by the CA be considered to involve a Change Order which has not already been acknowledged as a Change Order by the CA, notify the CA without delay and in any case within 7 days, and do not proceed with ordering, fabrication, or fixing until subsequently instructed. Claims for the extra cost of such work, if made after it has been carried out, may not be allowed

Submit sufficient copies of the final design/production information to the CA for distribution to all affected parties.

311.000 PRODUCTION INFORMATION

Liaise with the CA and others as necessary to help ensure co-ordination of the work with related building elements and services.

Provide drawings and other information as specified showing such details of the work as the CA may reasonably require.

Submit to the CA for comment, make any necessary amendments and resubmit for further comment unless the CA confirms that this is not necessary.

Submit sufficient copies of final information to the CA for distribution to all affected parties.

313.000 CO-ORDINATION OF ENGINEERING SERVICES

Co-ordination of the Engineering Services Installations will be carried out as part of this contract and will include the following:

- Agree principles of co-ordination with all parties concerned.
- Incorporate details provided by others into the Co-ordination Drawings as requested by the CA.
- Provide all necessary details/drawings/schedules etc. required to enable the co-ordination drawings to be prepared by others as requested by the CA.
- Ensure the installation drawings make due allowance for all building elements, structure and other services.
- Prior to submission check and approve all drawings, schedules and any other information provided by manufacturers, nominated suppliers or specialist sub-subcontractors to ensure that all the requirements of the contract documentation have been incorporated.

320.000 DRAWN AND OTHER INFORMATION

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

Initial copies for comment

Switchgear, starter and control instrumentation panel drawings:

- 1 no. electronic copy (PDF) issued by email to CA (draft & final)
- 1 no. hardcopy located in document holder within panel
- 1 no. hardcopy incorporated into each Operating and Maintenance manual within Health & Safety File
- 1 no. electronic copy within each Operating and Maintenance Manual Cd-Rom

As-installed drawings (as fully detailed in Section A37:120.00):

- 1 no. hardcopy full-sized set incorporated into each Operating and Maintenance manual within Health & Safety File
- 1 no. electronic copy (AutoCad & PDF) within each Operating and Maintenance Manual Cd-Rom
- 1 no. electronic copy (AutoCad & PDF) issued by email to CA

Record drawings

Plant room schedules and schematics:

- 1 no. framed set for plantrooms (as fully detailed in Section A37:130.00)
- 1 no. reduced set incorporated into each Operating and Maintenance manual.
- 1 no. set in PDF format for Client's use.
- 1 no. hardcopy full-sized set incorporated into each Operating and Maintenance manual within Health & Safety File
- 1 no. electronic copy (AutoCad & PDF) within each Operating and Maintenance manual CD-Rom
- 1 no. electronic copy (AutoCad & PDF) issued by email to CA

330.000 PREPARATION OF DOCUMENTS

Prepare drawings to commonly recognised scales generally on A1 sheets and details and schedules on A4 sheets as detailed in Section A37.

340.000 SYMBOLS

Use symbols and line conventions in accordance with tender drawing legends.

350.000 DOCUMENT NUMBERING/REGISTRATION SYSTEM

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

360.000 BUILDER'S WORK INFORMATION

Confirm and amplify any information provided by the CA.

Provide Builder's Work Information, appropriate to the stage of installation, and include requirements for foundations, bases, and supporting structures for plant and equipment.

Provide fully dimensioned drawings showing both size and position of builder's work.

Mark out on site, all cut holes and chases required, any pockets cast in concrete, any inserts, any built in sleeves or similar items.

Holes may not be cut in steelwork, reinforced or precast concrete without written permission from the CA. Under no circumstances will holes be cut in pre-stressed concrete. Permitted holes in steelwork must be drilled - burning by means of welding equipment is prohibited.

380.000 MAINTENANCE INSTRUCTIONS AND GUARANTEES

Retain copies delivered with components and equipment (failing which, obtain), register with manufacturer as necessary and hand over to CA on or before Practical Completion as part of Health & Safety File.

Notify CA of telephone numbers for emergency services after Practical Completion.

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

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

A32 MANAGEMENT OF THE WORKS

120.000 CO-OPERATION

Co-operate with other trades, suppliers, local authorities and statutory undertakings in the execution of their work.

In particular, the following works carried out by others will require close and careful liaison and co-operation:

- boilerhouse wiring
- installation of field control devices
- installation of rainwater harvesting system
- installation of fitted furniture incorporating mechanical services
- installation of ceilings incorporating mechanical services

130.000 PROGRAMME/PROGRESS

Provide detailed information to assist in producing a Master Programme for the Contract Works.

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

- Ordering and installation periods.
- The completion of drawing, etc. including a minimum of 5 days working days for comment.
- Concurrent work by other trades.
- Any temporary works necessary for the completion of the engineering services installations.
- Pre-commissioning, commissioning and performance testing of the engineering services installations.
- Preparation and provision of Record Drawings and Operating and Maintenance Manuals.

Provide programme information as simple bar chart type.

Provide a separate and detailed commissioning programme for agreement with the CA. Make due allowance for the following:

- Commissioning, demonstration and instruction procedures.
- Provision of written notice before each (or series of) test, inspection, commissioning or demonstration procedures are to be carried out, not less than 2 weeks.
- Demonstration to the CA that test instruments and equipment are accurate.

131.000 COMMISSIONING PROJECT MANAGEMENT

Compile a detailed commissioning programme and confirm/agree with the main contractor.

Refer to Section A33 for further details of commissioning requirements.

Compile and submit to the PSCP the appropriate health and safety method statements and risk assessments.

Establish a means (such as checklists) of monitoring the progress of the commissioning.

Ensure that all parties involved on the commissioning process have documentation procedures for dealing with variations to contract. Ensure that a control mechanism is set up which includes documentary back-up of what has been changed, how and why.

Establish a consistent numbering system to identify work items.

Ensure the consistent use of mnemonics to identify all BMS components and devices.

Ensure regular database and configuration back-ups are made throughout all stages of the commissioning process.

Ensure attendance of all appropriate and responsible parties for interface pre-commissioning tests (interface between BMS and other plant items/systems).

140.000 ASSESSMENT AND MONITORING

Record progress of the Works weekly on a copy of the programme kept on site. Update or redraft programme without delay if any circumstances arise which affect the progress of the Works.

Mark up "As Installed" details weekly and before any work is hidden from view.

150.000 INSPECTION AND MEASUREMENT OF WORK

Provide all necessary assistance to enable CA to examine or measure the Works.

151.000 BMS WITNESSING REQUIREMENTS

The project supervisor's nominated representative will implement the following witnessing requirements. Ensure that on-site commissioning staff facilitates the witnessing process.

Ensure that the BMS hardware is installed in accordance with Section W60.

Verify any operator software and associated graphics.

Witness completely the control of any main and/or critical items of plant along with a random sample of other points.

If less than 300 points, witness all points. Between 300 and 1,000 points witness 50% (minimum of 300 to be witnessed). If more than 1,000 points witness 20% (with a minimum of 500 points witnessed).

Reserve the right to witness 100% of the points if the failure rate is greater than 5%.

Witness a sample of specific functions, eg 10% of alarms and 10% of data logging.

Witness one of several identical items of plant in detail with the others witnessed on a random basis.

Verify the system security access.

Verify that all safety-related functions perform to that specified, eg plant shutdown on fire condition.

Verify all plant restarts according to that specified after building power failure and local power failure.

Witness all power meter data-points to ensure that they match the meters.

Ensure that trend logs are used when witnessing points in order to monitor the performance of control actions.

Verify the handover of all operating manuals and system documentation.

Verify the handover of backup copies of software.

Verify the completion of any specified system operator training.

152.000 BMS - POST HANDOVER CHECKS

Ensure that the following post-handover checks are performed:

- Global level checks
- Internal air temperature.
- Relative humidity.
- Ventilation.
- Energy consumption (ensure that the pulse-input counters match the meters).

Check that each of the above meets the specified requirements.

System level checks:

- Control strategies. Check that any suspect control strategies are appropriate for the intended application. Check that the suspect control strategy has been implemented and commissioned correctly. Check that the control strategy is still appropriate for the intended use.
- Network communications. Check that all relevant field controllers communicate properly. Check for correct sharing between controllers of relevant data and correct inter-controller operation.
- Control set-points. Check that the set-points in question are correct and appropriate for the actual operating conditions.
- Control loop settings. Check that the control loop settings result in accurate and stable control. Check that all self-learnt characteristics are valid.
- Control zones. Check that the control zones are appropriate.
- Occupant controls. Check that occupant controls work correctly.
- Sub-system/component level
- Sensors. Check the accuracy and location of any suspect sensors.
- Actuators. Check that any suspect actuators operate correctly.
- Dampers and valves. Check that any suspect dampers and valves are not jammed and that they operate as intended.

160.000 COVERING-UP

Ensure no section of the Works are covered, concealed or insulated until completion of a witnessed satisfactory test.

Give notice when Works which are to be covered or concealed are ready for examination and/or measurement, not less than 5 working days.

Give notice to CA.

170.000 STATUTORY AUTHORITIES

Orders for the incoming services will be placed by the Employer or CA where previously agreed.

Liaise with the Statutory Authorities and provide any test notices required to ensure final connections are made in accordance with the requirements of the testing and commissioning programme.

180.000 TEST NOTICES

Provide all formalities in connection with Test Notices, Agreement and Application for Supply Forms etc. Ensure all documents requiring the Employer's signature are forwarded to the CA in time to meet the building programme in order for the necessary test and supply arrangements to be made. No additional payments will be made for expenses incurred due to reconnections, re-visits etc., by Supply Authorities or any other officials.

A33 QUALITY STANDARDS/CONTROL

130.000 PERSON-IN-CHARGE:

Appoint a mechanical foreman-in-charge and/or site agent to ensure constant management and supervision of the Contract Works.

Give maximum possible notice to the Contractor and CA before changing the foreman-in-charge or site agent.

140.000 DIMENSIONS

Where installations are dependent upon site dimensions ensure that these are available before proceeding with the Works.

Do not take dimensions by scaling from the drawings.

Where dimensions are indicated on drawings check these on site, as appropriate, to ensure building construction and manufacturing tolerances can be accommodated.

Do not order or manufacture equipment using dimensions indicated on the Tender drawings, specification or schedules.

160.000 SITE MODIFICATIONS

Do not make site modifications to assemblies without authorisation.

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

Ensure that modifications made comply with any type test certificate obtained for arrangement of components.

175.000 PROTECTION AND PACKAGING

All plant, equipment, materials and prefabricated elements of the works shall be properly packaged and protected against damage during delivery, storage and until fully, finally and properly installed and set to work.

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

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

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

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

All plant, equipment and materials shall be protected against ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building works and operations of others. Plug, cap or seal open ends on all ductwork, tubes, conduit, trunking and associated equipment whilst in storage, during transportations to site and where installed but left partially completed for any period over eight hours.

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

Any plant or equipment subject to incorrect storage or inadequate protection will be deemed unacceptable for incorporation into the works and new plant or equipment shall be replaced prior to handover. Damaged plant, equipment and materials or that suffering from deterioration shall be replaced prior to handover.

Install fragile items such as grilles, diffusers, light fittings, switches, valve actuators, electrical accessories, etc as near to practical completion as possible.

190.000 TEST CERTIFICATES

Where testing specific to the project is required, ensure test certificates include

- Project title.
- Details and date of test.
- Instruments used, serial numbers, calibration dates.
- Signature of those witnessing test.
- Contractor's name.
- Specific location of the item in the Works.

200.000 INSPECTION AND TESTS - ON OR OFF-SITE

Submit schedules showing those parts of the Works for which inspections and tests are required in the specifications, to substantiate conformity with the Specification and for which records are required to be maintained.

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

Where required, provide formal method statements supported by risk assessments detailing the procedures for carrying-out on site tests. Agree in advance with all parties procedures for inspections and tests including periods of notice.

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

Arrange access for personnel who require to be in attendance, to manufacturer's or other off site premises when any inspections and tests carried out.

Attendance or otherwise of the supervisory personnel during specified inspections or tests will not reduce the obligations or restrictions of the Contract.

Carry out all tests required by legislation under the direction of a competent person.

210.000 INSPECTIONS AND TEST RECORDS

Prepare a set of drawings and/or report sheets to record accurately the test and inspection information including the following:

- Plant identification, section and installation under test.
- Manufacturer's reference number.
- Date, time, duration of test, weather conditions.
- Test results with itemised readings including records of all other checks and tests.

Maintain records of all specified inspections and tests performed including third party and works test certificates.

Include in records, as appropriate, details of the element, item, batch or lot, the nature, number and date of the inspections and tests, the number and type of deficiencies found, any corrective action taken and other relevant particulars.

Maintain all records on site for inspection. On completion of the Works, include copies in the operating and maintenance manuals.

Submit copies of records within one week of request.

220.000 TESTING AND COMMISSIONING OF SERVICES

Refer to Section A32 for further commissioning requirements.

Agree with the CA a programme for pre-commissioning checks, setting to work, commissioning and performance testing, and allow for all costs incurred.

Where required, provide formal method statements supported by risk assessments detailing all commissioning procedures.

Give notice to the Contractor and CA and state any requirements for the attendance and co-operation of others.

Provide all necessary facilities to enable tests to be witnessed and inspections carried out either on site or at manufacturer's works.

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

If following test or inspection any plant or part thereof is shown to be defective or not conforming to the specification the CA will reject such defective parts by written notice, within reasonable time, indicating area of dispute.

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

Provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.

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

Complete all tests before any paint, cladding or similar materials are applied or before services are concealed.

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

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

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

Provide test equipment subject to a quality assurance procedure complying with IS EN ISO 10012.

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

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

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

Gas, fuel oil, electricity and water for testing and commissioning will be provided by the Contractor.

230.000 COMMISSIONING PROCEDURES

Observe the following requirements when commissioning the Engineering Services.

Progressive static testing will be witnessed by the CA when work is presented for testing. This will include:

- Pipeline pressure tests.
- Air Ductline Pressure Tests.
- Flow measurement tests

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

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

Pre-commissioning examination and testing to ensure that each system or item of equipment is complete, in a safe condition and all notices are displayed.

240.000 OPERATIONAL DEMONSTRATION

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

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

Run each plant for 72 hours.

Provide a log book and record all hours run.

Carry out performance testing in both summer and winter conditions.

Provide facilities to fully simulate and demonstrate all controls points.

250.000 OUTSTANDING ACCEPTANCE TESTS

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

260.000 SYSTEMS USED BEFORE PRACTICAL COMPLETION

Systems may not, without the prior written approval of the CA be used before Practical Completion. Systems to be used before practical completion for the benefit of the Contractor must have all defective consumable elements (including lamps and tubes) replaced by new not more than seven days prior to Practical Completion.

No system shall be put into use prior to handover to the employer, except for testing and commissioning, unless in accordance with the following procedure:

Following the receipt of written instructions, the Subcontractor shall operate designated parts of the Subcontract Works, provided that such operation is practicable and does not prejudice the Subcontractor's responsibilities and obligations under the Subcontract.

Following the receipt of written instructions, the Contractor shall operate designated parts of the Contract Works, provided that such operation is practicable and does not prejudice the Contractor's responsibilities and obligations under the Contract.

Additionally and with adjustment to the Subcontract sum, the Subcontractor, shall if instructed, provide:

Additionally and with adjustment to the Contract sum, the Contractor, shall if instructed, provide:

- comprehensive insurance including indirect loss for any plant being operated
- maintenance of the installation
- re-instatement of the installation to as new condition prior to handover to the Employer
- allow the defects liability period to commence on handover.

300.000 OPERATION OF SYSTEMS BEFORE THE PRODUCTION OF DRAWINGS AND/OR OPERATING AND MAINTENANCE MANUALS

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

In the event of the Subcontractor failing to provide this service satisfactorily the Employer shall be entitled to make his own arrangements and recover the full cost through the Contract.

In the event of the Contractor failing to provide this service satisfactorily the Employer shall be entitled to make his own arrangements and recover the full cost through the Contract.

310.000 INSPECTION BY EMPLOYER'S INSURANCE COMPANY

Where indicated in the Work Sections items are to 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. The installations concerned shall satisfy the Insurance Company's requirements in all respects.

Agree a programme for inspection and certification of specified equipment.

Inform the CA when equipment is to be ready for examination.

The Employer will place an order with the Insurance Company. Details and nature of the order will be provided to all interested parties.

Provide all detailed drawings etc. of the equipment to enable the Insurance Company to approve design before manufacture.

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.

No plant which is 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.

All Insurance Company charges for examination and approval of drawing, inspection of works during construction and inspection and certification of the completed work will be paid by The Employer.

A34 SECURITY/SAFETY/PROTECTION

115.010 SAFETY, HEALTH & WELFARE AT WORK REGULATIONS:

Comply with the requirements of the Safety, Health & Welfare at Work Regulations by:

- adhering to the rules of the Pre-Construction Information and Construction Phase Plan.
- adhering to the rules of the Pre-Tender Safety & Health Plan and Construction Stage Safety & Health Plan.
- reporting accidents, injuries or dangerous occurrences.
- providing appropriate input to the health and safety plan, including risk assessments, and to the health and safety file.
- providing the Contractor with information on the mechanical works which might affect the health or safety of any person.

120.000 DELIVERY

Provide an adequate and safe protection for all materials and products during transport to site.

Deliver all tubes, conduit, trunking and associated equipment with open ends effectively plugged, capped or sealed.

Deliver all ductwork, tubes, conduit, trunking and associated equipment with open ends effectively plugged, capped or sealed.

130.000 HANDLING

Offload and transport about the Works all materials and products as recommended by manufacturers.

140.000 STORAGE

Store all materials and products as recommended by manufacturers.

Provide sufficient, safe and secure storage for all materials and products.

Provide racks to prevent distortion for storage of conduits, pipes and similar materials.

Store all fittings, accessories and sundry items in clean bins or bagged and stowed in racks and maintained under suitable weatherproof cover.

151.010 PROTECTION OF CONTRACT WORKS

Provide adequate and safe protection for all materials and products after installation.

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.

Protect during erection all easily damaged materials with hardboard covers or heavy duty polythene sheet. Such items include but are not limited to:

- control panels,
- switchboards,
- distribution boards,
- heater batteries,
- finned pipework,
- gauge glasses,
- insulation
- all radiators
- valve actuators

Protect all finished items from damage and paint splashes.

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

Only install filter media when the plant items concerned are being commissioned and tested.

Cover all plant items with polythene sheeting except when being worked upon.

Cap all open ends of pipes, ducts, conduit and trunking etc except when being worked upon.

Leave plant and equipment in a ready to paint condition where specified as part of the Works or to be carried out by others.

Paint parts liable to corrosion immediately after removal of any temporary protection.

Replace material, plant or equipment where deterioration or damage has occurred prior to handover.

160.000 IDENTIFICATION

Where appropriate, ensure that materials, plant and equipment bear the brand name, serial/batch number and any other data required to identify their nature in relation to the Works.

170.000 ROTATING PLANT

Immediately prior to Practical Completion adjust, ease and lubricate moving parts as necessary to ensure easy and efficient operation.

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

Ensure that rotating plant is hand-turned periodically if temporary supplies are not available.

180.000 MAINTENANCE OF EXISTING SERVICES

Fully maintain existing services to existing premises as detailed in Part 1: Particular Specification.

Provide any additional work and materials necessary to maintain these services at all times during the duration of the Contract. Any existing services disturbed by the Works are to be reinstated fully in accordance with the standards of quality defined in the specification and to the satisfaction of the CA.

Make all connections to existing services out of normal working hours.

A35 SPECIFIC LIMITATIONS ON METHOD/SEQUENCE/TIMING

110.010 CONTRACT PRELIMINARIES:

See Contract Preliminaries for specific limitations on method/sequence/timing.

130.000 ORDERING OF MATERIALS AND PRODUCTS

Ensure that procurement details of materials are incorporated in the Contract programme.

Avoid delays by submitting details of alternative manufacturers or types of materials/products to the CA in time to comply with the agreed programme of the Works.

Order all materials/products necessary for the completion of the Works immediately after receipt of comments received and/or instructions to proceed. No delay to practical completion, or completion of any part thereof caused by delays in ordering will be accepted.

A37 OPERATION/MAINTENANCE OF THE FINISHED BUILDING

102.000 SUBMISSION OF DOCUMENTS FOR HEALTH AND SAFETY FILE:

To satisfy the provisions of the Health, Safety & Welfare 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 his operating and maintenance staff.

Provide Record Documents - being part of the Works - prior, and as a prerequisite, to Practical Completion to the satisfaction of the CA.

Prepare manuals in draft as the Works progress and make suitable arrangements where the Works are subject to Partial Possession or Sectional Completion.

Submit draft Record Documents to the CA for comment prior to commissioning.

Prepare two temporary Manuals with provisional record drawings and preliminary performance data available at commencement of commissioning to enable Employer's staff to familiarise themselves with the installation. These should be of the same format as the final Manuals with temporary insertions for items which cannot be finalised until the installations are commissioned and performance tested.

Provide the CA with copies of the final Manual 1 week prior to Practical Completion.

Prepare electrical record drawings in accordance with IS EN 61082-1.

Prepare Operating and Maintenance Manuals for heating system not requiring a trained operator in accordance with IS EN 12171.

120.000 RECORD DRAWINGS AND SCHEDULES

For inclusion in the Health & Safety File, prepare As-Installed Drawings and Schedules to a scale not less than 1:100 from the Record Drawings maintained on site as the Works progress. Endorse all such documents 'AS-INSTALLED DRAWINGS'. Where agreed with the CA certain detailed information may be provided in schedule form. Prepare electrical drawings in accordance with IS EN 61082-1.

Provide reduced scale copies for inclusion in the operating and maintenance manuals as detailed in clause A37.150.000.

Record Drawings and Schedules must include, but are not limited to:

- Location, including level if buried, of Utility Service connections, including those provided by the appropriate Authority, indicating points of origin and termination, size and material of service, pressure and/or other relevant information.
- Disposition and depth of all underground systems.

- Schematic drawings of each system indicating principal items of plant, equipment, zoning, means of isolation, etc. in sufficient detail to make it possible to comprehend the system operation and the inter-connections between various systems.
- Details of the principles of application of automatic controls and instrumentation.
- Diagrammatic dimensioned plans and sections of each system or service showing sizes and locations of all ancillaries, plant, equipment controls, test points, and means of isolation etc. including any items forming an integral part of the engineering systems provided by others (such as plenum ceilings, builders' work shafts, chimneys etc.).
- Identification of all terminals/cables etc. by size/type and duty/rating as recorded from the approved commissioning results.
- Ensure routes indicate if pipework is surface mounted, concealed in wall chase, in floor screed, cast in-situ, above false ceiling etc.
- Details to show inter-connections between the Works and equipment or systems provided by others to which wiring, pipework and connections are carried out as part of the Works.
- Location and identity of each room or space housing plant, machinery or apparatus.
- Dimensioned plans and sections at a scale of 1:20 of plantrooms, service subways, trenches, ducts and other congested areas where in the opinion of the CA smaller scale drawings cannot provide an adequate record. Indicate the location, identity, size and details of each piece of apparatus.
- Manufacturers' drawings of equipment indicating
- general arrangement and assembly of component parts which may require servicing.
- internal wiring diagrams together with sufficient physical arrangement details to locate and identify component parts.
- schedules as required to locate, reference and provide details of ratings and duty of all items incorporated into the Works together with all fixed and variable equipment settings established during commissioning.
- For each programmable control item, schedules indicating for each input and output point connected, full data in respect of that point including reference, type of input/output, connected equipment reference, set values of temperature or pressure etc., set values of start/stop/speed change times, alarm priority, control specification reference and any other such parameters as are applicable.
- Each spare input and output point including reference, type of input/output and space for future entry of appropriate parameters as listed above.
- Schedules setting out details of all initial values of user-defined variables, text statements for alarm messages etc.

130.000 PLANT ROOM AND SWITCH ROOM DRAWINGS, SCHEDULES AND SCHEMATICS

Provide good quality plant and switch room drawings, schedules and schematics.

Hang the following in each plant room and switch room, any other appropriate location or where directed by the CA:

- Schematic drawings of circuit layouts showing identification and duties of equipment, numbers and locations, controls and circuits.
- Schedules in the form of printed sheets showing the number, type, location, application/service and symbol, and normal operating position of each means of isolation.
- First aid instructions for treatment of persons after electrical shock.
- All other items required under Statutory or other regulations.
- Location of all incoming service isolating and metering facilities.
- Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
- Prepare electrical drainings in accordance with IS EN 61082-1.
- Protect surface of drawings by framing under glass or other rigid, transparent, cleanable and protective surface.

145.000 OPERATING AND MAINTENANCE MANUAL FORMAT

The operating and maintenance manuals shall be prepared in a PC based word processing software tool.

150.000 OPERATING AND MAINTENANCE MANUALS

The operating and maintenance manuals must include:

- A full description of each of the systems installed, written to ensure that the Employer's staff fully understand the scope and facilities provided.
- A description of the mode of operation of all systems including services capacity, restrictions and BMS operation as detailed in Section A37:152.000.
- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- Details of how to re-commission so that complex plant services within the building can be re-commissioned by an engineer without any historic knowledge of the systems.
- A photo-reduction of all record drawings together with an index. Reduced size A3.
- Legend of all colour-coded services.
- A photo-reduction of all record drawings as detailed in Section A37:120.000 together with an index. Reduced size [A3.
- Legend of all colour-coded services.]

- Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.
- The name, address and telephone number of the manufacturer of every item of plant and equipment together with catalogue list numbers.
- Manufacturer's technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.
- A copy of all Test Certificates, Inspection and Test Records, Commissioning and Performance Test Records (including, but not limited to, electrical circuit tests, corrosion tests, type tests, start and commissioning tests) for the installations and plant, equipment, valves, etc., used in the installations.
- A copy of all manufacturers' guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturers.
- Copies of Insurance & Inspecting Authority Certificates and Reports.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed..
- Schedules of all fixed and variable equipment settings established during commissioning.
- Procedures for seasonal change-overs and/or precautions necessary for the care of apparatus subject to seasonal disuse.
- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- Details of lubrication systems and lubrication schedules for all lubricated items.
- Details of regular tests to be carried out (e.g. water cooling towers etc.)
- Details of procedures to maintain plant in safe working conditions.
- Details of the disposal requirements for all items in the works.
- A list of normal consumable items.
- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- A list of any special tools needed for maintenance cross referenced to the particular item for which required.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.
- Back-up copies of any system software.
- Documentation of the procedures for updating and/or modifying software operating systems and control programmes.
- Instructions for the creation of control procedure routines and graphic diagrams.
- Details of the software revision for all programmes provided.
- Two back-up copies of all software items, as commissioned.
- Contractual and legal information including but not limited to details of local and public authority consents; details of design team, consultants, installation contractors and associated subcontractors; start date for installation, date of practical completion and expiry date for the defects liability period; details of warranties for plant and systems including expiry dates, addresses and telephone numbers.

152.000 BMS OPERATION AND MAINTENANCE MANUALS

Confirm that an initial draft of the O&M manual has been submitted for approval prior to commissioning. Ensure that the O&M documentation is produced as the work proceeds and is updated when necessary. Ensure that this work commences at the start of the contract and is added to/updated as the contract progresses. Confirm that approved final copies of the O&M manuals are provided at handover. Ensure that the O&M manual is properly indexed. Ensure that terminology and references are consistent with the physical identification of component parts.

Confirm that the O&M manual includes the following and is included in the site health and safety file:

- A written description of plant operation.
- Details of system application software configuration.
- A points list including hard and soft-points (all points should have a unique mnemonic)
- A description of user adjustable points.
- Commissioning record details.
- Detailed data sheets for all control components and equipment.
- Wiring circuit details including origin, route and destination of each cable.
- Basic security access to the system.
- Comprehensive instructions for switching on, operation, switching off, isolation, fault finding and procedures for dealing with emergency conditions.
- Instructions for any precautionary measures necessary.
- Instructions for the routine operation of the control system including simple day-to-day guidance for those operating the control system with limited technical skill.
- Instructions for servicing and system upkeep.
- A provision for update and modification.

Confirm that the O&M manual includes comprehensive system operating instructions.

160.000 PRESENTATION OF THE OPERATING AND MAINTENANCE MANUALS

Encase the Manuals in A4 size, plastic-covered, loose leaf, four ring binders with hard covers, each indexed, divided and appropriately cover- titled. Fold drawings larger than A4 and include in the binder so that they may be unfolded without being detached from the rings.

Include secure inner pocket(s) for storage of asscoiated CD-Roms.

170.000 RECOMMENDED SPARE PARTS

Four weeks before practical completion submit to the CA a schedule of spare parts as called for in individual sections and any others that the Contractor recommends should be obtained and kept in stock by the Employer for maintenance of the services installations included in the Contract.

State against each item the manufacturer's current price, including packaging and delivery to site. Identify those items which are additional to those specified for inclusion in individual Sections.

171.000 INITIAL SUPPLY OF ADDITIONAL SPARE PARTS

Submit to the CA a quotation, priced in detail, for the initial supply to the Employer of the additional spare parts identified under clause A37.170.000, and including for:

- Checking that each spare part is suitable for the replacement of the corresponding part supplied with the item of plant or equipment.
- Checking receipt, marking and numbering in accordance with the schedule of spare parts.
- Referencing to the plant and equipment list in the Operation and Maintenance Manual.
- Painting, greasing, etc. and packing to prevent deterioration during storage.

Time scale: Within 2 weeks of request.

180.000 RECOMMENDED TOOLS

Four weeks before practical completion submit to the CA a schedule of tools and portable instruments as called for in individual Sections and any others that the Contractor recommends should be obtained and kept in stock by the Employer for maintenance of the services installations included in the Contract.

State against each item the manufacturer's current price, including packaging and delivery to site. Identify those items which are additional to those specified for inclusion in individual Sections.

190.000 TRAINING OF EMPLOYER'S STAFF

Before practical completion explain and demonstrate the purpose, function and operation of the installations including all items and procedures listed in the Operation and Maintenance Manual to the Employer's maintenance and operational staff.

Include for not less than indicated number of operating days for this purpose and demonstrate the safe day to day running and maintenance of all systems, plant and equipment.

Provide training for the operation of the controls, monitoring or BMS installations for basic operator.

Ensure that the operator is trained to:

- Call up and view point-data from plant schematics and/or points lists.
- Acknowledge system alarms.
- View trend logs.

In addition to the requirements for a basic operator, ensure that the operator is trained to make basic alterations to the BMS including changes to:

- Time and occupancy programmes.
- Control set-points.

Ensure that the operator is also trained for testing and routine inspection of sensors and actuators.

Ensure that training is completed before the BMS is handed over.

Ensure that each trained operator signs a training acceptance certificate(s).

Provide appropriate reference and training manuals for the operator.

Include for 2 no. additional training visits, one after 2 months and one at the end of the defects period to allow training in additional detail once operator become familiar with systems.

200.000 READING OF METERS

Record readings of all water, gas, and electricity meters immediately on completion of the Works and forward to the CA.

210.000 OBLIGATIONS DURING DEFECTS LIABILITY PERIOD

Prepare and submit records of failures or malfunctions of any part of the Contract Works during the Defects Liability Period, together with details of remedial action taken, subsequent re-testing and the results.

Notify the Main Contractor of damage, failures or malfunctions to the Subcontract Works demonstrably caused by incorrect operation of the installations, vandalism or other actions by a

Notify the Contractor of damage, failures or malfunctions to the Contract Works demonstrably caused by incorrect operation of the installations, vandalism or other actions by a third party.

Inform the CA, via the Main Contractor, in writing when all defects are finally rectified so that an inspection may be carried out prior to the issue of a Final Certificate.

Inform the CA in writing when all defects are finally rectified so that an inspection may be carried out prior to the issue of a Final Certificate.