# 7.0 DETAILED CASE STUDY: KEYNSHAM CIVIC CENTRE

## 7.1 Keynsham Civic Centre

**Client:** Bath and North East Somerset Council
**Architect:** AHR
**M&E and Sustainability Consultants:** Max Fordham LLP
**Engineer:** Hydrock Group
**Contractor:** Wilmott Dixon Construction Ltd:

The headquarters for Bath and Northeast Somerset Council (B&NES) serves as an exemplar for sustainability in public buildings in the UK. It is the first building to employ the full 'Soft Landings' methodology, where the energy performance aims were not just forecast in the design but written into the contract.

The design includes natural ventilation and the use of concrete 'radiators' for thermal mass combined with a cross laminated timber structure. It also features a system for recovering heat from the IT servers to heat the building. Pipes cast in to the concrete 'radiators' allow for low energy cooling to be added as part of a future climate change strategy.

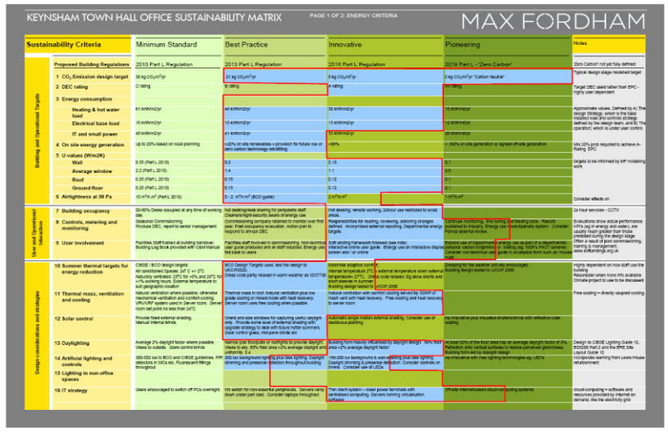
BANES Council set the challenging brief of achieving an energy-in-use DEC rating of by the end of the second year of operation. The strategy for achieving a DEC A came from our Soft Landings Champion: Max Fordham developed an Energy Risk Register based on their experience from post occupancy evaluation and research we carried out with UCL. The aim was to identify risks to achieving the DEC A target, and then consider how to mitigate the risks at each stage of the project from briefing through to building operation.

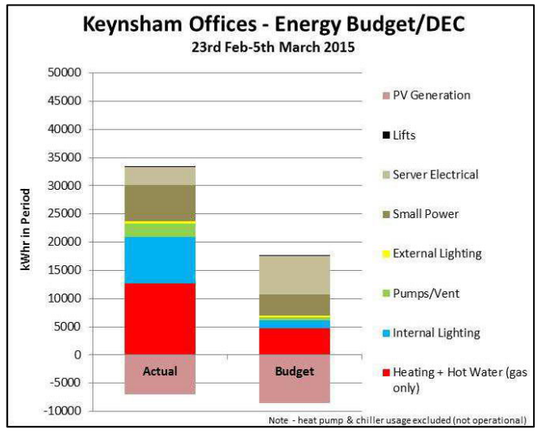
For this project, Max Fordham wrote some of the industry's first Soft Landings Employers Requirements, setting out various roles and processes that will contribute towards achieving DEC A target. These requirements have since been incorporated into BSRIAs publication 'How to Procure Soft Landings.'

**Project data:**
£35 million

**Cost per sqm**:
£29m for 8200sqm = £3500/sqm
M&E £3.5m = £426sqm

**Awards:**
Civic Trust: South West: 2016; British Council for Offices: Best of the Best: 2015
British Council for Offices: National Award: 2015; RIBA: South West Award: 2015
RIBA: South West Sustainability Award: 2015




## 7.2 Derek Quilter's presentation

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# Keynsham Regeneration Project

# Sustainability

Derek Quilter

Divisional Director: Property and Project Delivery

Bath & North East Somerset Council

# Keynsham Town Hall

## Scope of the Project

- Offices for 680 of B&NES and Partner staff
- Library and One Stop Shop
- Circa 20,000ft2 of retail
- Enhanced public realm
- Highway improvements
- Chance to provide community leadership in cutting carbon emissions

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# BREEAM or DEC

**BREEAM Assessment**

» 10 Sections within the overall assessment
» Only 1 section relates to Energy
» Of this section maximum score is 35 yet only 15 relate to CO2 reduction
» Points for Bat Boxes, Wildflower meadows, Consultation strategy etc
» Experience of Very Good rated building using more energy than Victorian Buildings

**Display Energy Certificate** (DEC)

» From the 1st January 2009, public bodies occupying buildings over 1,000m2 are required to exhibit a DEC
» The DEC is based on the **measured energy use**, where the actual energy consumed in the building is compared to a benchmark for similar buildings
» DEC "A" Rating = $CO_2$ emissions 75% less than the benchmark building
» Up to Feb 2010 only 13 out of 3,230 offices certified achieved a rating of A (0.4%)

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# Project Aims

## Sustainability Aims

- Display energy Certificates (DEC) are based upon the actual energy usage of the building and all public buildings above 1000m$^2$ require one
- Aim is a DEC “A” Rating = $CO_2$ emissions 75% less than the benchmark building
- For a general office building the benchmark $CO_2$ emissions figure is 75.1 kg$CO_2$
- DEC “A” Rating = < 18.775 kg$CO_2$

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# Sustainability Matrix

KEYNSHAM TOWN HALL OFFICE SUSTAINABILITY MATRIX

PAGE 1 OF 2: ENERGY CRITERIA

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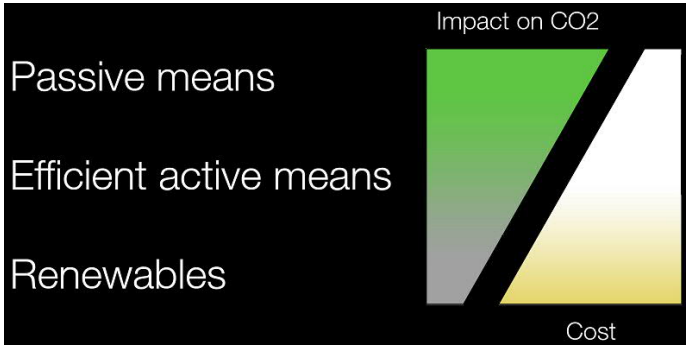
| | Sustainability Criteria | Minimum Standard | Best Practice | Innovative | Pioneering | Notes |
|---|---|---|---|---|---|---|
| Building and Operational Targets | Proposed Building Regulations | 2010 Part L Regulation | 2013 Part L Regulation | 2016 Part L Regulation | 2019 Part L - 'Zero Carbon' | Zero Carbon' not yet fully defined |
| | 1 $CO_2$ Emission design target | 30 kg $CO_2/m^2/yr$ | 21 kg $CO_2/m^2/yr$ | 8 kg $CO_2/m^2/yr$ | 0 kg $CO_2/m^2/yr$ "Carbon Neutral" | Typical design stage modelled target |
| | 2 DEC rating | C rating | B rating | A rating | A+ rating | Target DEC used rather than EPC - highly user dependent |
| | 3 Energy consumption | | | | | |
| | Heating & hot water load | 61 kWh/m2/yr | 46 kWh/m2/yr | 30 kWh/m2/yr | 15 kWh/m2/yr | Approximate values. Defined by A) The design Strategy, which is the base installed load and controls strategy defined by the design team, and B) The operation; which is under user control |
| | Electrical base load | 16 kWh/m2/yr | 15 kWh/m2/yr | 13 kWh/m2/yr | 12 kWh/m2/yr | |
| | IT and small power | 48 kWh/m2/yr | 41 kWh/m2/yr | 33 kWh/m2/yr | 26 kWh/m2/yr | |
| | 4 On site energy generation | Up to 20% based on local planning | >20% on site renewables + provision for future low or zero carbon technology retrofitting | >50% | > 100% on site generation or agreed off-site generation | Min 20% prob required to achieve A-Rating EPC |
| | 5 U-values (W/m2K) | | | | | |
| | Wall | 0.35 (Part L 2010) | 0.2 | 0.15 | 0.1 | targets to be informed by MF modelling work |
| | Average window | 2.2 (Part L 2010) | 1.4 | 1.1 | 0.8 | |
| | Roof | 0.25 (Part L 2010) | 0.15 | 0.12 | 0.1 | |
| | Ground floor | 0.25 (Part L 2010) | 0.15 | 0.12 | 0.1 | |
| | 6 Airtightness at 50 Pa | 10 $m^3/h.m^2$ (Part L 2010) | 5 - 2 $m^3/h.m^2$ (BCO guide) | 2 $m^3/h.m^2$ | 1 $m^3/h.m^2$ | Consider effects on |
| User and Operational Interaction | 7 Building occupancy | 50-80% Desks occupied at any time of working day. | hot desking/desk sharing for peripatetic staff. Cleaners/night-security aware of energy use | Hot desking, remote working, 24hour use restricted to small areas. | | 24 hour services - CCTV |
| | 8 Controls, metering and monitoring | Seasonal Commissioning. Produce DEC, report to senior management | Commissioning company retained to monitor over first year. Post occupancy evaluation. Action plan to respond to annual DEC | Responsibilities for reading, reviewing, actioning changes defined. Anonymised external reporting. Departmental energy targets | Continual monitoring, fine-tuning and feeding back. Results published to industry. Energy use rewards/penalty system. Consider Formal external review. | Evaluations show actual performance KPI's (eg in energy and water), are usually much greater than those predicted during the design stage. |
| | 9 User involvement | Facilities Staff trained at building handover. Building Log Book provided with O&M Manual | Facilities staff involved in commissioning. Non-technical user guide produced and all staff inducted. Energy use fed back to users | Soft landing framework followed (see note) Interactive online user guide. Energy use on interactive display screen and / or online | Explore use of Departmental energy use as part of a departmental / personal carbon footprinting or trading (eg. WSP's PACT scheme) Consider non-technical user guide in accessible form such as 'mouse-mats' | Often a result of poor commissioning, training & management. www.softlandings.org.uk |
| Design considerations and strategies | 10 Summer thermal targets for energy reduction | CIBSE / BCO design targets: Air conditioned Spaces: 24° C +/- 2°C Naturally ventilated: 25°C for <5% and 28°C for <1% working hours. External temperature to suit geographic location | BCO Design Targets used, test the design to UKCIP2020. Dress code partly relaxed in warm weather as ISO7730 | Maximise adaptive comfort: Internal temperature 2°C < external temperature when external temperature> 27°C, Dress code relaxed. Eg allow shorts and short sleeves in summer. Building design tested to UKCIP 2050 | Dressing for the weather actively encouraged. Building design tested to UKCIP 2050 | Highly dependent on how staff use the building Reconsider when more info available Climate project to use to be discussed |
| | 11 Thermal mass, ventilation and cooling | Natural ventilation where possible, otherwise mechanical ventilation and comfort cooling. VRV/VRF system used in Server room. Server room set point no less than 24°C | Thermal mass in roof. Natural ventilation plus low grade cooling or mixed-mode with heat recovery. Server room uses free cooling when possible | Natural ventilation with comfort cooling served by GSHP or mech vent with heat recovery. Free cooling and heat recovery to server room | | Free cooling = directly coupled cooling |
| | 12 Solar control | Provide fixed external shading. Manual internal blinds | Orient and size windows for capturing useful daylight only. Provide some level of external shading with upgrade strategy to deal with future hotter summers Solar control glass, mid-pane blinds etc | Automatic single motion external shading. Consider use of deciduous planting | As innovative plus insulated shutters/blinds with reflective outer coating | |
| | 13 Daylighting | Average 2% daylight factor where possible. Views to outside. Glare control blinds | Narrow plan floorplate or rooflights to provide daylight. Views to sky. 80% floor area >2% average daylight and uniformity 0.4 | Building form heavily influenced by daylight design. 80% floor area >2% average daylight factor | At least 80% of the floor area has an average daylight factor of 5%. Reflection onto vertical surfaces to reduce perceived gloomness. Building form led by daylight design | Design to CIBSE Lighting Guide 10, BS8206 Part 2 and the BRE Site Layout Guide 10 |
| | 14 Artificial lighting and controls | 300-500 lux to BCO and CIBSE guidelines. PIR detectors in WCs etc. Fluorescent fittings throughout | 300 lux background lighting plus task lighting. Daylight dimming and presence detection throughout building | 150-200 lux background & wall-washing plus task lighting. Daylight dimming & presence detection. Consider controls on timers. Consider use of LEDs | As innovative with new lighting technologies eg. LED's | Incorporate learning from Lewis House refurbishment |
| | 15 Lighting in non-office spaces | | | | | |
| | 16 IT strategy | Users encouraged to switch off PCs overnight. | Kill switch for non essential peripherals. Servers ramp down under part load. Consider laptops throughout | Thin client system – lower power terminals with centralised computing. Servers running virtualisation software | Off-site internet-based cloud-computing systems | cloud-computing = software and resources provided by internet on demand, like the electricity grid |

**Reducing Energy Use = Less Renewables Required**

- Use passive measures to reduce the energy consumption of the building. Improve insulation & air-tightness, utilise daylight & natural ventilation whenever possible.
- Use high efficiency, low energy systems and equipment. Variable speed pumps and fans etc. Recover waste heat off IT servers
- Finally add in renewable energy sources to offset energy use.



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# Passive Design

- Building orientation to maximise daylight and minimise solar gain
- Glazing on North and South elevation,  shading on East and West
- Building height and floor layout designed to allow fresh air to move freely essential for natural ventilation
- Airtightness and levels of insulation

**Ventilation**

- Natural ventilation avoids large fans and ductwork
- Healthier internal environment
- 50% of the energy of A/C building

**Lighting** (30% of the building energy use)

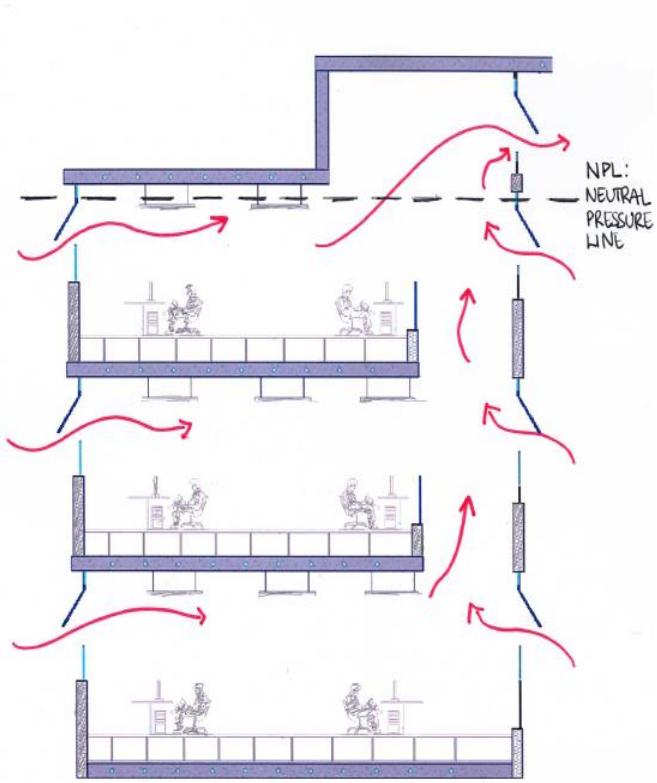
- Maximise daylight so this is adequate for 70% of normal working day
- Low energy light fittings
- Simple local control

**Heating / Cooling**

- High levels of air tightness (Use of CLT frame solution)
- High levels of insulation
- Use recovered heat from IT servers
- Building orientation, solar controlled glazing and thermal mass

## Ventilation

It is a general rule that the energy use of a naturally ventilated building should be around half that of an equivalent air-conditioned building.




Stack Vent

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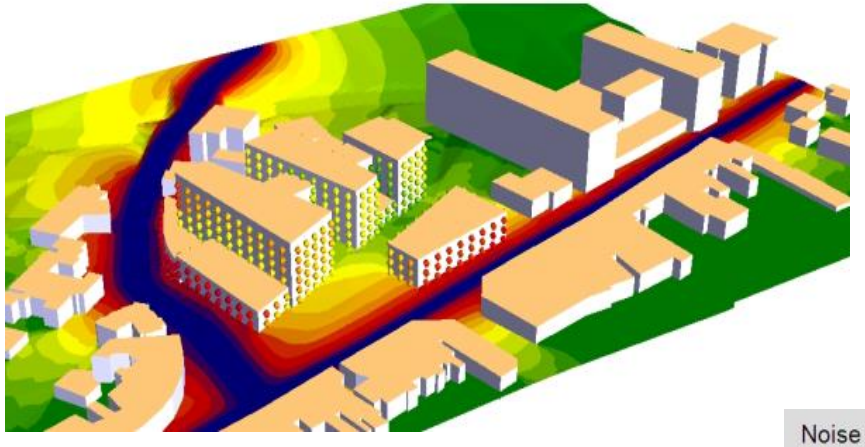
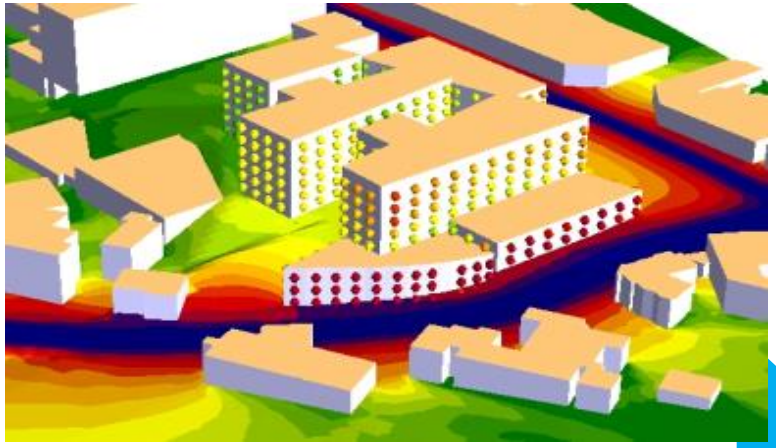
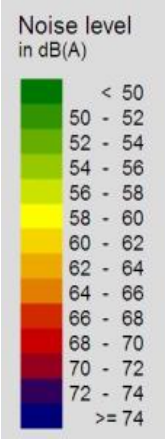
## Acoustic Issues

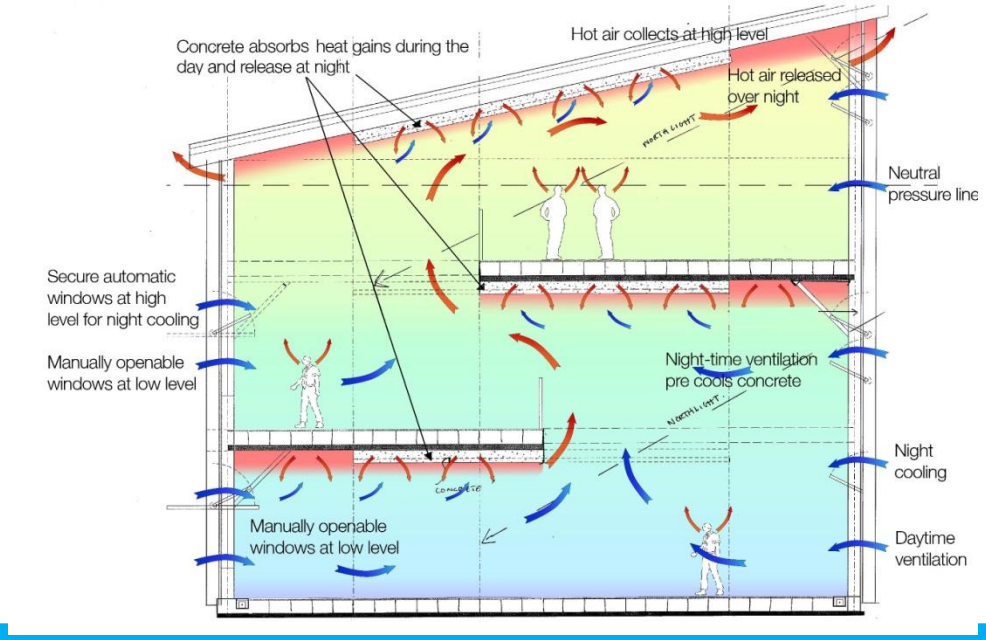
Acoustic Survey Noise Maps





**Thermal Comfort**

- Thermal mass is required to regulate the building temperature peaks.
- For the thermal mass material to absorb heat it needs to be cooler than the room air in the day and for it to release heat it needs to be hotter than the room air at night.
- Exposed concrete soffits are generally the best form of thermal mass. Heat rises and so is best absorbed at high level, the ceiling can be cooled to a lower temperature than the floor and provide more effective radiant cooling.



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**Carbon Assessment**

- Heating & HW: 38kWh/m$^2$/yr = 7.54kg$CO_2$/m$^2$
- Electrical Base load: 14kWh/m$^2$/yr = 7.23kg$CO_2$/m$^2$
- IT & Small Power: 41kWh/m$^2$/yr = 21.2kg$CO_2$/m$^2$

- Emissions excess of 17.22kg$CO_2$/m$^2$ above DEC "A" Rating.
- Total $CO_2$ savings required is 113,150 kg$CO_2$.
- Eliminating the Heating & HW load and Electrical Base Load will not provide the necessary $CO_2$ savings.
- The IT and Small Power load has to be addressed.

**ICT Strategy**

- ICT currently accounts for an estimated 59% of the building $CO_2$ emissions.
- Reducing this load is the top priority in order to achieve a DEC “A” Rating.

**Thin Client**

- Software, data, and CPU power resides on a network server rather than on the client computer. Studies have shown a 50% decrease in power consumption.
- Opportunity to recover heat from main servers to act as a heating source for the building
- Each desktop devices reduced its power consumption by 90% compared to a PC

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# PV Installation

- 750 solar panels on the main office roof
- Cover an area equivalent to more than 4 tennis courts
- Generate over 230,000 units of electricity each year, equivalent to the annual energy use of almost 70 homes.
- This will reduce annual CO2 emissions by 125 tonnes.

## 7.3 Keynsham Tender Documentation

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## Soft Landings ITT Questions.

Listed below are nine key Soft Landings skills that BANES would expect bidders to possess or develop for the project. Please provide on a maximum of four sides of A4 details of experience that demonstrates capability in the areas listed.

Where direct experience is lacking, bidders should provide an explanation of how this will be managed or developed and state your knowledge and understanding of appropriate Soft Landings processes.

1. **General understanding of Soft Landings**

2. **Review of past experience** (of earlier projects, or knowledge of post-occupancy research relevant to Keynsham Regeneration Project)

3. **Environmental and other performance targets** (with follow-through after handover and monitoring of results)

4. **Use of feedback methods to measure performance** (both at design and during post-occupancy studies. Please identify the methods of analysis, such as methods of reporting energy use and occupant satisfaction)

5. **Migration planning** (planning for move-in, with emphasis on demonstration, training and systems documentation)

6. **Building user guides** (for lay occupants rather than expert managers. Provide examples if appropriate)

7. **Project aftercare experience and use of feedback** (experience on specific projects and management of a feedback loop)

8. **Aftercare services offered** (describe scope, and name projects and any significant outcomes)

9. **Learning from experience and knowledge management** (Please describe your company's processes).

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# Keynsham Town Hall
# Soft Landings – Contract Preliminaries

A Soft Landings approach is being followed on this project in line with BSRIA BG 4/2009 'Soft Landings Framework'. A 'soft landing' is a collaborative process that starts at the briefing and design stage and carries on through the project past completion and defects liability. The objective of soft landings is to improve the usability of buildings and focus the design and construction process on operational outcomes.

A fundamental element of the brief is to achieve an 'A' rated Display Energy Certificate (DEC) in use for both the office building and for the library/ one stop shop. Operation of the building will be essential in achieving low energy consumption in use and the soft landings process is a key element. As part of this process an 'energy risk register' has been prepared and is included within the stage C report. This risk register will be continually reviewed through the lifetime of the project by the Contractor. The office and library/ one stop shop buildings are also required to achieve an Energy Performance Certificate (EPC) rating of A at design stage and as-built stage

Another key element identified within the energy risk register and generally within the soft landings framework is the importance of building commissioning, and, by implication, effective commissioning planning and management.

The main contractor is to nominate a person responsible for delivering the contractors' responsibilities under soft landings (the "soft landings co-ordinator") and provide a CV detailing their role and experience within the ITT return. The soft landings co-ordinator will be involved throughout the construction and for 2-years post occupation.

In addition to the soft landings coordinator, the main contractor will be required to appoint from the outset a specialist commissioning manager to plan and manage the commissioning of the building. This specialist commissioning manager should report directly to, and be directly appointed by, the main contractor and not to the M&E subcontractor. The specialist commissioning manager should remain appointed through to 12 months post occupation of the building. Bidders should provide a CV for the appointed commissioning manager detailing their role and experience within the ITT return.

**Requirements of the Soft Landings Coordinator**
The soft landings coordinator appointed by the main contractor is to oversee, manage and contribute to the soft landings process. The main roles at each programme stage are:

**Second stage tender**
Prepare a draft of the building readiness programme outlining the soft landings process through the rest of the design, construction, handover and occupation.

Contribute to three key soft landings meetings. Meeting one will concentrate on the stage 1 checklist items within BSRIA BG 4/2009. Meeting two will concentrate on a design review and meeting three on incorporating the requirements of soft landings into the building contract.

Advise on requirements to be included in key subcontract packages within the tender documents.

**Construction phase**
Coordinate soft landings processes including design reviews, input from key subcontractors and meetings.

Liaise with the building commissioning manager, and the client FM team.

Input into and coordinate the production of the occupant user guide, technical guide to the building and review of the O&M manuals.

Advise on specialist maintenance contracts.

Input into the client migration planning.

Prepare a detailed training programme with the client team.

Prepare soft landings summary reports for site meetings. Report to include:

- Demonstration of compliance with energy performance parameters
- Progress against building readiness programme
- Update of energy risk register

**Handover and building occupation**
Coordinate staff training including production of filmed records of the training.

During the initial month of building occupation the soft landings coordinator is to be available full time within the building.

**Post handover**
Coordinate with the commissioning manager.

After the initial month occupation period attend site fortnightly for the first six months and then monthly for the next five. Work closely with the client FM and operations team to provide technical support.

Input into quarterly reports and meetings with the client team for the second year post handover.

Input into the post occupancy evaluation .

**Requirements of the Commissioning Manager**
The specialist commissioning manager role is primarily a technical role to coordinate the commissioning of the building and building services, including any low and zero carbon energy systems, and the integration of the BMS and building control systems. The commissioning manager will also contribute to the soft landings process and staff training. The main roles at each programme stage are:

**Second stage tender**

Carry out two design stage reviews for commissionability. One review against the current design after appointment and a further review before tender documentation. Coordinate and consult with any specialists that will be necessary.

Prepare a commissioning plan and draft commissioning programme, coordinating training requirements into the programme with the soft landings manager. The commissioning programme should be based on a Critical Path Analysis that identifies the sequence that commissioning tasks need to be completed in to determine the overall commissioning period. The commissioning plan should follow the format set out in BSRIA Guide BG 8/2009.

Advise on requirements for commissioning, including seasonal commissioning, to be included within the tender documents.

**Construction Phase**
Coordinate the commissioning programme with the soft landings process, and prepare a final commissioning programme.

Carry out design reviews for commissionability as the detailed design progresses.

Review the development of the BMS graphics and user interface to ensure that FM staff are consulted on the design of the interface and that it meets their requirements

Co-ordinate and manage all building commissioning, including commissioning of lighting and lighting controls, all meters and submeters, and the Automatic Meter Reading (AMR) system. Ensure clear records are kept up to date and distributed.

Liaise with the Client's Energy Manager to ensure that the commissioned AMR system meets their requirements

Review the design of user control interfaces, and ensure that these are clearly intelligible and accord to the guidance set out in the BSRIA guide "Controls for End Users", May 2007. This work should include testing the proposed user control interfaces with potential building occupants as well as the FM staff.

**Handover and building occupation**
Input into client training with the FM staff.

During the first month of building occupation the commissioning manager is to be based on site full time working with the FM staff. Duties to include: reviewing building and building services performance against design targets; attend meetings of the aftercare team, liaison with the designers and specialist sub-contractors to 'fine tune' the systems and record the results of any fine tuning; assist in identifying and rectifying any "snagging" issues relating to the metering system, BMS, building controls or key items of plant.

**Post Handover**
After the initial three month period the commissioning manager is to continue to visit site to monitor the performance of the systems and liaise with the soft landings team and FM staff. Attendance to be:

- Month 2: two days per week

- Month 3: one day per week
- Months 4-12: one visit per week.

Coordinate the seasonal re-commissioning once the building is occupied, over a 12 month period, in line with BSRIA guidelines. This should cover:

- testing of all building services under full load conditions, i.e. heating equipment in mid-winter, cooling/ ventilation equipment in mid-summer, and under part load conditions (spring, autumn)
- re-commissioning of systems based on the above, and incorporating any revisions in operating procedures, and/or revised settings, in the building logbook

Input into the post occupancy evaluation.

Attend site quarterly in the second year of occupation to review the systems and provide reports.

# Keynsham Town Hall

# Employers Requirements

# Prelims

1st November 2012

Tender. Revision B

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## ISSUE HISTORY

| Issue | Date | Description |
|---|---|---|
| B | 01-11-12 | Clause 900.110 Re-inserted. |
| A | 05-04-12 | Sections that are Updated have been highlighted. |
| * | 28-02-12 | Stage D Tender Issue |
| | | |
| | | |

## MAX FORDHAM LLP TEAM CONTRIBUTORS

| Engineer | Role |
|---|---|
| SR | Project Engineer |
| TT | Soft Landings Co-ordinator |
| | |
| | |
| | |

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## CONTENTS

# 1.0 A64 GENERAL CONDITIONS

## 100.000 PROJECT PARTICULARS

**100.010 CONTRACTOR**
Where the term Contractor is used within this specification it refers to the contractor undertaking the Works defined by this specification and associated drawings.

**100.020 MAIN CONTRACT PRELIMINARIES**
These Preliminaries are in addition to, and are to be read in conjunction with, the Main Contract Preliminaries & General Conditions.

It is the Contractor's responsibility to obtain a copy of the Main Contract Preliminaries. Claims due to want of knowledge of the Main Contract Preliminaries will not be entertained.

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

- the person named in the Main Contract Preliminaries & General Conditions

**100.050 THE CONTRACT WORK:**
The engineering services included in the Works and covered by these Employers Requirements comprise the following installations for the buildings and site as described in the Main Contract Preliminaries.

Mechanical Services
Public Health Services
Electrical Services
Security Services
IT Data Provision (Non Active Systems)
Building Controls / Building Management System
Fire Fighting Services

The work includes the full design and drawing production, manufacture, supply, installation, inspections, testing (on and off site), setting to work, commissioning, system proving, provision of 'as installed' drawings, record drawings and operating & maintenance documents, investigating and advising on operating problems, making good of defects that may arise during the defects liability period, provision of Health & Safety File(s), and all the labour required to form a complete installation.

Take the phrase "complete installation" to mean not only the major items of plant, equipment & materials described explicitly within this specification and drawings, but also those incidental sundry components that are implicitly required for the proper and safe working of the systems as a whole.

A fundamental element of the brief for this project is to achieve an A rated Display Energy Certificate (DEC) in use for both the office building and for the Civic Centre. Furthermore an Energy Performance Certificate (EPC) rating of A at the design stage and at the as-built stage is to be achieved.

Allow for commissioning and testing as required by the tender documents and as may otherwise be required to give an efficient, effective and safe working installation, all to the satisfaction of the CA.

Provide programming information and method statements as required.

Carry out and complete the work of design and installation in accordance with the true intent and meaning of this specification and drawings to the entire satisfaction of the CA.

Allow for the coordination and cooperation with others when designing and installing the Works.

Participate fully in the Soft Landings process.

**100.060 DESIGN RESPONIBILITIES OF THE CONTRACTOR:**
The design responsibilities of the Contractor are as detailed in the following clauses:

**100.060C THE CONTRACTOR CARRIES OUT THE DESIGN:**
The Contractor is to carry out ALL of the DESIGN and drawing production for the services installations covered by these Employers Requirements.

The Contractor will offer himself as an expert in the field of building services, and will design and install an installation that is in accordance with the tender documentation, is constructed in accordance with the agreed programme and within the tender price.

The Contractor is to employ experienced design engineers who have available to them all published knowledge relevant to buildings, building services and relevant specialist fields.

The Contractor is to allow sufficient time within the programme for carrying out and completing the design, detailed information, energy calculations and working drawings, review by the CA, incorporation of any comments or necessary amendment(s), subsequent resubmission(s) and review(s).

The contractor is to prepare sufficient calculations and appropriate drawings of the services installations for the purposes of assisting the Architect to achieve Building Regulations approval including submission of calculations and report to comply with Part L and to allow the Client to review progress on meeting the DEC A requirement.

The Contractor is responsible for the suitability, compatibility and correct installation of all components whether specified within the tender documentation or chosen by the Contractor to meet the specified performance of the installation(s).

The Contractor is to provide all detailed information and drawings as described in Table C of Appendix A, together with all other information which is reasonably necessary to co-ordinate the design and construction of the Works with the design and construction of all other works in time to meet the overall building programme. The Contractor is to request such further information as may be required to design and construct the Works in sufficient time to meet the programme. Development of the design is to be in conjunction with the CA, all other trades and works contractors.

**ADDITIONAL CO-ORDINATION RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR:**
Notwithstanding the overall responsibility of the Main Contractor to programme and coordinate the entire works, the contractor responsible for the mechanical services installations (the "Mechanical Contractor") is to allow for and price within their tender the following additional responsibilities:

A. the overall coordination of all services installations within the Works, utilising information provided by others for the structure, architectural form, electrical installations, security installations, fire protection installations, and all other specialist services installations.

B. production of composite Builders Work Drawings incorporating all services installation requirements

with his own and all other contract package requirements properly defined.

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

D. Completing the design, labelling and co-ordination (including the Architecture and Structural models) of all the works using a building information modelling (BIM) software compatible with Autodesk® Revit® MEP software. A project BIM co-ordinator will be appointed by the Main Contractor who will set all of the BIM standards and required outputs that are to be adhered to throughout the Project. Refer to the Project BIM Strategy documents for details.

The Mechanical Contractor is to nominate a representative to be responsible, in conjunction with the Main Contractor, for the management and programming of the entire services coordination for the Works including, but not limited to, chairing services coordination meetings, REVIT co-ordination meetings, preparing a schedule of drawings required, preparing a production programme, reporting on progress, and supervising the timely production of coordinated drawings by each of the relevant services contractors.

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

## SOFT LANDINGS

**What is Soft Landings?**
A Soft Landings approach is being followed on this project in line with BSRIA BG 4/2009 'Soft Landings Framework'. Soft Landings is an enhancement of the conventional design and construction process that focusses on delivering buildings that really work for their owners and occupiers: buildings that are comfortable and straightforward to use, and with systems optimised to minimise running and maintenance costs.

Soft Landings is a collaborative approach affecting all stages of the process, from briefing, through design and construction, and continuing for a period after the building is occupied to ensure that it is operating to its full potential.

Through Soft Landings, the needs and experience of building managers and occupants are specifically taken into account as the project progresses.

Specific emphasis is put on the handover process so that the building's operation is thoroughly tested, checked and demonstrated. Managers and occupants are then familiar with the building operation and maintenance requirements as soon as they take it over, making them better prepared to use and run their building smoothly.

Members of the delivery team will remain involved after the building is occupied to provide support, reviewing and fine tuning systems to maximise comfort and minimise running costs.

**Soft Landings for this project**
The Main Contractor will appoint both a Soft Landings Coordinator ('SLC') and a specialist Commissioning Manager ('CM'). The SLC is responsible for coordinating all Soft Landings activities and the CM responsible for coordinating all commissioning activities. Close liaison with both the SLC and CM will be required throughout the design coordination, installation, handover and post occupancy stages of the programme.

The Soft Landings process to date has identified several critical items necessary to achieve the desired operational performance. These include both technical requirements of the installations and process requirements for effective commissioning, handover, training and post occupancy use. The Contractor has responsibilities in delivery against several of the Soft Landings objectives.

A fundamental element of the project brief is to achieve an 'A' rated Display Energy Certificate (DEC) in use for both the office and civic centre buildings. Furthermore an Energy Performance Certificate (EPC) rating of A at design stage and as-built stage is to be achieved.

An 'Energy Risk Register' has been prepared highlighting risks to the achievement of this target, and setting out mitigation measures. The Contractor will be responsible for ultimately discharging many of these risks and demonstrating that the design and as installed compliance of the engineering systems are in line with the schedule of technical compliance parameters A[10]510. This is a schedule of the key design and performance parameters necessary to achieve the DEC A rating.

Achieving the DEC 'A' rating is a key target for all members of the project team and a requirement of this Work Package. Critical to this, is that sufficient time is allowed for thorough commissioning and that the planned commissioning period is not eroded at the end of the construction phase. It will be the responsibility of the SLC and CM to ensure this with support from the Contractor.

Also critical to the energy performance of the buildings: the Contractor will carry out fine tuning and seasonal commissioning of the building services during the first year of occupation as set out below.

**Commissioning Manager**
The Contractor is to price for the Commissioning Manager within their tender, although the CM will be appointed directly by the Main Contractor. These costs are to be separately identified in the tender price as:

1. Pre- Construction and
2. Construction and Post Construction.

The Commissioning Manager is to be selected from one of the following companies:

- *Core Group*
- *Cardiff Commissioning*
- *Pure Group*
- *Commissioning Technical Services*

**Requirements of the Contractor**
The Contractor is responsible for the appointment of specialist subcontractors that will have direct input into the Soft Landings process. The Contractor is responsible for coordinating the input of the specialists, although the specialists will be involved directly in the Soft Landings process.

*Design completion and coordination stage*
The overall allowable Building Energy and Carbon Budget in order to achieve DEC A is set out in Schedule A[10]510. Within the allowable Budgets given for each particular system (Heating, cooling etc.) the Contractor is to develop their design and allocate their calculated Energy and Carbon figures to each of the proposed associated energy sub-meters as listed in the metering strategy (main MECHANICAL AND ELECTRICAL specification), demonstrating how their chosen system design will not exceed the available budgets. This information is to be shown in the format of the example sub-meter energy budget tables within the schedule by the end of the design stage.

The energy performance requirements necessary to achieving the energy budgets have also been set out in Schedule A[10]510, these were previously listed in the main MECHANICAL AND ELECTRICAL specification. The Contractor is required to provide documentary evidence to the SLC demonstrating compliance with these energy performance parameters, to achieve sign off of the Contractors design.

Liaise with the CM and demonstrate design for commissionability. Provide information as required by the CM to coordinate the commissioning and training programme.

Attend a minimum of 3 Soft Landings meetings with the SLC and client team. During this stage at least one meeting will be dedicated to controls and user operation. Attendance will be required from the BMS controls and lighting controls specialists. Other controls specialists, where appointed or identified for appointment in the future may be required to attend.

During this stage ensure that the Clients Active ITC system provider is aware of the interface between their equipment and the building electrical, heating and cooling systems. Confirm the Clients ITC strategy prior to commencing the design.

*Construction Phase*
Continue to attend and input to Soft Landings meetings with the SLC and client team.

Discharge any remaining technical compliance and any other on-going Soft Landings related queries.

Input into finalisation of the commissioning programme in liaison with the CM.

Input into preparation of the building user guide, Building Log Book and O&M manuals. Draft copies of these are to be available three months prior to the programmed PC date for circulation and comment.

Liaise with the Clients Active IT system provider and ensure that any proposed changes to the IT strategy are fully considered with regard to the overall energy requirements, kill switches and the linked heating and cooling systems.

*Handover and initial occupation*
Input into user training as detailed in the training programme prepared by the SLC. All training is to be recorded by video by the Main Contractor so that building users can refer back to this.

Liaise with the Clients Active IT system provider to confirm the installed ITC loads (peak power and off peak power) ensure that the interface between their equipment and the building heating and cooling systems is working to both parties satisfaction.

During the handover and initial occupation phase, full time on site attendance will be required by the Contractor's overall project co-ordinator. This period is to cover one month prior to PC to one month following occupation of the building.

*Post Handover (Aftercare)*
Monitor the performance of the systems and liaise with the SLC, CM and the Soft Landings team. Attendance requirements are to be:

- Month 2-4: One day per week
- Months 5-6: One day per fortnight
- Months 7-12: One day per month

In addition to the Soft Landings attendance, input into the seasonal commissioning in line with the programme prepared by the CM.

The Contractor is to monitor the building on a monthly basis against their sub-meter Energy Budgets. See schedule A[10]510. Where the actual performance differs significantly from the monthly Energy Budget, the Contractor must determine the reason for the difference. Where the cause of discrepancy is within the control of the Contractor, the Contractor is to put in place corrective measures. Where the cause of discrepancy is outside the control of the Contractor, the Contractor is to notify the client's representative and SLC.

**Additional Requirements of the BMS Contractor**
The BMS package is critical to delivering effective and intuitive controls and for successful energy performance of the building. The BMS controls contractor should therefore be appointed as early as possible and the date of appointment should be agreed prior to the design stage commencing. The BMS controls specialist will also form an essential part of the soft landings team and will be required to input into the soft landings process as set out below:

*Design completion and coordination stage*
The BMS Contractor is to attend all soft landings meetings as required, they will present the controls proposals including detailed descriptions of the building operations and user interfaces including the graphical front end.

The design of user control interfaces must be clearly intelligible. Test the proposed user control interfaces with potential building occupants as well as the client's FM staff during soft landings and dedicated controls meetings. Incorporate their feedback as agreed within the minutes of any meeting.

Develop the BMS user interface in collaboration with the client's FM staff. Allow adequate time (1 month) for FM staff to review and comment on BMS proposals and make reasonable attempts to incorporate their feedback into the final design and implementation.

The requirement for collaborative development applies particularly to:

- Local heating controls
- Local automated window controls
- Any other local controls
- BMS user interface
- Central window controls
- Central energy monitoring.

Input into the commissioning and training programme with the CM.

*Construction Stage*
Continued attendance input into the soft landings meetings.

*Handover and initial occupation*
Carry out client training and be available for client queries. All training is to be recorded by video by the Main Contractor so that building users can refer back to this. A dedicated presence is required specifically for client training, demonstration and 'tuning' of the controls full time for one month prior to PC to one month following occupation of the building

*Post Handover*

Monitor the performance of the control systems, carry out seasonal commissioning and fine tune the systems under the guidance of the commissioning manager. Liaise with the SLC, CM and soft landings team. Present findings to the soft landings team – see also Clause 900.110 PROVING PERIOD AND FINE TUNING:.

Post-Handover attendance to be:

- Month 1: full time (as above)
- Month 2-4: One day per week
- Months 5-12: Two days per month

Seasonal commissioning requirements are set out in clause 740.170.

## 200.000 DEFINITIONS

**200.010 GENERAL:**
Where used in the documentation the following definitions shall apply and shall be interpreted as such:

- Works: All services shown on the drawings and described in the specification shall be deemed to be included in the contract.
- Drawings: The tender drawings.
- Elsewhere: Detailed or specified elsewhere in other clauses, sections, shown on the drawings or contained in the specification or conditions of contract.
- Services: Services means the inclusion of one or more system.
- System: All equipment, accessories, controls, supports and ancillary items, including supply, installation, connection, testing, commissioning and setting to work necessary for that section of the Works to function.
- Design process: All the activities necessary to convert design input into design output
- Review: Give notice and submit details to the CA for his comment and review, which shall be granted in writing only. In the event of the CA not accepting that submitted, resubmit alternative details for review or modify that submitted in accordance with the CA comments. Review of any submittal by the CA shall not mean that the CA is responsible for the correctness of the submittal or its suitability for purpose and does not relieve any contract responsibilities.
- Competent person: A person, by reason of theoretical and practical training or actual experience or both, is competent to perform the task or function or assume the responsibility in question and is authorised to perform such a task or function.
- Duct: An enclosed space specifically intended for the distribution of services, with direct access for personnel.
- Trench: A covered horizontal service space in the floor or ground with access from above.
- Cavity: A space enclosed within the elements of a building within which services are installed, e.g. the space between ceiling and floor above. See Building Regulations.
- Service Areas: Includes areas within a building with limited finishes such as loading bays, car parks etc.
- Concealed Services: Includes installations within ducts, trenches or cavities.
- Exposed Services: Includes installations outdoors or unprotected within service or occupied areas.
- Terminal Units: Terminal units such as radiators, convectors, fan coil units, induction units, variable or constant volume air boxes and other like equipment.
- Ancillaries: All specified fittings, accessories, inserts, test points, bracketing, terminal equipment connected to and installed in the engineering services system.
- CIBSE: The Chartered Institution of Building Services Engineers
- BSRIA: The Building Services Research and Information Association
- IET: The Institution of Engineering and Technology
- IOP: Institute of Plumbing
- FRS: Fire Research Station
- HSE: Health and Safety Executive

- Soft Landings: the process described in BSRIA BG4/2009

**200.020 DEFINITIONS OF TECHNICAL TERMS**
The definitions of technical terms associated with the engineering services installations are those included the latest edition of:

- CIBSE - Guides; Commissioning Codes; Technical Memoranda; Building Energy Codes; Lighting Guides; Application Manuals;
- IOP - Plumbing Engineering Services Design Guide
- BSRIA - Technical Publications
- Loss Prevention Council - Rules for Automatic Sprinkler Installations
- BS 7671 Requirements for Electrical Installations (IEE Wiring Regulations)
- British Standards, including Codes of Practice.
- Statutory Acts.

## 300.000 TENDERING INSTRUCTIONS

**300.010 GENERAL:**
This section outlines the tendering procedures and requirements.

**300.020 SCOPE:**
- These conditions are supplementary to those stated in the invitation to tender and on the Form of Tender and Agreement.

**300.040 PRIVACY OF INFORMATION:**
The information contained in the tender documentation shall be treated as private and confidential.

**300.050 CHECKING DOCUMENTS:**
Check the tender documentation for obvious errors and omissions. Should any such errors or omissions be discovered inform the office issuing the documents immediately in writing in order that a correction may be issued before the date for submission of the tender.

**300.130 SITE VISIT:**
Before tendering, ascertain the nature of the site, access thereto and all local conditions and restrictions likely to affect the execution of the Contract Works.

- Inspect any existing installations relevant to the works and study any relevant existing records.
- No claims will be allowed after submission of a tender for lack of information or other reasons which could have been resolved by such a visit to the site.
- Arrangements for visiting the site must be made with prior agreement through:

- The office issuing the tender documentation.

**300.150 ALTERATIONS TO TENDER DOCUMENTS:**
No alterations or erasures to the text of any part of the tender documentation shall be permitted.

Any tender containing such alterations or erasures may be rejected.

**300.195 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.

**300.200 PROCUREMENT OF MATERIALS:**
Allow for the procurement of materials and equipment from suppliers at such a time, and in such a manner as may be necessary to allow for the completion of the Works in accordance with the contract programme.

Clearly state in the tender submission any foreseen difficulties with delivery periods for selected equipment or proposed alternatives.

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

**300.210 SUBLETTING:**

- Where it is proposed to sublet any portion(s) of the Works a schedule must be submitted with the tender.
- The schedule should define such portion(s) and give for each the details of the proposed company.

## 310.000 TENDER SUBMISSION

**310.010 GENERAL:**
This section details the particular tender submission requirements.

**310.031 TENDER STAGE METHOD STATEMENTS:**
Method statements must be submitted:

- With the Tender.
- Before the execution of the Contract.

Provide the following method statements in addition to those stated elsewhere:

- Health and safety statement to include:
  - Management procedures.
  - Any significant and unavoidable risks that might arise as a result of executing the Works.
  - An outline of the health and safety procedures to be undertaken to safeguard the operatives and of any person who may be affected by the Works.
  - A copy of the company's health and safety policy document including risk assessment procedures
  - Accident records for the last five years
  - Details of any Health and Safety Executive enforcement action
  - Details of staff responsible for health and safety on this project with details of their qualifications and duties.
- Management procedures to be adopted for the project.
- Managing and resourcing of design duties and responsibilities including design capability.
- Commissioning and testing procedures and management.
- Quality control management and procedures.
  - The method statement must:
    - Indicate the quality control programme
    - Demonstrate compliance with the contract in regard to materials and workmanship.
    - Demonstrate the establishment of standards by means of sample installation and submission of samples prior to installation.
- Statement outlining the management team, stating the definition of each person's role, and the commitment to the project.
  - Include the curriculum vitae and references for each of the key personnel that will be used on the project.
  - A line management diagram starting at the site supervisors and rising through the management levels.
  - Details shall be provided for both site and office based team’s staff.
- The Tenderer, at his discretion and at the same time, can submit method statements for other parts of the Works.

**310.032 PROGRAMME:**
Submit with the tender a programme indicating the sequence and timing of the principal parts of the works including periods for planning, design, procurement, installation and commissioning.

**310.040 MAINTENANCE CONTRACT:**
Maintain the works covered by this specification for **twelve months,** or for the period of the Defects Liability Period if longer, from the date of Practical Completion.
Itemise the cost of this maintenance contract separately within the tender return and tender summary provided

## 320.000 PRICING AND COSTS

**320.010 GENERAL:**
This section details particular requirements for the pricing of the tender documentation and cost procedures during the contract.

**320.030 TENDER PRICING DOCUMENT:**
Alterations and qualifications to the specification must not be made without the written consent of the CA. Tenders containing such alterations or qualifications may be rejected.

Costs relating to items in the specification that are not priced will be deemed to have been included elsewhere in the tender.

The Tenderer shall complete all sections of the tender pricing document in full.

Items described in the pricing document are abbreviated for the purpose of the schedule. The Tenderer is to make full allowance for all works associated with the installation of a particular element.

Items entered in the pricing document shall be deemed to include all costs involved in carrying out the Works.

- Where required the Tenderer must identify separately the cost of all items specifically described under preliminaries.
- Provisional items will be adjusted at the final agreed rates when information is issued in respect of these items.

**320.040 SCHEDULE OF RATES:**
A schedule of rates must be submitted.

The schedule must be quantified and total the contract sum.

- Within one week of request.
- The schedule of rates must include rates for all significant items of work.
- Rates to include Contractor's cash discount.

A quantified schedule of rates accepted by the CA shall only constitute part of the contract in the following respects:

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

**320.060 PROVISIONAL SUMS:**
Include in the contract price the provisional sums detailed in the main contract preliminaries and below.

- The work is defined as follows:
  - New gas provision from the street main
  - New mains water services provision from the street main

## 410.000 PARTICULAR CONDITIONS

**410.010 GENERAL:**
This section details particular conditions and requirements for the project.

**410.020 INFORMATION PROVIDED BY OTHERS:**
Instructions, drawings, or other information required to be provided by the CA will be provided in due time upon written request provided always that such information is not requested unreasonably distant from nor unreasonably close to the date upon which it is necessary.

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

**410.030 PROVIDE EVERYTHING NECESSARY:**
Provide everything necessary for the proper execution and completion of the contract works to the true intent and meaning of the contract documents.

- Details of construction or materials which have not been referred to in the contract documents but the necessity for which may reasonably be implied or inferred from the said documents or which are usually or essential to the completion of the Works, shall be installed with no additional cost.

**410.040 SUPPLY OF INFORMATION:**
The CA will provide supplementary information from time to time as may be necessary to enable the completion of the Works in accordance with the contract conditions. Allow for such progressive release of further information by the CA during the course of executing the Works.

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

**410.041 CO-ORDINATION OF TRADES:**
Allow for co-ordinating the contract works with the works of other trades and installations which may be on site during the period of the contract.

**410.050 NOTICE OF OPERATIONS:**
Work that requires interruption or interference with the operation of any existing services or buildings shall not be commenced without prior written permission of the CA.

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

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

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

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

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

    Allow adequate time for the examination and approval by the CA. Actual activities of production, adjustment, resubmission and review must be identified
- Installation periods for each system
- Work resulting from instructions issued in respect to the expenditure of provisional sums.
- Concurrent work by other trades.
- Any temporary works necessary for the completion of the engineering services installations.
- Period required for operating the systems, load simulation tests and final adjustment.
- Environmental load testing.
- Period for instructing the Employer training.
- Pre-commissioning, commissioning and performance testing of the engineering services installations.
    - The period required and latest dates for the production, approval and issue of record drawings and operating and maintenance instruction manuals.
- Provide programme information as
    - simple bar chart type.

- critical path network.

- 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 1 week
  - Demonstration to the CA that test instruments and equipment are accurate.

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

The reports shall include:

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

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

**410.100 ORDERING SCHEDULE:**
- Prepare an ordering schedule for submission to the CA that shall indicate the following data:
  - Item of material or plant
  - Manufacturer
  - Date of order and reference number
  - Acknowledgement of order and reference
  - Delivery period quoted
  - Date required on site
  - Allowable programme float
  - Date delivered to site
- Update and modify and submit the ordering schedule on a regular basis as agreed with the CA. Indicate on the schedule any possible problems and when delivery to site has been achieved.

**410.190 USE OR DISPOSAL OF MATERIALS:**
- Do not discharge any oil, noxious liquids or gases and all water discharged shall be reasonably free from impurities.

**410.200 STORAGE:**
Weatherproof, safe and secure storage shall be provided for all materials and equipment.

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

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

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

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

**410.210 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.

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

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

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

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

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

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

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

**410.240 MATERIALS USED:**
No acoustic insulation or thermal insulation or sound attenuation materials shall be manufactured with any form of animal hair.

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

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

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

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

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

Warrant that deleterious materials are not incorporated in the Works.

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

**410.270 BENEFICIAL USE OF INSTALLATIONS:**

- Systems shall not be used before practical completion without prior approval of the CA.
- Systems used before practical completion not for the benefit of the Employer must have all defective consumable elements replaced by new including:
    - lamps and tubes
    - filters

Replacement of consumable elements shall be not more than 5 days prior to practical completion.

- If instructed by the CA operate the installations or any part of them prior to practical completion, provided that such operation is practicable and does not prejudice the responsibilities and obligations under the contract.

**410.280 DEFECTS LIABILITY:**

Liability for making good defects in the Works shall be for a period of **12** months from the date of issue of the certificate of practical completion for the installations.

If it is necessary to replace or renew any portion of the contract works as part of liability for defects, the defects liability period in respect of that portion of the contract Works shall be deemed to commence from the date of such replacement or renewal.

The CA may require that new tests be carried out to demonstrate that the plant is continuing to work satisfactorily if the replacement or renewal may affect the efficiency of the Works or any portions thereof.

In the remedying of defects in the contract Works take all necessary precautions to minimise the risk of damage to the buildings, the decorations, the fittings and the equipment.

- In the event of such damage occurring bear the cost of replacement or making good, subject to the proviso of being granted the benefit of any settlement in respect of such damage accepted by the insurers under the insurance policies taken out in accordance with the requirements of the contract.
- Agree with the CA a programme for the carrying out and the completion of any work not finally finished at the time of the contract Works being offered for acceptance and which does not prejudice the issue of a practical completion certificate. This work may be requested to be executed out of normal hours and no additional costs will be accepted for this action.
- Prior to practical completion submit a method statement for the approval of the CA outlining how the defects which arise during the defects liability period will be rectified to ensure that disruption to the use of the building is kept to a practical minimum.
- No additional costs will be accepted for undertaking works executed out of normal hours.
- 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 CA 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 in writing when all defects are finally rectified so that an inspection may be carried out prior to the issue of a Final Certificate.

**410.300 RATIONALISATION OF COMPONENTS:**
Similar items of apparatus and equipment shall be made and provided by the same manufacturer where practicable and corresponding parts of all apparatus and equipment shall be interchangeable to reduce the need for different attention and spares.

**410.310 SUPPLY OF COMPUTER HARDWARE AND SOFTWARE:**
Obtain on behalf of the end user all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Ensure that application software is written in compliance with BS 7649.

**410.320 FIRE PRECAUTIONS:**
Take all reasonable fire precautions in respect of stores, workshops and other installations. Where it is necessary to use any naked flame or welding equipment in executing the contract works and where combustible materials are in use, adequate protection shall be given to other adjacent materials and personnel. Suitable fire extinguishers shall be readily available at the position where such work is proceeding.

**410.330 DAMAGE TO STRUCTURE:**
- Exercise due care and attention in carrying out the contract works and be fully responsible for any damage caused to the structure or building finishes.

- Obtain permission from the CA before any holes are cut in floors, walls or steelwork, etc.

**410.335 METHOD STATEMENTS:**
Submit method statements to the CA prior to commencement of the contract works for the following work activities.
Precautions to be taken to reduce risk of Pseudomonas contamination of all water systems

**410.340 INSPECTION BEFORE CONCEALMENT:**
Whenever work requiring inspection or testing is subsequently to be concealed give the following the notice to the CA so that inspections may be made or tests witnessed before concealment:

- 5 working days notice

**410.350 EQUIPMENT GUARANTEES:**
Plant and equipment guarantees shall commence at the date of practical completion and run for a minimum of 12 months after this date.

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

**410.360 SITE MODIFICATIONS:**
Site modifications to assemblies shall not be made without written approval of the CA.

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

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

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

## 430.000 QUALITY

**430.020 WORKMANSHIP AND MATERIALS:**
All materials, articles and workmanship shall be of the best quality and execution as detailed in the specification and drawings.

All equipment and materials to be installed shall be new unless otherwise indicated.

All equipment shall be installed in accordance with the manufacturer's written instructions and recommendations.

All materials considered by the CA to be unsound or not in accordance with the specification shall immediately be removed and properly replaced to the satisfaction of the CA at no additional cost. All work carried out imperfectly or with faulty materials must be immediately removed and properly replaced to the satisfaction of the CA at no additional cost.

The manufactured articles specified shall serve as a quality standard.

Where manufactured items are not specified by name submit with the tender all necessary details of proposed articles. The CA shall approve these articles before their use is permitted.

## 500.000 ORGANISATION AND DESIGN MANAGEMENT

**500.010 SITE STAFF:**

- Employ a competent full-time site based project manager/engineer and supporting team dedicated full time to the project and not involved in the installation of the Works who shall have full authority to act in connection with the contract works.
- Staff of sufficient number and competence in the opinion of the CA, shall be provided as necessary for design, drawing and technical information production, programming and administration to ensure efficient and satisfactory execution of the contract works.
- Employ on the site suitable qualified engineering staff to be in charge of the contract works from commencement to completion. The said staff shall be in attendance on site during the whole time that work is in progress.
- Any change made to the appointment of staff during the contract works shall be agreed with the CA with maximum notice being provided.

## 510.000 SUBMITTALS AND APPROVALS

**510.010 GENERAL:**
This section outlines the requirements and procedures for submittals to the CA.

**510.020 SUBMITTALS:**
Prior to any orders being placed the CA shall review all drawings and manufacturer's details.

Submittals shall be in a clear, definable and easily read format with the specified technical details, notes, performance data and calculations where applicable all in the English language.

Where drawings are to be examined the manufacturer's details shown on the drawings must have been previously approved.

Agree with the CA where samples of materials offered for review are to be sent.

Issue progressively drawings, calculations and submittals as agreed in advance with the CA for review.

The timescale for review or comment or otherwise on all submittals shall be

- 15 working days from the date of receipt by the

**510.030 SCHEDULE OF DRAWINGS AND SUBMITTALS:**
Provide a schedule of all proposed drawings and submittals required for comment. The schedule shall be provided

- No later than 4 weeks from contract appointment

Indicate as a minimum the following information on the schedule:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**510.050 EQUIPMENT PERFORMANCE DETAILS:**
Details of the equipment selected for inclusion into the Works shall include the following information:

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

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

**510.051 PREPARATION OF DRAWINGS:**
Agree with the CA a document numbering system prior to preparing any documents. See Section 100.060 for further information on the intended uses building information modelling (BIM) Autodesk® Revit® MEP software.

All drawings shall be prepared using a computer aided draughting system and the software used to produce drawings shall be building information modelling (BIM) Autodesk® Revit® MEP software.

A project BIM co-ordinator will be appointed by the Main Contractor who will set all of the required BIM standards and required outputs that are to be adhered to throughout the Project. Refer to the Project BIM Strategy documents for details.

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

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

The medium for transfer of information between the design team and contractor shall be primarily:

Autodesk® Revit® MEP Building Information Model (.RVT) integrated with both the architects and structural engineers models

Additionally for use on site, and for review of submittals AutoCad drawing files shall be

- DWG

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

The standard drawing size is to be

- A1

Scales used on drawings shall be

- selected to convey clearly the proposals

**510.060 REVIEW OF SUBMITTALS:**
The CA or their appointed representative may review proposals and drawings (including Installation Drawings) submitted by the Contractor for these Works or parts thereof, for general compliance with the design intent and performance criteria. The CA will not 'approve' any drawings or other information submitted for review. Review will not relieve the Contractor of any responsibilities or obligations under the contract and it will remain the sole responsibility of the Contractor to ensure the contract requirements are met. The Contractor will remain liable for any defects in or omissions from the information supplied by them.
Any changes to drawings or other information that are needed to meet the contract requirements are deemed to have been taken into account within the contract sum and programme.

**510.070 MISTAKES IN SUBMITTALS:**
Examination and/or issue on a CA instruction of submittals shall not be deemed to remove any duties, obligations and responsibilities under the contract.

The submittal producer shall remain responsible for any error, discrepancy or omission in any submittal, presentation or drawing prepared or where others have prepared these for submittal.

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

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

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

**510.100 FORM AND NUMBER OF SUBMITTALS TO BE PROVIDED:**
Drawn information provided by the Contractor for review is to be produced using the latest version of AutoCAD, or in a CAD package fully compatible with AutoCAD. Note also the previously stated requirements to complete the design in building information modelling (BIM) Autodesk Revit MEP software and to work to the Project BIM Strategy documents requirements which may differ.

Each service shall be represented by a separate layer for subsequent easy modification.
Agree with the CA a document numbering system prior to preparing any documents.
Drawing plots shall be A size to British Standard, with an agreed logo/title block.

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

**Design & Installation drawings:**
Initial copies for comment – provide in print form
Final copies for distribution – provide in print form and as required by the Project BIM Strategy documents
Provide drawn information for the design team and client in the following numbers
Initial copies for comment - 2 or as stated in the Main Contract Preliminaries if greater.
Final copies for design team - 2 or as stated in the Main Contract Preliminaries if greater.
As-installed drawings: Maintain up to date site record copy as the work proceeds.

**Record Drawings:**
Initial copies for comment - 2 or as stated in the Main Contract Preliminaries if greater.
2 preliminary sets for use during commissioning.
One reduced set incorporated into each O&M manual.
Set as .RVT Autodesk Revit and .dwg AutoCAD format drawings presented on a CD.
Plant room schedules and schematics:
Initial copies for comment - 2 or as stated in the Main Contract Preliminaries if greater.
2 preliminary sets for use during commissioning.
One framed set for plantrooms.
One reduced set incorporated into each O&M manual.
Set as .dwg AutoCAD drawings presented on a CD.

## 520.000 OBLIGATIONS AND RESPONSIBILITIES

**520.010 GENERAL:**
This section details the specific obligations, duties and responsibilities undertaken as part of the contract works.

Undertake responsibility for all works detailed in the contract, engineering specification and shown on the drawings.

Detailed design responsibilities are as stated below, in addition to those activities normally undertaken through the custom and practice of the industry.

Comply with the obligations as designers under all Health and Safety Regulations.

Responsibility of the suitability and correctness of the design or other obligations as defined in the contract documentation will not be affected by comments of the CA.

Refer to the preliminaries section of the contract and elsewhere in this specification for those items of attendance provided, free of charge.

The schedule below outlines the responsibilities and obligations to be undertaken relating to the engineering services works. The listing is not exhaustive and does not relieve any responsibilities stated or implied within the contract documents or stated elsewhere in the specification.

**520.050 CO-ORDINATION OF SERVICES:**
All aspects of the works require detailed co-ordination to avoid any possible clash or conflict with other trades and disciplines. Undertake such co-ordination in relation to the works.

- No extra cost or claim will be allowed due to conflict of works or installations, where full liaison with other trades and disciplines would have prevented such an occurrence.

When any new, revised or updated architectural, structural or services information is issued by the CA under the authority of an instruction, examine such information and if necessary modify the works accordingly to prevent any clashes or abortive work due to such instruction.

- No extra cost or claim will be allowed to cover any clashes or abortive work that result from not requesting an explanation or seeking clarification in respect of any such revision.
- No extra cost or claim will be allowed due to conflict of works or installations, where full liaison with other trades and disciplines would have prevented such an occurrence.

**520.060 CO-ORDINATION OF SERVICES ON SITE:**
Allow for co-ordinating the contract works with the works of other trades and installations which may be on site during the period of the contract either during or prior to their incorporation into the works.

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

No instructions will be issued to cover such minor clashes

**520.070 SURVEYS:**
- Ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the Works.
- Before commencing work, carry out a survey and examination of buildings, structure and engineering services affected by the works.
- Examine all available drawings of the engineering services and report any discrepancies to the CA.

**520.080 SITE DIMENSIONS AND LEVELS:**
Install all engineering services using a laser levelling system wherever possible and co-ordinate the measurements with all other trades and disciplines to prevent any clashes.

Obtain all dimensions and levels on site for the actual setting out of the works.

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

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

**520.090 MAINTAINABILITY:**
Demonstrate that all plant and equipment incorporated into the Works can be safely and easily maintained in full compliance with:
Health and Safety legislation.
CDM requirements.
British Standards.
Health Technical Memoranda.
Building Regulations
Ensure that adequate space is provided for future replacement of plant or parts and that all access panels/doors are unobstructed.

## 530.000 LOCAL AUTHORITY REQUIREMENTS

**530.010 GENERAL:**
This section details the requirements for compliance with Local Authority By-laws.

**530.020 STATUTORY AUTHORITY APPROVALS:**
- Notify the District Surveyor, Building Control Officer and Fire Officer directly in respect of all tests and demonstrations relevant to life safety installations, and include for all necessary attendance, documentation, etc., to ensure full Statutory Authority approval of the installation.

**530.040 BYE-LAWS, NOTICES, ETC:**
Observe and comply with the requirements of all Statutes and Bye-Laws.

Serve notices on the Authorities having control of the road surfaces before the same are broken up and likewise serve notices on the owners of sewers, drains, water, gas or other mains, electric cables, tramways and other services which may in any way be affected by the execution of the Works.

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

## 540.000 HEALTH AND SAFETY

**540.010 GENERAL:**
- Refer to the Main Contract Preliminaries for the requirements of safety, health and welfare.

**540.020 CDM REGULATIONS:**
- The management of health and safety is to be undertaken in conformity with the requirements of The Construction (Design and Management) Regulations, The Construction (Design and Management) (Amendment) Regulations 2000, and the corresponding Approved Code of Practice.
- Comply with the requirements of the CDM Regulations by
  - Compiling risk assessments
  - Preparing method statements
  - Providing information on the contract works that might affect the health and safety of any person

- Providing all necessary input to the health and safety plan
- Providing all necessary input to the health and safety file

- Supply any method statements and comply with all CDM procedures required by the Planning Supervisor and the Principal Contractor.

**540.030 HEALTH AND SAFETY PLAN:**

- A tender stage health and safety plan is included as part of the tender documents.
- The tender stage health and safety plan provides information required by the CDM Regulations and highlights significant risks to health and safety identified during the design stage.
- Develop the tender stage health and safety plan in accordance with the requirements of the CDM Regulations prior to the commencement of works on site
- The development of the health and safety plan shall not be limited to those particular risks identified in the tender stage health and safety plan but shall include consideration of all reasonably foreseeable risks
- The health and safety plan must be adequately developed, as far as is reasonably practicable allowing for any phasing of works, etc., in sufficient time to allow it to be submitted for approval prior to the commencement of any works on site.
- In the case of phased works the health and safety plan relating to the work content of any phase must be adequately developed and submitted for approval prior to the commencement of any work within that phase of the project.
- Where design activities are undertaken or there is involvement in the design of any elements of the contract works co-operate with and provide information to the Planning Supervisor in accordance with the designer's duties under the CDM regulations.
- Ensure that all sub-contractors are issued with copies of the health and safety plan prior to the submission of their tenders and that they price for compliance.
- Ensure that all sub-contractors complete appropriate assessments of the risks to health and safety in respect of their works as required under applicable statutory legislation, including The Management of Health and Safety at Work Regulations, The Control of Substances Hazardous to Health Regulations and The Control of Substances Hazardous to Health (Amendment) Regulations 2003.
- The health and safety plan shall be reviewed and revised as necessary in line with any information received or any changes in the requirements of the contract works. Any changes shall be promptly advised to all relevant parties.
- Ensure, so far as is reasonably practicable, that all sub-contractors, employees and self employed persons who are at work on the construction of the project conform to the requirements of the health and safety plan.

**540.040 COSHH REGULATIONS:**

- Comply with The Control of Substances Hazardous to Health Regulations and The Control of Substances Hazardous to Health (Amendment) Regulations 2003.
- Provide with the tender an assessment of the risks in undertaking the contract works
- Provide with the tender a method statement on the steps proposed to meet the requirements of the Regulations

- Undertake COSHH assessments for all activities and substances provided or used on site to assess their potential health hazards.
- Copies of all relevant COSHH assessments must be issued to the operatives concerned and strictly monitored. Particular attention must be given to the use of glues and sealant.
- Where the use of substances falling within the scope of the Regulations forms part of the contract works notify the CA in writing, together with the additional costs, if any, of use of non-hazardous alternative.
- Ensure during the course of the contract works, and under all circumstances, that all substances falling within the scope of the Regulations are positively so identified at all times and that they are transported, handled, stored, used and disposed of in strict accordance with their manufacturer's/supplier's recommendations.
- Where use of substances falling within the scope of the Regulations are required for the operation and maintenance of the completed contract works, ensure that
    - Suitable facilities are available for the on site storage of such substances and that all necessary warning/instruction notices are provided at the point of their storage and use
    - Provision of any special protective clothing, eye protection and similar safety equipment for the operation and maintenance of the Works and in sufficient quantity for
        - 1 year operation
    - Employer's staff have been fully trained in the use, handling, storage, transport and disposal of the substances concerned prior to handover.
    - The type, use and control of the substances have been fully and correctly identified in the operating and maintenance manuals/health and safety file.

**540.050 ASBESTOS:**

- No material or goods containing asbestos shall be incorporated in the contract works.
- Be responsible for certifying at practical completion of any section of the contract works that no asbestos or asbestos related materials have been incorporated or by any sub-contractor employed.

**540.060 RISKS TO HEALTH AND SAFETY:**

Submit a statement with the tender describing any significant and unavoidable risks which may arise as a result of carrying out the contract works and the measures proposed to safeguard the health and safety of operatives and of any person who may be affected by the contract works.

## 550.000 BUILDING REGULATIONS REQUIREMENTS

**550.010 GENERAL:**

This section details the requirements for compliance with the Building Regulations.

**550.020 BUILDING REGULATIONS APPROVALS:**

- Make full and formal submissions to Building Control/District Surveyor/Approved Inspector at the earliest opportunity to ensure the approval of the relevant Authorities for the proposed installation works.

**550.030 BUILDING CO2 EMISSIONS RATE (BER) CALCULATIONS:**

- On completion of the works, carry out the Building $CO_2$ Emissions Rate (BER) calculation to confirm operating performance.

## 610.000 EXISTING SERVICES

**610.010 GENERAL:**

This section provides information on existing services.

**610.020 EXISTING MAINS:**

Existing services removals are covered under a separate package.

**610.040 RISKS TO HEALTH AND SAFETY:**

- The nature and condition of the existing services cannot be fully and certainly ascertained before opening up.
- The Employer or the CA do not guarantee the accuracy and sufficiency of this information.
- Undertake responsibility to obtain any information required to ensure the safety of all persons and the Works.
- Comply with the requirements of the CDM Regulations by
- compiling risk assessments for the contract works.
- providing information on the contract works which might affect the health or safety of any person.
- providing appropriate input to the health and safety plan and file for the works.

**610.050 MAINTENANCE OF EXISTING SERVICES:**

- No existing services need to be maintained during the progress of the Works unless notified by the CA.
- Provide to the CA prior to commencement of the contract works, if required by the CA:
    - a method statement outlining the method and procedures to be used for the maintenance of the existing services
    - a planned maintenance programme for the existing services
    - details of permit to work procedures
- Provide any additional work and materials necessary to maintain these services at all times during the duration of the contract works.
- 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.

**610.060 REMOVAL OF EXISTING SERVICES:**

- The approval of the CA shall be sought prior to the removal of any existing services.
- Provide to the CA prior to commencement of the contract works

- a method statement outlining the method and procedures to be used for the removal of the existing services including health and safety procedures
- details of permit to work procedures
- programme for removal of existing services
- details of temporary works to be provided

**610.060: REMOVAL OF EXISTING SERVICES:**
The removal of existing services is covered by a separate package.

**610.070 SURVEY:**
- Ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the Works.
- Before commencing work, carry out a survey and examination of the engineering services.
- Examine all available drawings of the engineering services and report any discrepancies to the CA.

## 710.000 GENERAL DESIGN CRITERIA AND STANDARDS

**710.010 GENERAL:**
This section outlines the general design criteria and definitions applicable to the engineering services forming the contract Works.

**710.020 GENERAL DESIGN CRITERIA:**
- The criteria listed in the following clauses apply to all work sections included in the contract unless specified otherwise.
- The design of the engineering services is based on the criteria and design data stated in the following clauses
    - Changes or amendments shall be by prior written notice from the CA.

**710.030 OUTSIDE CONDITIONS:**
- Ambient conditions for the design of all thermal loads and selection of equipment:
    - Winter
        - -3 ° C dry bulb
        - -3 ° C wet bulb
    - Summer
        - CIBSE Cardiff Design Summer Year ° C dry bulb
        - CIBSE Cardiff Design Summer Year ° C wet bulb
    - CIBSE Design Summer Year

- For the design and selection of heat rejection equipment:
  - Summer
    - 35 °C dry bulb
    - 20° C wet bulb
- An external ambient of -4° C shall be taken for the design of all frost coils.

**710.070 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

**710.090 ELECTRICAL WIRING:**

Where systems are specified as being maintained under fire conditions ensure wiring selected is suitable for the temperatures to be encountered.

**710.100 ELECTRICAL SUPPLY CHARACTERISTICS:**

The characteristics of the electrical supply or supplies:

- Nominal voltage(s) 230 V / 400V ± 6%.
- Nature of the current and frequency 50Hz
- Confirm with the Supply Authority before ordering any equipment dependent upon voltage or frequency.
- Ensure all electrical equipment supplied and installed is suitable for the power supply indicated.

**710.110 STANDARDS AND REGULATIONS:**

- Unless stated otherwise the Works shall comply with the appropriate current British Standard (BS) or Code of Practice (CP) and where no BS or CP is applicable comply with
  - the Agreement Certificate for the particular item.
  - CIBSE recommendations and guides to current practice.
  - BS 7671 Requirements for Electrical Installations
  - Guidance published by IEE and IET.
  - Building Regulations.

- Ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed in the same location.
- All product and materials shall have product conformity certification (e.g. BSI Kitemark, BSI Safety Mark or CARES scheme) or product approval (e.g. British Board or Agreement Certificate)
- All products must have the recognised 'CE' mark attached.
- In the absence of specific design, performance or installation standards being stated seek the instructions of the CA prior to commencement of the Works and with adequate time so as not to cause delay.
- When new editions, versions and amendments are published during the construction, seek the instructions of the CA with respect to any modifications or changes necessary.
- References to BSI documents shall be to the versions and amendments listed in the British Standards Catalogue and in subsequent issues of BSI Update Standards up to
    - one month prior to the tender issue date.

**710.130 ELECTROMAGNETIC COMPATIBILITY:**

- Ensure 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, BS 6651.
- Ensure all equipment meets the requirements of the appropriate electromagnetic compatibility standard.
- Ensure all apparatus covered by the Wireless Telegraphy Act meets regulations issued by the Radiocommunications Agency.
- Ensure all equipment and systems meet the requirements of BS 6701 and BS EN 41003.
- Ensure that all cable installations meet the minimum guidance separation in EMC of Installations and Recommended Cable Separations, published by the ECA.

**710.150 ATEX DIRECTIVE:**

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

Equipment meeting the requirements of the Directive shall have the CE symbol clearly affixed to indicate compliance

All equipment, protective systems and components must bear the specific marking of explosion protection as required by the ATEX Directive 94/9/EC in addition to the CE marking.

**710.160 FACILITIES FOR REMOVAL OF EQUIPMENT:**

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

**710.170 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.

**710.180 EU DECLARATION OF CONFORMITY:**
Provide an EU Declaration of Conformity prior to delivery to site.

- As requested by the CA

The declaration shall state the following as a minimum:

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

## 720.000 BUILDERS WORK

**720.010 BUILDERS WORK PROVIDED:**

- Where structural and/or architectural facilities or provisions, for engineering services are already indicated check that these are correct, satisfactory and adequate for the purpose and confirm same in writing to the CA.

  Timescale:

  - Within weeks of the award of contract (no) 4

- Where the preliminary builder's work facilities issued prior to the award of contract are not correct or insufficient advise the CA immediately and obtain further instructions.
- Where alternative equipment or materials has been offered that the CA has accepted and which subsequently varies the works in any way whatsoever, then undertake the redesign of the associated builder's work.

**720.020 BUILDER'S WORK RESPONSIBILITIES:**

- Provide fully dimensioned drawings showing both size and position of builder's work making due reference to the structural engineering and architectural final dimensioned detailed drawings.
- As approved by the CA Mark out on site, all cut holes and chases required, any pockets cast in concrete, any inserts, any built in sleeves or similar items.
  - All builders work information shall be provided to comply with the programme and include sufficient time for the necessary approvals.

**720.040 MARKING OUT OF BUILDER'S WORK HOLES ON SITE:**
Mark out on site actual locations of minor non-structural holes through walls, partitions, floors, etc and also chases in non fair-faced walls and the like in preference to providing drawings of such builder's work requirements.

**720.050 BUILDER'S WORK INFORMATION TO BE PROVIDED:**

- All builder's work drawings shall be fully dimensioned.
- Builder's work drawings to be provided shall be as follows:
- Details of all bases for plant formed in concrete, brickwork or blockwork
- Details of all attendant builders work, holes, chases, etc. for conduits, cables and trunking etc. and any item where access for a function of the installation is required
- Details of all types of purpose made brackets for supporting service or plant/equipment
- Details of all accesses into ceilings, ducts, etc.
- Details and dimensions of any cast in conduits or ducts within the concrete floor slabs.

**720.060 STRUCTURAL STEELWORK:**

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

**720.070 PRE-CAST CONCRETE:**

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

**720.080 SECONDARY STEELWORK:**
The Contractor shall include in his tender for the supply and installation of all steelwork required to support the services from the primary structure within his works package unless specifically detailed as the responsibility of the Main Contractor on the drawings provided with this package.

## 740.000 COMMISSIONING AND TESTING

**740.010 DEFINITIONS:**
Where used in the documentation the following definitions shall apply and shall be interpreted as such:

- Commissioning: The advancement of an installation from the stage of static completion to working order to the specified requirements

- Testing: The measurement and recording of specified quantifiable characteristics of an installation or parts thereof and includes off site testing.
- Setting to work: The process of setting a static system in motion
- Regulation: The process of adjusting the rates of fluid flow in a distribution system to achieve specified values
- Environmental testing: The measurement and recording of internal environmental conditions
- System proving: the measuring, recording, evaluating and reporting on the seasonal performance of the systems against their design values
- System demonstration: Demonstrating the capability of the installation to achieve and maintain the specified performance criteria
- Fine-tuning: The adjustment of the system where usage and system proving has shown such a need and includes the re-assessment of design values and control set points to achieve the required system performance.

**740.020 PROGRAMME:**
Refer also to section 1.2 Soft Landings, which describes the entire commissioning and pre commissioning requirements in greater detail. Prepare comprehensive programmes for the pre-commissioning checks, setting to work, testing, commissioning, system proving and environmental testing of the contract works.

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

Review and update the commissioning programme at agreed intervals and if necessary revise and amend the programme to suit the progress of the contract works.

- Due account shall be taken of any phasing requirements.

**740.040 COMMISSIONING AND TESTING:**
Refer also to section 1.2 Soft Landings, which describes the entire commissioning and pre commissioning requirements in greater detail. Appoint an "approved" engineer to supervise and coordinate the whole of the testing, commissioning, and instruction of client's staff.

Compile a separate and comprehensive testing and commissioning programme, coordinated with the main project programme. Issue to the CA for comment at least 1 month prior to the testing and commissioning commencement date.

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

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

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

The CA will only witness testing and commissioning results once it has been confirmed by the Contractor, in writing, that satisfactory results have been achieved. The purpose of witnessing by the CA is to confirm recorded results and determine if the specified requirements have been satisfied, and in no way relieves the Contractor of their responsibilities under the Contract. If following test or inspection any system or plant item

is shown to be defective or not conforming to the specification the CA will reject such defective parts, and after rectification by the Contractor may wish to re-inspect the system or systems involved.

Provide all the necessary labour and facilities to enable tests to be witnessed and inspections carried out on site and/or at manufacturer's works. Provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities. Allow for all the costs incurred.

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

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

Ensure all requirements such as cleanliness, protection from harmful external and internal elements etc. are provided prior to commencement of commissioning.
Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust, as necessary, to meet the specified design requirements.

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

Provide test equipment subject to a quality assurance procedure complying with BS 5781

Do not start system demonstration 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 review by the CA before any system is offered for final acceptance.

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

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.

Only after a successful demonstration to the CA will the Contractor be able to commence staff training.
The lift installation is to be demonstrated by the installer to the employers' insurers.

**740.050 STATIC TESTING:**
Progressive static testing shall include the following tests, but other tests may be required and witnessed:

- Insulation resistance
- Earth fault loop impedance
- Earth continuity
- Pressure testing of hydraulic systems
- Air leakage testing of ductwork systems

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

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

Timescale:

- days prior to test (no) 7

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

All necessary notices shall be displayed.

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

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

**740.065 BUILDING REGULATIONS COMMISSIONING PLAN:**
As required by Part L2 of the Building Regulations 2010, Section 2 clauses 2.5 to 2.7 inclusive, it is the Contractors responsibility to demonstrate that the building services installations have been installed, inspected and commissioned in accordance with the requirements of Part L of the Building Regulations.

As part of showing compliance the Contractor is to provide a "commissioning plan" (as defined in clause 2.6(a) of Part L2) and a "commissioning report" (as defined in clause 2.6(b) of Part L2) detailing that the inspection and commissioning activities necessary to establish that the Works complies with Part L have been completed to a reasonable standard. It is for the Contractor is to demonstrate to the local Building Control office that the person(s) providing this report are suitably qualified. This plan is to be available prior to Practical Completion. (Note: this clause is not relevant to Works, or those parts of the Works, classed as domestic dwellings under Part L1 of the Building Regulations).

**740.140 BMS WITNESSING REQUIREMENTS:**
- The CA or nominated representative will implement the following witnessing requirements.
- Ensure that on-site commissioning staff facilitate the following witnessing process.
    - The BMS hardware is installed in accordance with the requirements as stated elsewhere.
    - Verify any operator software and associated graphics.
    - Witness completely the control of any main and/or critical items of plant along with a random sample of other points.
    - 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.

- Verify the handover of all operating manuals and system documentation.
- Verify the completion of any specified system operator training.

**740.150 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.
  - 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.

**740.160 ROTATING EQUIPMENT:**
Immediately prior to practical completion adjust, ease and lubricate moving parts as necessary to ensure easy and efficient operation.

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

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

**740.170 SEASONAL COMMISSIONING**
Seasonal commissioning of the building is required. The Contractor shall include for the cost of testing of all of the building services under full load conditions i.e. heating equipment in midwinter and cooling/ventilation equipment in mid-summer, and under part load conditions in spring/summer. Where applicable, testing should also be carried out during periods of extreme (high or low) occupancy.

The Contractor shall carry out interviews (over the course of one day minimum) with building occupants, including FM staff, after 3 months of occupancy to identify problems or concerns regarding the effectiveness of the systems including controls interfaces, and carry out modifications as necessary to improve both system performance and usability.

At the end of the 12 month period, the Contractor shall re-commission systems (following any work needed to serve revised loads) and incorporate any of the required revisions into the operating procedures within the O&M manuals.

## 800.000 DRAWING DEFINITIONS

**800.010 GENERAL:**
This section defines each of the main drawing types and outlines the extent and content of drawn information.

**800.020 THE TENDER DRAWINGS:**
Drawings produced to enable those tendering to interpret the design and to submit a tender for executing all or any part of the Works as defined elsewhere.

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

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

**800.040 DETAILED SCHEMATICS::**
Line diagrams describing the interconnection of components in a system and showing the engineering principles. The main features of a schematic drawing are as follows

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

- volumetric flow rates.
- design total pressure losses at equipment.
- location of dampers.
- location of valves and flow measuring stations.
- electrical fault levels.
- current ratings.
- short circuit capacities and tripping times.

**800.050 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:

The design is completed in building information modelling (BIM) Autodesk Revit MEP software to the Project BIM Strategy documents requirements for detailed design which may differ to those below which primarily refer to the paper output drawings:

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

**CO-ORDINATED WORKING DRAWINGS**
Drawings showing the inter-relationship of two or more engineering services and their relation to the structure and building fabric.

Complete the design in building information modelling (BIM) Autodesk Revit MEP software to the Project BIM Strategy documents requirements for co-ordinated working drawings which may differ to those below which primarily refer to the paper output drawings:

The main features of co-ordinated working drawings are:

- Plan layouts to a scale of at least 1:50, accompanied by cross-sections to a scale of at least 1:20 for all congested areas.
- The drawings should make allowance for installation working space and space to facilitate commissioning and maintenance.

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

**800.070 INSTALLATION DRAWING:**
A drawing based on the detailed drawing or co-ordination drawing with the primary purpose of defining that information needed by the tradesman on site to install the works.

Complete the design in building information modelling (BIM) Autodesk Revit MEP software to the Project BIM Strategy documents requirements for installation drawings which may differ to those below which primarily refer to the paper output drawings:

The main features of installation drawings should be as per co-ordinated working drawings plus:

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

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

**800.120 RECORD DRAWING:**
Drawing showing the building and services installations as installed at the date of practical completion.

Complete the design in building information modelling (BIM) Autodesk Revit MEP software to the Project BIM Strategy documents requirements for record drawings which may differ to those below which primarily refer to the paper output drawings:

The main features of the paper record drawings should be as follows.

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

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

**800.150 BUILDER'S WORK DETAILS**
Drawing to show requirements for building works necessary to facilitate the installation of the engineering services.

Unless stated or agreed with the CA the following builder's work details can be marked out on site:

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

Builder's work drawn information to be provided shall include:

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

**800.170 PLANTROOM SCHEDULES AND SCHEMATICS:**
Provide good quality plant and switch room drawings, schedules, schematics and instructions and hang in the respective plant room or any other appropriate location or where directed by the CA.

Protect surfaces of such information by

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

Hang using suitable fixings and provide backboards if necessary

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

- Schematic drawings of circuit layouts showing:
    - Location, identification and duties of equipment.
    - Location of controls devices.
    - Circuit layout.
- Valve schedules in the form of printed sheets showing the number, type, location, application/service and symbol, and normal operating position of each valve.

- Control schematics.
- Location of mechanical and electrical plant and equipment items.
- First aid instructions for treatment of persons after electric shock.
- Location of isolating switch for electricity supply.
- Location of main incoming gas valve serving gas meter and isolation point.
- Location of main incoming water main and isolation point.
- Location of sprinkler fire main control valve.
- Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
- All other items required under Statutory or other regulations.

## 810.000 RECORD DOCUMENTATION

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

- The Project BIM directory Standards
- BS 4737 and BS EN 50131-1 - Intruder alarm systems.
- BS 5839 - Fire detection and alarms in buildings.
- BS 6651 - Protection of structures against lightning.
- BS 7671 - Requirements for electrical installations.(IEE Wiring regulations)
- BS EN 12170 - Heating Systems with a trained operator
- BS EN 12171 - Heating Systems not requiring a trained operator
- Building Regulations (Approved Document Part L2)
- BS EN 13015 and as stated in the system specification section X10.

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

**810.020 RECORD DOCUMENTS:**
Provide:

- Record drawings and schedules.
- Plant room and switch room drawings, schedules and schematics.
- Operating and maintenance manuals.
- Blank maintenance logs.
- Log books

  - in compliance with the Building Regulations.
  - in accordance with CIBSE TM 31.
- Ensure record documents clearly record the arrangements of the various sections of the Works as actually installed and identify and locate all component parts.
- Ensure record documents make it possible to comprehend the extent and purpose of the Works and the method of operation thereof.
- Ensure record documents set out the extent to which maintenance and servicing is required and how, in detail, it should be executed.
- Ensure record documents provide sufficient, readily accessible and proper information to enable spares and replacements to be ordered.
- Correlate record documents so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.
- Demonstrate as required throughout the execution of the contract works that complete and accurate records are being maintained and that the record documents are being progressively compiled as the work on site proceeds.
- Ensure that building log books contain all the information necessary to comply with the Building Regulations Approved Document Part L2.

**810.030 RECORD DRAWINGS AND SCHEDULES:**

- Prepare record drawings and schedules based on the As Installed Drawings maintained on site during the progress of the contract works.
  - The scale of the drawings shall be not less than the scale at which the design or installation drawings were produced.
- Each record drawing shall show the following information:
  - The name of the contract and, where appropriate, the zone or floor designation.
  - Description of drawing, drawing reference and scale.
  - Name and address of the installer and the consultant.
- Endorse all such documents
  - 'Record drawings'
- Where agreed with the CA certain detailed information may be provided in schedule form.
- Where portions of the work are to be concealed, draft copies of record drawings shall be supplied to the CA before the work is concealed in order to facilitate checking and examination.
- Prepare electrical drawings in accordance with BS EN 61082.
- Issue at practical completion the complete approved package of record drawings in the following numbers and format:
  - Revit and CAD format on 2 No DVD disk. Each DVD shall be labelled and the DVD jewel cases shall be labelled identifying project title, issue date and index of contents.
    - Number of sets of complete record drawings (no) 2

- 'White' prints.
    - Number of sets of complete record drawings (no) 2
- Provide reduced scale copies for inclusion in the operating and maintenance manuals as stated elsewhere.

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

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

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

**810.040 PLANT ROOM AND SWITCH ROOM DRAWINGS, SCHEDULES AND SCHEMATICS:**
Provide good quality plant and switch room drawings, schedules, schematics and instructions and hang in the respective plant room or any other appropriate location or where directed by the CA.

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

- Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
- Location of metering facilities.
- All other items required under Statutory or other regulations.
- Prepare electrical drawings in accordance with BS EN 61082.

**810.060 PRESENTATION OF THE OPERATING AND MAINTENANCE MANUALS:**

- Agree format and contents with the CA.
- Provide the operating and maintenance manuals in the following form:
    - Encase the manuals in A4 size, plastic-covered, loose leaf, four ring binders with hard covers, each indexed, divided and appropriately cover- titled. Fold drawings larger than A4 and include in the binder so that they may be unfolded without being detached from the rings.
    - Electronic format stored on CD/DVD
- Provide copies of the operating and maintenance manual as follows:
    - Draft copies for comment (no) 1
    - Final copies for Client use (no) 3
- Provide a draft copy of the operating and maintenance manual to the CA for comment

  Timescale:

    - Weeks before the contract completion date (no) no less than 6
- The draft copy of the manual shall conform to the final format required by the specification to enable all relevant comments to be made by the CA.
- Although it will not be necessary for the draft copy to contain testing and commissioning certificates, it will be complete in every other way.

**810.070 OPERATING AND MAINTENANCE MANUALS:**

The operating and maintenance manuals must include:

- A full description of each of the systems installed, written to ensure that the Employer's staff fully understand the scope and facilities provided.
- A description of the mode of operation of all systems including services capacity and restrictions.
- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- A photo-reduction of all record drawings together with an index. Reduced size of drawings to be A3
- Legend of all colour-coded services.
- Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.
- The name, address and telephone number of the manufacturer of every item of plant and equipment together with catalogue list numbers.

- Manufacturer's technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.
- A copy of all test certificates, inspection and test Records, commissioning and performance test records including, but not limited to, electrical circuit tests, corrosion tests, type tests, start and commissioning tests, for the installations and plant, equipment, valves, etc., used in the installations.
- A copy of all manufacturer's guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturers.
- Copies of insurance and inspecting Authority certificates and reports.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.
- Procedures for seasonal change-overs and/or precautions necessary for the care of apparatus subject to seasonal disuse.
- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- Details of lubrication for lubricated items including schedules of lubricant type, frequency, etc.
- Details of regular tests to be carried out (e.g. water analysis for pseudonomas.)
- Details of procedures to maintain plant in safe working conditions.
- Details of the disposal requirements for all items in the works.
- A list of normal consumable items.
- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- A list of any special tools needed for maintenance cross-referenced to the particular item for which required.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.
- Hospital Operational Policy.
- Back-up copies of any system software.
- Documentation of the procedures for updating and/or modifying software operating systems and control programmes.
- Instructions for the creation of control procedure routines and graphic diagrams.
- Details of the software revision for all programs provided.
- Two back-up copies of all software items, as commissioned.
- Copies of relevant HSE/CIBSE/IET Guidance notes etc.
- Contractual and legal information including but not limited to

- details of local and public authority consents
- details of design team, consultants, installation contractors and associated subcontractors
- start date for installation, date of practical completion and expiry date for the defects liability period
- details of warranties for plant and systems including expiry dates, addresses and telephone numbers.

- A provision for update and modification.

## 900.000 COMPLETION AND HANDOVER

**900.010 GENERAL:**
This section details the requirements and procedures for completion and handover.

**900.015 PRODUCTION OF HANDOVER INFORMATION:**
The Contractor is to comply with the requirements of Appendix A Table E "Production of Handover Information" as well as the following clauses.

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

- All the contract works are complete.
  - With the exception of minor snags or limited defects as agreed with the CA that could be reasonably completed within an agreed programme without causing disruption to the Employer's use of the building or part thereof.
- All spares, keys, tools and other consumables as stated elsewhere have been supplied and handed over to the Employer.
- The instruction of the Employer's staff in the use and correct operation of the installation has been completed satisfactorily. In particular, safety devices and controls demonstration.
- All commissioning and testing completed and signed off by reviewer
  - including the issue of a final commissioning report signed by an approved competent person
- A complete demonstration of the contract works with fully functional operational controls tested has been undertaken in the presence and to the satisfaction of the CA.
- All necessary certification by the Employer's insurers has been completed.
- All approved record documentation including record drawings, operation and maintenance manuals, etc is issued
- All information required for the health and safety file is issued to the satisfaction of the Planning Supervisor.

  The information shall include:

  - A written description of plant operation.
  - Basic security access to the system.

  - Comprehensive instructions for switching on, operation, switching off, isolation, fault finding and procedures for dealing with emergency conditions.
  - Instructions for any precautionary measures necessary.
- All necessary Statutory Authority approvals have been undertaken and written confirmation established
- Completion and issue of log books in accordance with Building Regulations.
  - in accordance with CIBSE TM31 Building Log Book Toolkit (standard templates)
  - It should be noted that this log-book is in addition to the Operating & Maintenance Manuals and is to be issued as a separate document. The log-book is in effect a summary of the O&M manuals suitable for day-to-day use by the building managers/users.
- Air permeability test certificate in accordance with Building Regulations.
- Should adequate record documentation not be available Practical Completion will not be granted.

**900.040 RECOMMENDED SPARE PARTS:**
Before Practical Completion submit to the CA a schedule of spare parts as stated elsewhere and recommend any that should be obtained and kept in stock by the Employer for maintenance of the installations included in the Works.

Time scale

- 4 weeks before Practical Completion

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

**900.060 RECOMMENDED TOOLS:**
Prior to Practical Completion submit to the CA a schedule of tools and portable instruments as stated elsewhere and recommend any that should be obtained and kept in stock by the Employer for maintenance of the installations included in the Works.

Time scale

- 4 weeks before Practical Completion

**900.080 INSPECTION BY EMPLOYER'S INSURERS:**
Where indicated elsewhere installations, equipment, plant or materials are to be inspected by a representative acting for the Employer's insurers.

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

- Inform the CA when the installation or equipment is ready for examination
- Provide a programme for the inspection and certification by the Employer's insurers.
- All necessary information shall be provided to enable the insurers to approve the design before manufacture.

- Arrange for the attendance of the insurance company's representative at agreed stages of manufacturer and installation.
- All necessary attendance, access and facilities for inspecting and testing as is required shall be provided.
- Certification shall have been received from the insurers before equipment or installations subject to inspection and certification will be accepted on behalf of the Employer.

**900.090 TRAINING OF EMPLOYER'S STAFF:**
Prior to 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 staff.
- to the operational staff.

Submit to the CA for approval a detailed programme for the training of the Employer's staff as also set out in Section 1.2 *Soft landings*.

Time scale

- Weeks before commencement of training (no) 4
- Provide each person with a comprehensive set of teaching notes and diagrams.
- Be responsible for the correct operation and maintenance of the installation during such periods of instruction.
- All costs associated with the instruction of the Employer's personnel and required attendance following practical completion shall be included in the contract price.

Training

- Number of persons to be included for training is to be detailed in the SLC training programme.
- 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.
- Number of days - As detailed in the SLC training programme.

Provide training for the operation of the controls, monitoring or BMS installations as follows.

- Carry out initial training at the works of the controls supplier.
- Include hands on experience of equipment and software similar to the installation.
- Include instruction on the procedures for testing and routine inspection of sensors and actuators to enable the operator to assess the nature of faults and extent of remedial action required.
- Provide all appropriate reference and training manuals.
- Complete initial instruction prior to commissioning of the installed system.
- Provide site instruction on the installed system.
- Include for training operating staff as to be detailed in the SLC training programme, no less than 2 persons.

- 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.

  •Number of days - As detailed in the SLC training programme.

**900.100 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 withholding payment or other means deemed appropriate.

**900.110 PROVING PERIOD AND FINE TUNING:**
Requirements for the mechanical works contract:

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

Over this period, provide monthly reports on the performance and operation of the controls system including observations and proposals for remedial works and/or refinement of the control strategy, this is to be included as part of the monthly checks against the building energy performance . Adjust and fine-tune the controls to optimise performance. Carry out any software modifications instructed by the Services Engineer (Max Fordham LLP).

Carry out further client training/demonstrations if necessary. Up-date controls O&M Manuals as and if necessary.

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

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

Requirements for the electrical works contract:

In conjunction with the lighting controls supplier/specialist, under take post-occupancy checks of the lighting controls system at 3 month intervals over the first 12-month period of operation following Practical Completion.
Adjust and fine-tune the operation of the lighting controls (including interfaces with other systems if necessary) to correct and optimise their performance. Carry out further client training/demonstrations if necessary.

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

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

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

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

## 910.000 MAINTENANCE

**910.030 PROVISION FOR 12 MONTHS MAINTENANCE:**
From the date of Practical Completion, for a period of 12-months, maintain all the major installed plant and equipment in accordance with the manufacturer's recommendation and instructions in order to ensure that the terms and conditions of the warranties and/or guarantees provided by the manufacturers/suppliers concerned are not invalidated. Plant and equipment to include, but not limited to, the following:

-boilers;
-heat pumps and chillers (water to water & air to water)
-pump sets;
-air handling units;
- fans;
- pressurisation plant;
- hot water production plant;
- electromagnetic water conditioners;
- security and CCTV equipment;
- fire alarm equipment; and
- access control equipment.

- PV equipment
- lift
Provide a list of the equipment to be maintained in this way under their warranties with the tender return.

Allow for liaising with the employer during this period.
In addition to the above, and if required by the Employer/CA, provide a supplementary proposal for an annual maintenance contract for all services installations. The proposal should set out the terms of the offer, the work to be carried out, the guarantees of performance, emergency response times, and the price. Discuss requirements and terms & conditions with Employer prior to submitting offer.

The maintenance works shall be in accordance with the recommendations set out in the appropriate standard. The maintenance works shall include:

- planned preventative maintenance to maintain the installations in efficient working order including routine checks, adjustments, lubrication and replacement of consumable spares, etc.
- preparation of work schedules and recording activities.
- providing breakdown and emergency cover.
- planning and undertaking shut-downs for maintenance works.
- employing of all necessary specialist maintenance .

- attendance on and supervision of specialist maintenance.
- carrying out all necessary safety checks .
- liaison with the employer.

Emergency maintenance response time shall be no more than 4 hours.
Emergency response time if a person is trapped in a lift shall be no more than 1 hour.
No longer than 4 weeks prior to Practical Completion submit to the CA a detailed planned preventative maintenance programme for the works and a method statement outlining how the maintenance works is to be undertaken including any necessary specialist maintenance.

# APPENDIX A

## 1.2 Design, Commissioning & Handover Information Responsibilities

Note: This appendix only contains Tables C, D & E.

**Allocation of Design Responsibilities**

TABLE C: THE CONTRACTOR CARRIES OUT THE DESIGN

The Contractor is to carry out the whole of the design and drawing production for the Works or specialist elements described within the tender documentation.

| **TABLE C** | **DESIGN & DRAWING PRODUCTION ACTIVITIES** | | | | |
|---|---|---|---|---|---|
| **Design Activity** | | **Responsibility** | | | **Comments** |
| | | **MFLLP** | **Cont'r** | **Other** | |
| C1 | Prepare proposals for the installations for the agreement of the CA. Investigate the options available and describe the performance that can be achieved. | | ✓ | | |
| C2 | Prepare and develop, to a form agreed with the CA, the Sketch & Detailed Design Drawings. | | ✓ | | |
| C3 | Design and detail the installations as part of the overall co-coordinated building design allowing for every stage of the design to be brought to a successful conclusion by the process of repeated refinement until it is clear that the Installation and Coordination Drawings can be completed. | | ✓ | | |
| C4 | Provide copies of calculations if requested by the CA. | | ✓ | | |
| C5 | Provide copies of any risk assessments undertaken in compliance with the requirements of Regulation 13 of the Construction (Design and Management) Regulations 1994. | | ✓ | | |
| C6 | Negotiate and agree all details with regulatory bodies as necessary. | | ✓ | | |
| C7 | Negotiate and agree all details with the Statutory Authorities as necessary | | ✓ | | |
| C8 | If appropriate, meet with Building Control and provide the CA with written confirmation of | | ✓ | | |

| TABLE C | DESIGN & DRAWING PRODUCTION ACTIVITIES | | | | |
|---|---|---|---|---|---|
| **Design Activity** | | **Responsibility** | | | **Comments** |
| | | **MFLLP** | **Cont'r** | **Other** | |
| | the various stages including detailed Building Control Approval for the installations proposed, prior to construction. | | | | |
| C9 | Modify the design and/or an installation, should the installation not meet the specification and/or agreed proposals, Statutory requirements, etc. | | ✓ | | |
| C10 | Production of Drawings. | | | | See Preliminaries for definitions and BRSIA TN22/97 for example drawings. |
| | Sketch Drawings | | ✓ | | |
| | Schematic Drawings | | ✓ | | |
| | Detailed Design Drawings | | ✓ | | |
| | Coordination Drawings | | ✓ | | Services co-ordination is to be managed by the Mechanical Contractor (see Preliminaries clause 100.070). |
| | Installation Drawings | | ✓ | | Co-ordination of the Installation Drawings is to be managed by the Mechanical Contractor (see Preliminaries clause 100.070). |
| | Installation Wiring Diagrams | | ✓ | | |
| | Manufacturer's Drawings | | ✓ | | |
| | Manufacturer's Certified Drawings | | ✓ | | |
| | As-installed Drawings | | ✓ | | To be marked up on site as the work proceeds. |
| | As-installed Drawings | | ✓ | | |
| | Record Drawings | | ✓ | | |
| | Builder's Work Drawings | | ✓ | | Co-ordination of the Builder's Work Drawings is to be managed by the Mechanical Contractor (see Preliminaries clause 100.070). |
| | Specialist Drawings | | ✓ | | |
| C11 | Spatial Co-ordination (i.e. overall responsibility for resolving difficult spatial clashes) | | ✓ | | Process to be managed by the Mechanical Contractor (see Preliminaries clause 100.070). |
| C12 | Confirmation of plant or system sizing. | | ✓ | | |
| C13 | On-site Co-ordination. | | ✓ | | Process to be managed by the Mechanical Contractor (see Preliminaries clause 100.070). |
| C14 | System Compatibility Confirm the compatibility of | | ✓ | | |

| TABLE C | DESIGN & DRAWING PRODUCTION ACTIVITIES | | | | |
|---|---|---|---|---|---|
| Design Activity | | Responsibility | | | Comments |
| | | MFLLP | Cont'r | Other | |
| | plant/equipment specified for use within the same system or where an interface is required between systems. | | | | |

**Allocation of Commissioning Responsibilities**

| TABLE D | SPECIFYING SYSTEM COMMISSIONING ACTIVITIES | | | | |
|---|---|---|---|---|---|
| Design Activity | | Responsibility | | | Comments |
| | | MFLLP | Cont'r | Other | |
| **Design** | | | | | |
| D1 | Ensure that the selected systems will meet the employer's brief and that their commissioning requirements are compatible with any project restraint concerning sectional handover/phasing. | | ✓ | | |
| D2 | Identify and incorporate into system designs the essential components and features necessary to enable the proper preparation and commissioning of building services. | | ✓ | | |
| D3 | Review all designs to ensure that systems can be properly prepared, and are commissionable. | | ✓ | | |
| D4 | Prepare the commissioning specification. | | ✓ | | |
| **Management** | | | | | |
| D5 | a) Produce a commissioning method statement and logic diagram for integration into the building contractor's construction and finishes programmes.<br>b) Produce a "commissioning plan" as required by Part L2 of the Building Regulations. | | ✓<br>✓ | | It is for the Contractor is to demonstrate to the local Building Control office that the person(s) providing this report are suitably qualified.<br>See Preliminaries clause 740.065. |
| D6 | Produce a flushing, chemical cleaning and water treatment method statement, logic diagram and programme for integration into the building contractor's construction, | | ✓ | | |

| TABLE D | SPECIFYING SYSTEM COMMISSIONING ACTIVITIES | | | | |
|---|---|---|---|---|---|
| Design Activity | | Responsibility | | | Comments |
| | | MFLLP | Cont'r | Other | |
| | commissioning and finishes programmes. | | | | |
| D7 | Attend commissioning meetings as necessary OR Arrange and chair commissioning meetings as necessary. | | ✓ | | |
| D8 | Comment on the adequacy of systems for commissioning as detailed on specialists' drawings and manufacturers' shop drawings prior to actual manufacture at works. Ensure comments are incorporated into finished products. | | ✓ | | |
| D9 | Carry out site inspections, to ensure that the commissioning facilities are being installed. Check compliance with specified guides and standards. | | ✓ | | |
| D10 | Monitor the on-going progress of the procurement, manufacture, installation and commissioning of all plant items. | | ✓ | | |
| D11 | Assess the effects of any anticipated delays to the services installation and the completion of interfaces with the building works critical to the commissioning programme. Formulate strategies to overcome potential delays. | | ✓ | | |
| D12 | Establish an agreed set of pro forma documentation relating to the commissioning and testing of plant and systems. | | ✓ | | Issue to MFLLP for comments. |
| D13 | Approve the proposed set of instruments of the commissioning and testing works. | | ✓ | | |
| D14 | Ensure that the instrumentation is periodically calibrated as necessary and records retained. | | ✓ | | |
| D15 | Witness the flushing, cleaning and treatment of systems in accordance with the specification. | ✓ | ✓ | | Contractor is to be fully satisfied with the pre-commissioning cleaning before inviting MFLLP to witness. |

| TABLE D | SPECIFYING SYSTEM COMMISSIONING ACTIVITIES | | | | |
|---|---|---|---|---|---|
| **Design Activity** | | **Responsibility** | | | **Comments** |
| | | **MFLLP** | **Cont'r** | **Other** | |
| D16 | Witness pre-commissioning activities in accordance with the specification. | ✓ | | | |
| D17 | a) Commission all systems to methods, logic and programme (see 4.5) and record results. | | ✓ | | |
| | b) Witness specified demonstration of system commissioning results. | ✓ | ✓ | | Contractor is to be fully satisfied with the commissioning results before inviting MFLLP to witness. |
| D18 | Witness and record the specified demonstration and testing of plant items and systems in accordance with the specification. | ✓ | ✓ | | Contractor is to be fully satisfied with the commissioning results before inviting MFLLP to witness. |
| D19 | Establish procedures to allow the demonstration of normal emergency, shutdown and standby mode operation of plant and systems. | | ✓ | ✓ | "Other" = manufacturers or suppliers of plant items. |
| D20 | Witness demonstration of same to specified requirements. | ✓ | ✓ | | Contractor is to be fully satisfied with the demonstration results before inviting MFLLP to witness. |
| D21 | Demonstrate the partial load testing of plant to the employer and designer in accordance with the specification. | | ✓ | | |
| D22 | Witness the operation of the BMS on site to the specified requirements. | ✓ | ✓ | ✓ | "Other" = BMS Specialist Designer.<br>Contractor is to be fully satisfied that the performance of the BMS meets the requirements of the contract documents before inviting MFLLP to witness. |
| D23 | Witness the functional testing of all safety interlocks in accordance with the commissioning specification. | ✓ | ✓ | | Contractor is to be fully satisfied with the commissioning results before inviting MFLLP to witness. |
| D24 | Witness the demonstration of acoustic tests, if any, in accordance with the specification. | ✓ | ✓ | | Contractor is to be fully satisfied with the commissioning results before inviting MFLLP to witness. |
| D25 | Witness the operation of plant and systems for specified periods of time to prove plant reliability. | ✓ | ✓ | | |
| D26 | a) Produce commissioning | | ✓ | | |

| TABLE D | SPECIFYING SYSTEM COMMISSIONING ACTIVITIES | | | | |
|---|---|---|---|---|---|
| Design Activity | | Responsibility | | | Comments |
| | | MFLLP | Cont'r | Other | |
| | report detailing the results of the commissioning and commenting on the performance of systems.<br>b) Produce a "commissioning report" as required by Part L2 of the Building Regulations for submission to the local Building Control office. | | ✓ | | It is for the Contractor is to demonstrate to the local Building Control office that the person(s) providing this report are suitably qualified.<br>See Preliminaries clause 740.065. |
| D27 | Ensure that all plant settings are recorded, including appropriate reference to plant items. The records should be incorporated within the operating and maintenance manuals. | | ✓ | | |

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

**Production of Handover Information**

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

| TABLE E | PRODUCTION OF HANDOVER INFORMATION | | | | |
|---|---|---|---|---|---|
| **Design Activity** | | **Responsibility** | | | **Comments** |
| | | **MFLLP** | **Cont'r** | **Other** | |
| | manuals. Specify the section headings and required technical content of the manuals. | | | | |
| E6 | Prepare a specification for record drawings. Specify content, form of delivery and the method of production of the drawings to be produced. | | ✓ | | |
| E7 | Define what level of documentation, commissioning results and other information must be available prior to practical completion and handover. Take into account possible implications of phased handover and partial possession. | | ✓ | | In order to comply with the CDM Regulations the Contractor is to ensure that complete O&M information and Record Drawings are available to the employer prior to Practical Completion. |
| E8 | Produce operation and maintenance manuals in accordance with the specified requirements. | | ✓ | | |
| E9 | Ensure that information needed for inclusion in the operating and maintenance manuals is obtained as the works progress. Identify individual sources of information. | | ✓ | | |
| E10 | Establish target dates for when information must be available to the author of the operating and maintenance manuals. Advise on timescales for production of maintenance information relative to key dates i.e. installation start date, setting to work, start dates for testing and commissioning and handover dates. | | ✓ | | |
| E11 | Monitor the programme for production of operating and maintenance manuals and adjust dates to allow for progress of the project. | | ✓ | | |
| E12 | Receive, inspect and comment on the contents of the operating and maintenance manuals in order to confirm general compliance with the | ✓ | ✓ | | The Contractor is to inspect and comment on the manuals where produced by others on their behalf prior to submission to MFLLP. |

| TABLE E | PRODUCTION OF HANDOVER INFORMATION | | | | |
|---|---|---|---|---|---|
| **Design Activity** | | **Responsibility** | | | **Comments** |
| | | **MFLLP** | **Cont'r** | **Other** | |
| | specified requirements. | | | | The Contractor is to ensure that drafts of the O&M manual(s) are available for comment at least 3 months prior to Practical Completion. |
| E13 | Modify and update operating details to reflect commissioning results. | | ✓ | | |
| E14 | Accept the completed operating and maintenance manuals on behalf of the employer. | ✓ | | | |
| E15 | Identify key dates and intervals at which draft record drawings will be inspected. | | ✓ | | Contractor is to provide schedule of dates for the release of this information. |
| E16 | Modify the record drawings as the works progress so that all alterations from the installation drawings are recorded as work proceeds. | | ✓ | | Contractor is to ensure that the As-installed Drawings are maintained on site and updated as the work proceeds. The As-installed Drawings are to be made available for inspection when requested by the CA. |
| E17 | Receive, inspect and comment on the Record Drawings in order to confirm general compliance with the specified requirements. | ✓ | ✓ | | The Contractor is to inspect and comment on the record drawings where produced by others on their behalf prior to submission to MFllp. |
| E18 | Accept the completed record drawings on behalf of the employer. | ✓ | | | |
| E.19 | Prior to handover, make recommendations for the commencement and carrying out of operation and maintenance during and after the Defects Liability Period. | | ✓ | | When stated in the Preliminaries the Contractor is to provide a priced proposal for the maintenance of the installed services during the period concurrent with the Defects Liability Period within their contract price. |
| E20 | Provide the employer with a log-book as required by statute under Part L2 of the Building Regulations. | | ✓ | | |

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