Building Services Design
Consulting Engineers

The Corby Cube
George Street
Corby
NN17 1QG

161190 - T3
December 2016

MECHANICAL SERVICES SPECIFICATION FOR CORBY CUBE OFFICE FIT OUT

TENDER

1 Brisbane House, Corbygate Business Park, Priors Haw Road, Corby, Northamptonshire, NN17 5JG
Tel: 01536 403304 Fax: 01536 403838 www.bsd.co.uk
Email: sallyp@bsd.co.uk

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Specification Expert – Introduction

This document has been compiled using Specification Expert, which the copyright belongs to AMTECH Group.

The content incorporates that of the National Engineering Specification (NES).

NOTES FOR TENDERERS

Dependent on the nature of the works specified within this document, the specification shall contain some or all of the items below:-

1. PRELIMINARIES

The Preliminary clauses (‘A’ sections) included are those that relate to the Engineering Works in particular and must be read in conjunction with the "Preliminaries" of the "Main Contract".

2. SYSTEM SPECIFICATIONS

The system specifications are sub-divided into four parts:-

Part 1 System objectives:

The system objectives are clauses giving details of design information, system performance and description, together with lists of the system schematics and drawings.

Part 2 Selection schedules for the reference specifications:

These selection schedules specify items in the system that is contained in the Reference Specifications (Y group). Required Y group clauses are invoked by reference.

Part 3 Clauses specific to the system:

These specification clauses are specific to the system concerned and in general make no reference to the Y group clauses.

BS Appendix

The BS Appendix contains a list of all the British and European Standards referred to in the particular system specification.

3. APPENDICES

The appendices shall consist of some or all of the following:-

Tender Summary

A pricing schedule for the system specifications.

Equipment Schedules

Schedules for the equipment specified within the document.

Reference Specifications (Clauses from the Y Group).

All the reference specifications relevant to all the systems for the job. Required clauses are invoked in Part 2 (Selection schedules for the reference specifications) for each system.

4. NON-SPECIFICATION CLAUSES

User created, non Specification Expert, clauses may appear within the specification.

Project Revision Sheet

Mechanical Services Installation for New Office Fit Out of Corby Cube

161190

Revision T3

Date of issue 02/12/2016

Prepared by Sally Pope

Revision	Date	Details	Changes	Author	Checked
P1	02/12/2016	Preliminary Issue		Sally Pope	
T1	06/01/17	Tender Issue		Sally Pope	
T2	10/01/17	Tender Issue		Sally Pope	
T3	20/01/17	Tender Issue	Water boiler spec added	Sally Pope	

A10 PROJECT PARTICULARS

110.000 THE PROJECT
- Particulars of the project as a whole are
  - The internal remodelling of the forth floor of the Corby Cube building to create 4 new office spaces and a tea area.

120.000 THE EMPLOYER:
Corby Borough Council

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

DSPM Limited
The White House
Walton Road, Kimcote
Leicestershire
LE17 5RU
Contact: Gareth Davis
Tel: 01455 557522
Email: gareth.davis@corby.gov.uk

140.000 DESIGN TEAM:

Building Services Engineer
Building Services Design
1 Brisbane House
Corbygate Business Park
Priors Haw Road
Corby
Northamptonshire
NN17 5JG
Contact: Sally Pope
Tel. 01536 403 304
Email: sallyp@bsd.co.uk

170.000 SUBCONTRACTOR:
The term Subcontractor is used throughout this specification and is deemed to be synonymous with the term Subtrader and the like which may be used elsewhere within the Contract Documentation.

180.000 THE SUBCONTRACT:
This document has been prepared using the Common Arrangement of Sections and this Subcontract comprises the following
- Mechanical Services Installations
- Public Health Service Installations

190.000 MAIN CONTRACTOR:
TBC

A11 TENDER AND CONTRACT DOCUMENTS

110.000 THE TENDER DRAWINGS:
- The tender drawings are:

161190/M/1100 Mechanical Services Proposed Heating & Cooling Layout
161190/M/1200 Mechanical Services Proposed Domestic Water & Above Ground Drainage Layout
161190/M/1500 Mechanical Services Proposed Ventilation Layout

120.000 THE SUBCONTRACT DRAWINGS:
- The subcontract drawings are the same as the tender drawings.

140.000 THE PRE-TENDER HEALTH AND SAFETY PLAN:
- Details of the Pre-tender health and safety plan are included in the Main Contract Preliminaries.

150.000 INSPECTION:
Drawings and other documents relating to the Contract generally maybe inspected, by appointment, prior to the submission of tender.
- Engineering Services documents may be inspected at the offices of the Building Services Engineer
- As built documents may be inspected at the Facilities Management Office, within The Corby Cube.

A12 THE SITE EXISTING BUILDINGS

110.000 THE SITE / EXISTING BUILDINGS:
The site/existing buildings are:

- The site is located on the existing site of Corby Cube

120.000 SITE LOCATION:
The site is located at The Corby Cube Parkland Gateway George Street, Corby NN17 1QG

130.000 EXISTING MAINS / SERVICES:

- Existing mains/engineering services comprise Natural Gas, Mains Cold Water, Mains Electricity and Telecommunications

140.000 RISKS TO HEALTH AND SAFETY:
The accuracy and sufficiency of this information is not guaranteed by the Employer or the CA and the Subcontractor must ascertain for himself any information he may require to ensure the safety of all persons and the Works.
Comply with the requirements of the CDM Regulations by:-

- compiling risk assessments for the sub-contract works
- providing information on the sub-contract works which might affect the health or safety of any person.
- providing appropriate input to the Pre-Construction Information, Construction Phase Plan, and health and safety file for the works.

150.000 SURVEY:

- Ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the Works.
- Examine all available drawings of the engineering services and report any discrepancies to the CA.

170.000 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 Subcontract Works. Site visit may be made by the Subcontractor by prior agreement.

A31 PROVISION, CONTENT AND USE OF DOCUMENTS

100.000 DEFINITIONS AND INTERPRETATIONS

110.000 MAIN CONTRACT PRELIMINARIES:
Definitions and interpretations given in Main Contract Preliminaries apply to the whole of the Works, including this Subcontract. In the case of conflicting statements the Subcontract Preliminaries will prevail.

120.000 DEFINITIONS:
The definitions of technical terms associated with the engineering services installations are those included in:

CIBSE, IOP and 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.
Associated Statutory Acts.

Where used in the documentation the following definitions apply

- 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 within plant rooms, outdoors or unprotected within service or occupied areas.
- System: System means 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.
- Services: Services means the inclusion of one or more systems.

130.000 REFERENCES TO BSI DOCUMENTS:
References to BSI documents are to the versions and amendments listed in the British Standards Catalogue

- and in subsequent issues of BSI Update Standards up to and including that for the month of tender issue.
- any subsequent versions and amendments specifically referred to in the project documents.

140.000 MANUFACTURERS' REFERENCES:
Manufacturers' references are those current at tender issue.
References mean the particular product as specified in the manufacturer's technical literature current at that time.

150.000 TENDER DRAWINGS:
Tender drawings means drawings listed in

- the Main Contract Preliminaries

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

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

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

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

- A two dimensional layout drawing with divisions to show the distribution of the system between building levels. Or an isometric style layout indicating the distribution of systems across individual floor levels. The drawing is not necessarily constructed to scale. Include all functional components which make up the system, i.e. plant items, pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components.
- Symbols and line conventions in accordance with BS EN ISO 11091 Recommendations for symbols and other graphic conventions.
- Symbols and line conventions in accordance with
- Label the drawing with appropriate pipe, duct and cable sizes where these are not shown elsewhere.
- Indicate components which have a sensing and control function and show the links between them, e.g. building management systems, fire alarms and HV controls.
- Identify the major components indicated on the schematic drawing so that their whereabouts in specification and on other drawings can be easily determined.
- Commissioning specification

Include all data essential to testing and commissioning including volumetric flow rates, design total pressure losses at equipment, locations of dampers, valves and flow measuring stations, electrical fault levels, current ratings, short circuit capacities and tripping times.

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

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

Indicate on the drawing the space available for major service routing in both horizontal and vertical planes.

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

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

- Support the drawing with individual services drawings for clarity.
- Plantroom layouts to a scale of at least 1:20, accompanied by cross-sections and elevations to a scale of at least 1:20.

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

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

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

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

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

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

169.000 MANUFACTURER'S CERTIFIED DRAWING:
Drawing provided by a manufacturer or supplier to indicate details of the product, components or plant items and which the manufacturer or supplier guarantees the supplied equipment will comply with.

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

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

171.000 BUILDER'S WORK DRAWING:
Installation stage
- Drawing to show requirements for building works necessary to facilitate the installation of the engineering services (other than where it is appropriate to mark out on site).

180.000 CONTROLS LOGIC DIAGRAMS:
Diagrams, drawings and/or schematic details of all control components and instruments showing the layout with each item uniquely identified together with a description of the controls operation and details of the associated interlocking.

181.000 SWITCHGEAR, STARTER AND CONTROL INSTRUMENTATION PANEL DRAWINGS:
Drawings showing the construction and internal wiring diagrams of the starters, panels and/or other devices.

182.000 AS-INSTALLED DRAWINGS:
Drawings/records retained on site to record the progress of and any site modifications to the Works including any changes to software.

183.000 PLANTROOM SCHEDULES AND SCHEMATICS:
Frame the following under glass and hang in each plant room and any other appropriate location.
- Schematic drawings of circuit layouts showing identification and duties of equipment, numbers and locations, controls and circuits.
- Valve schedules in the form of printed sheets showing the number, type, location, application/service and symbol, and normal operating position of each valve.
- 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.
- 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.

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

200.000 DOCUMENTS PROVIDED ON BEHALF OF THE EMPLOYER

210.000 MAIN CONTRACT PRELIMINARIES:
Conditions given in Main Contract Preliminaries under the heading 'Documents provided on behalf of Employer' apply to documents relating to this Subcontract.

230.000 DRAWN AND OTHER INFORMATION:
Drawn information will be provided by the design team and client as follows.
- Sketch drawings
- Schematic drawings
- Detailed design drawings
- Builder's work information

300.000 DOCUMENTS TO BE PROVIDED BY SUBCONTRACTOR

311.000 PRODUCTION INFORMATION:
- Liaise with the CA, Contractor, Mechanical Services Sub-Contractor and others as necessary to help ensure co-ordination of the work with related building elements and services.
- Provide drawings and other information as specified showing such details of the work as the CA may reasonably require.

- Submit to the CA for comment, make any necessary amendments and resubmit for further comment unless the CA confirms that this is not necessary.
- Submit sufficient copies of final information to the CA for distribution to the Contractor and all affected parties.

313.000 CO-ORDINATION OF ENGINEERING SERVICES:
Co-ordination of the Engineering Services Installations will be carried out
- as part of the Mechanical Sub-Contract works
- under the direction of the Mechanical Sub-Contractor's appointed project manager – the Mechanical Sub-Contractor has responsibility for production of the detailed co-ordination drawings.

Agree principles of co-ordination with all parties concerned.
- Provide details for the Co-ordination Drawings, to be incorporated by the Mechanical Services Subcontractor.

Ensure the installation drawings make due allowance for all building elements, structure and other services.
- Prior to submission check and approve all drawings, schedules and any other information provided by manufacturers, nominated suppliers or specialist sub-subcontractors to ensure that all the requirements of the contract documentation have been incorporated. Accompany all documents submitted with a certificate indicating that they have been checked by the Subcontractor.

320.000 DRAWN AND OTHER INFORMATION:
Provide drawn information for the design team and client in the following forms:-

Initial copies for comment
- print form
- CAD format
  - Comply with BS EN ISO 13567-1.
  - Comply with BS EN ISO 13567-2.

Final copies for distribution
- print form
- CAD format
  - Comply with BS EN ISO 13567-1.
  - Comply with BS EN ISO 13567-2.

Provide drawn information for the design team and client in the following numbers

Sketch drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Schematic drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Co-ordination drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Installation drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Installation wiring drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Builder's work information
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Manufacturer's drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Controls logic diagrams
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Switchgear, starter and control instrumentation panel drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

As-installed drawings
- Site record copy

Record drawings
- Initial copies for comment (no) 2
- 2 preliminary sets for use during commissioning.
- One reduced set incorporated into each Operating and Maintenance manual.

Plant room schedules and schematics
- Initial copies for comment (no) 2
- 2 preliminary sets for use during commissioning.
- One framed set for plantrooms.
- One reduced set incorporated into each Operating and Maintenance manual.

Provide drawings for construction in form and number as required by the Contractor.

330.000 PREPARATION OF DOCUMENTS:
- Prepare drawings to commonly recognised scales generally on A1 sheets and details and schedules on A4 sheets.
- Agree scales, drawing sheet size and format with the CA before preparing any documents.
- Prepare electrical drawings in accordance with BS EN 61082-1.

350.000 DOCUMENT NUMBERING/REGISTRATION SYSTEM:
Agree with the CA the document numbering/registration system to be used before preparing any documents.

360.000 BUILDER'S WORK INFORMATION:
Confirm and amplify any information provided by the CA.
- Builder's work is excluded from the Subcontract, other than as detailed below.
- Builder's Work excludes drilling and/or plugging walls, floors, ceilings etc., for fixings for services and holes in walls up to 50mm diameter or 50x50mm, and such work is included in the Subcontract.
- Provide Builder's Work Information, appropriate to the stage of design development, and include requirements for foundations, bases, and supporting structures for plant and equipment.
- Mark out on site, all cut holes and chases required, any pockets cast in concrete, any inserts, any built in sleeves or similar items.
- Holes may not be cut in steelwork, reinforced or precast concrete without written permission from the CA. Under no circumstances will holes be cut in pre-stressed concrete. Permitted holes in steelwork must be drilled - burning by means of welding equipment is prohibited.

370.000 TECHNICAL LITERATURE:
The Subcontractor is
- advised

to keep copies of the following on site, readily accessible for reference by all supervisory personnel
- Relevant BS and Codes of Practice.

380.000 MAINTENANCE INSTRUCTIONS AND GUARANTEES:
Retain copies delivered with components and equipment (failing which, obtain), register with manufacturer as necessary and hand over to CA on or before Practical Completion.
Notify CA of telephone numbers for emergency services by Subcontractors after Practical Completion.

BS APPENDIX

BS 7671:2008
Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition with all current Amendments

BS EN 61082-1:2006
Preparation of documents used in electrotechnology. Part 1 Rules

BS EN ISO 11091:1999
Construction drawings. Landscape drawing practice

BS EN ISO 13567-1:2002
Technical product documentation. Organisation and naming of layers for CAD. Part 1 Overview and principles

BS EN ISO 13567-2:2002
Technical product documentation. Organisation and naming of layers for CAD. Part 2 Concepts, format and codes used in construction documentation

A33 QUALITY STANDARDS/CONTROL

110.000 MAIN CONTRACT PRELIMINARIES:

- Quality Standards/control

Applies to the whole of the Works, including this Subcontract. Comply with the requirements stated therein insofar as they relate or apply to the Subcontract Works, and co-operate with and assist the Main Contractor in complying with them generally.

130.000 SUBCONTRACTOR'S PERSON-IN-CHARGE:
Appoint a foreman-in-charge and/or site agent to ensure constant management and supervision of the Subcontract Works.

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

140.000 DIMENSIONS:
Where installations are dependent upon site dimensions ensure that these are available before proceeding with the Works.
Do not take dimensions by scaling from the drawings.
Where dimensions are indicated on drawings check these on site, as appropriate, to ensure building construction and manufacturing tolerances can be accommodated.

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

150.000 SETTING OUT FOR THE SUBCONTRACT WORK:
Where this is done by the Main Contractor check its accuracy and obtain his approval before proceeding with the work.

160.000 SITE MODIFICATIONS:
Do not make site modifications to assemblies without authorisation.
Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions.
Ensure that modifications made comply with any type test certificate obtained for arrangement of components.

170.000 STANDARDS AND REGULATIONS:
Provide all materials and works in accordance with the appropriate British Standard or Code of Practice and where no BS or CP is applicable the Agreement Certificate for the particular item.
Comply with all statutory instruments and regulations, and local byelaws relating to the area of the site current at

- the date of tender.

Comply with the requirements of the Local Authority Building Inspector.
Comply with all relevant requirements included in the Main Contract Preliminaries Section

- regarding Statutory Obligations.

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

- Where no specific design, performance or installation standards are quoted the following shall apply.
  CIBSE, Commissioning Codes.
  CIBSE Code for Lighting.
  CIBSE, Technical Reports.
  CIBSE, Technical Memoranda.
- Ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.
- Supply plant and equipment to achieve the specified design conditions and to provide stable control.

171.000 STANDARDS AND REGULATIONS:

Provide all materials and works in accordance with the appropriate British Standard or Code of Practice and where no BS or CP is applicable the Agreement Certificate for the particular item.

Comply with all statutory instruments and regulations, relating to the area of the site current at

- The date of tender.

Comply with the requirements of the Local Authority Building Inspector.

Comply with all Statutory Obligations arising from current legislation and regulations, together with other requirements, including, but not limited to, the following:-

- Statutory Obligations
  - Health and Safety at Work etc Act 1974
  - Management of Health & Safety at Work Regulations 1999
  - The Working Time Regulations 1998
  - Building Regulations 2013 and current amendments
  - Public Health Acts
  - Electricity Acts
  - Electricity at Work Regulations 1989
  - Clean Air Act 1993
  - The Control of Pollution Act 1974 and Amendment Acts
  - The Workplace (Health, Safety and Welfare) Regulations 1992
  - The Construction (Design and Management) Regulations 2015
  - The Health and Safety (Display Screen Equipment) Regulations 1992
  - The Control of Substances Hazardous to Health (COSHH) Regulations 2002
  - The Control of Substances Hazardous to Health (Amendment) Regulations 2003
  - The Provision and Use of Work Equipment Regulations 1998
  - Personal Protective Equipment at Work Regulations 1992
  - The Construction (General Provisions) Regulations 1961
  - The Lifting Operations and Lifting Equipment Regulations 1998
  - Other relevant Safety Regulations
- Public Utility Company and/or Statutory Authority regulations, specifications, and requirements.
- Other Requirements
  - British Standards and Codes of Practice.
  - BS 7671 - Requirements for Electrical Installations (IEE Wiring Regulations).
  - BS EN 50110.
  - Insurance Company Requirements.
  - LDSA Fire Safety Guides.
  - IEC Standards.
- Notify all authorities in accordance with their regulations and obtain any required approvals for the installation.
- Where no specific design, performance or installation standards are quoted the following shall apply.
  - BS-EN 12 464-1:2011
  - BS 5266-1:2011
  - BS 5839-1:2013
  - CIBSE Code for Lighting.
  - CIBSE Technical Memoranda.
- Ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.
- Supply plant and equipment to achieve the specified design conditions and to provide stable control.

180.000 TYPE TESTS:

Provide certificates of verification of type tests. Ensure that drawings and other documents forming part of certificate are available prior to any order being placed.

190.000 TEST CERTIFICATES:
Where testing specific to the project is required, ensure test certificates include
Project title.
Details and date of test.
Instruments used, serial numbers, calibration dates.
Signature of those witnessing test.
Contractor's name.
Specific location of the item in the Works.

200.000 INSPECTION AND TESTS - ON OR OFF-SITE:
Submit schedules showing those parts of the Works for which inspections and tests are required in the specifications, to substantiate conformity with the Specification and for which records are required to be maintained.
Should any alternative item be proposed which does not carry appropriate certification, ensure independent testing is carried out at no expense to the Employer to confirm compliance.
Where required, provide formal method statements supported by risk assessments detailing the procedures for carrying-out on site tests. Agree in advance with all parties procedures for inspections and tests including periods of notice.
Where a test indicates non-compliance with the Specification submit immediately details of the non-compliance and proposals for corrective action.
Arrange access for personnel who require to be in attendance, to manufacturer's or other off site premises when any inspections and tests carried out.
Attendance or otherwise of the supervisory personnel during specified inspections or tests will not reduce the obligations or restrictions of the Contract.
Carry out all tests required by legislation under the direction of a competent person.

210.000 INSPECTIONS AND TEST RECORDS:
Prepare a set of drawings and/or report sheets to record accurately the test and inspection information including the following.
Plant identification, section and installation under test.
Manufacturer's reference number.
Date, time, duration of test, weather conditions.
Test results with itemised readings including records of all other checks and tests.
Maintain records of all specified inspections and tests performed including third party and works test certificates.
Include in records, as appropriate, details of the element, item, batch or lot, the nature, number and date of the inspections and tests, the number and type of deficiencies found, any corrective action taken and other relevant particulars.
Maintain all records on site for inspection. On completion of the Works, include copies in the operating and maintenance manuals.
Submit copies of records within one week of request.

220.000 TESTING AND COMMISSIONING OF SERVICES:
Agree with the Contractor a programme for pre-commissioning checks, setting to work, commissioning and performance testing, and allow for all costs incurred.
Where required, provide formal method statements supported by risk assessments detailing all commissioning procedures.
Give notice to the Contractor and CA and state any requirements for the attendance and co-operation of others.
- Not less than fourteen working days.

Provide all necessary facilities to enable tests to be witnessed and inspections carried out either on site or at manufacturer's works.
The CA will only witness test proceedings, confirm recorded results and determine if the specified requirements have been satisfied.
If following test or inspection any plant or part thereof is shown to be defective or not conforming to the specification the CA will reject such defective parts by written notice, within reasonable time, indicating area of dispute.
- Appoint an "approved engineer", to supervise the whole of the testing, commissioning, performance testing and instruction of client's staff.

Provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.
Test all equipment, material and systems as detailed in Sections. If an inspection or test fails, repeat the procedure, until satisfactory results are obtained.

- Complete all tests before any paint, cladding or similar materials are applied or before services are concealed.
- Ensure all requirements such as cleanliness, protection from harmful external and internal elements etc. are provided prior to commencement of commissioning.
- Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust, as necessary, to meet the specified design requirements.
- Provide all necessary instruments and recorders to monitor systems during commissioning and performance testing.
- Provide test equipment subject to a quality assurance procedure complying with BS EN ISO 10012.
- Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the CA.

Maintain on site full records of all commissioning and performance testing, cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual.
Provide all certification documents for approval by the CA before any system is offered for final acceptance.

- Gas, fuel oil, electricity and water for testing and commissioning will be provided by
  - The main contractor.

230.000 COMMISSIONING PROCEDURES:
Observe the following requirements when commissioning the Engineering Services.

- Progressive static testing will be witnessed by the CA when work is presented for testing. This will include:
  - Insulation resistance tests.
  - Earth fault loop impedance tests.
  - Earth continuity tests.

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

240.000 OPERATIONAL DEMONSTRATION:
Provide a written statement to the CA confirming that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.
Demonstrate to the CA that all system components are operating correctly, and the completely integrated installation will function in accordance with the specified performance requirements.

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

260.000 SYSTEMS USED BEFORE PRACTICAL COMPLETION:
Systems may not, without the prior written approval of the CA be used before Practical Completion. Systems to be used before practical completion for the benefit of the Contractor and/or Subcontractor must have all defective consumable elements (including lamps and tubes) replaced by new not more than seven days prior to Practical Completion.
No system shall be put into use prior to handover to the employer, except for testing and commissioning, unless in accordance with the following procedure:

Following the receipt of written instructions, the Subcontractor shall operate designated parts of the Subcontract Works, provided that such operation is practicable and does not prejudice the Subcontractor's responsibilities and obligations under the Subcontract.
Additionally and with adjustment to the Subcontract sum, the Subcontractor, shall if instructed, provide:

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

300.000 OPERATION OF SYSTEMS BEFORE THE PRODUCTION OF DRAWINGS AND/OR OPERATING AND MAINTENANCE MANUALS:
Provide attendance, at no expense to the Employer, to put into service, operate 24 hours a day and maintain the systems to the Employer's requirements, including the provision of suitable competent labour, in the event that the Record Drawings and/or Maintenance Manuals are not available when the Works would, in the opinion of the CA, otherwise qualify for Practical Completion.
In the event of the Subcontractor failing to provide this service satisfactorily the Employer shall be entitled to make his own arrangements and recover the full cost through the Contract.

310.000 INSPECTION BY EMPLOYER'S INSURANCE COMPANY:
Where indicated in the Work Sections items are to be inspected by a competent person acting for the Employer's Insurance Company appointed under the provisions of the Factories Act or other relevant legislation. The installations concerned shall satisfy the Insurance Company's requirements in all respects.
Agree a programme for inspection and certification of specified equipment.
Inform the CA when equipment is to be ready for examination.
The Employer will place an order with the Insurance Company. Details and nature of the order will be provided to all interested parties.
Provide all detailed drawings etc. of the equipment to enable the Insurance Company to approve design before manufacture.
Arrange for the attendance of the Insurance Company's Engineer/Surveyor at each stage of manufacture and installation and provide all necessary access and facilities for inspecting and testing as may be required.
No plant which is subject to inspection will be accepted on behalf of the employer until a satisfactory certificate has been received by the Employer from the Insurance Company.
All Insurance Company charges for examination and approval of drawing, inspection of works during construction and inspection and certification of the completed work will be paid by

- The Employer.

BS APPENDIX

BS 7671:2008
Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition with all current amendments

BS EN ISO 10012:2003
Measurement management systems. Requirements for measurement processes and measuring equipment

A34 SECURITY/SAFETY/PROTECTION

110.000 MAIN CONTRACT PRELIMINARIES:
- Security/safety/protection

Applies to the whole of the Works, including this Subcontract. Comply with the requirements stated therein insofar as they relate or apply to the Subcontract Works, and co-operate with and assist the Main Contractor in complying with them generally.

115.000 CDM REGULATIONS:
Comply with the requirements of the CDM Regulations by
- adhering to the rules of the Pre-Construction Information and Construction Phase Plan.
- reporting accidents, injuries or dangerous occurrences to the main contractor.
- providing the main contractor with appropriate input to the health and safety plan, including risk assessments, and to the health and safety file.
- providing the main contractor with information on the subcontract works which might affect the health or safety of any person.

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

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

140.000 STORAGE:
Store all materials and products as recommended by manufacturers.
- Provide sufficient, safe and secure storage for all materials and products.
- Provide racks to prevent distortion for storage of conduits, pipes and similar materials.
- Store all fittings, accessories and sundry items in clean bins or bagged and stowed in racks and maintained under suitable weatherproof cover.

150.000 PROTECTION OF SUBCONTRACT WORKS:
Check regularly the protection provided after installation of equipment and inform the Main Contractor if inadequate.
- Install items such as grilles, diffusers, lighting fittings, switches, accessories etc. as near to completion as practicable.
- Only install filter media when the plant items concerned are being commissioned and tested.
- Leave plant and equipment in a ready to paint condition where specified as part of the Works or to be carried out by others.
- Paint parts liable to corrosion immediately after removal of any temporary protection.
- Replace material, plant or equipment where deterioration or damage has occurred prior to handover.

151.000 PROTECTION OF SUBCONTRACT WORKS:
Provide adequate and safe protection for all materials and products after installation.
- Ensure all items are protected against ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building works and operations of others.
- Protect during erection all easily damaged materials with hardboard covers or heavy duty polythene sheet. Such items include but are not limited to
  - control panels,
  - switchboards,
  - distribution boards,
- Protect all finished items from damage and paint splashes.
- Install items such as grilles, diffusers, lighting fittings, switches, accessories etc. as near to completion as practicable.

- Only install filter media when the plant items concerned are being commissioned and tested.
- Cover all plant items with polythene sheeting except when being worked upon.
- Cap all open ends of pipes, ducts, conduit and trunking etc except when being worked upon.
- Leave plant and equipment in a ready to paint condition where specified as part of the Works or to be carried out by others.
- Paint parts liable to corrosion immediately after removal of any temporary protection.
- Replace material, plant or equipment where deterioration or damage has occurred prior to handover.

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

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

- Ensure that, whenever necessary, temporary supplies are provided to enable motive plant items delivered and/or installed to be run at regular intervals to avoid damage or deterioration.
- Ensure that rotating plant is hand-turned periodically if temporary supplies are not available.

A37 OPERATION/MAINTENANCE OF THE FINISHED BUILDING

101.000 SUBMISSION OF RECORD DOCUMENTS:
To satisfy the provisions of the Health and Safety at Work Act the Employer will not accept handover of the installations until full and adequate information concerning the installations is in the possession of his operating and maintenance staff.
Provide Record Documents - being part of the Works - prior, and as a prerequisite, to Practical Completion to the satisfaction of the CA.
Prepare manuals in draft as the Works progress and make suitable arrangements where the Works are subject to Partial Possession or Sectional Completion.

- Submit draft Manual to the Services Engineer for comment **no less than 2 weeks** prior to commissioning.
- Prepare two temporary Manuals with provisional record drawings and preliminary performance data available at commencement of commissioning to enable Employer's staff to familiarise themselves with the installation. These should be of the same format as the final Manuals with temporary insertions for items which cannot be finalized until the installations are commissioned and performance tested.
- Provide the CA with copies of the **final** Manual prior to Practical Completion **no less than 2 weeks prior**.
- Prepare and submit two copies of a “Building User Guide” as described in section A37.155 below, submit a draft copy to the Design Team for comment **no less than 2 weeks prior** to hand-over.

102.000 SUBMISSION OF DOCUMENTS FOR HEALTH AND SAFETY FILE:
To satisfy the provisions of the Health and Safety at Work Act the Employer will not accept handover of the installations until full and adequate information concerning the installations is in the possession of his operating and maintenance staff.
Provide Record Documents - being part of the Works - prior, and as a prerequisite, to Practical Completion to the satisfaction of the CA.
Prepare manuals in draft as the Works progress and make suitable arrangements where the Works are subject to Partial Possession or Sectional Completion.

- Submit draft Record Documents to the CA for comment **no less than 2 weeks** prior to commissioning.
- Prepare two temporary Manuals with provisional record drawings and preliminary performance data available at commencement of commissioning to enable Employer's staff to familiarise themselves with the installation. These should be of the same format as the final Manuals with temporary insertions for items which cannot be finalised until the installations are commissioned and performance tested.
- Provide the CA with copies of the final Manual prior to Practical Completion **no less than 2 weeks prior**.
- Prepare electrical record drawings in accordance with BS EN 61082-1.

111.000 RECORD DOCUMENTS:
Provide the system records and full documentation as required in the appropriate standard.

- Standard
  - BS EN 50131-1 - Intruder alarm systems.
  - BS 5839 - Fire detection and alarms in buildings.
  - BS 6701 - Telecommunications equipment and telecommunications cabling.
  - BS EN 62305 - Protection against lightning.
  - BS 7671 - Requirements for electrical installations (IEE Wiring regulations).

Provide

- Record Drawings, Schematics and Schedules
- Plant room and switch room drawings, schedules and schematics.
- Operating and Maintenance Manuals.
- Building User Guide
- Blank maintenance logs
- Log book

- 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.
- Ensure Record Documents provide all the information, and in the format, required by the BREEAM accreditation of the project.
- 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 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 the building log book contains the information outlined in Section 3.2 of the Building Regulations Part L2A: 2013, Conservation of fuel and power in buildings other than dwellings.

120.000 RECORD DRAWINGS AND SCHEDULES:
Prepare Record Drawings and Schedules to a scale not less than 1:50 from the "As Installed Drawings" maintained on site as the Works progress. Endorse all such documents 'RECORD DRAWINGS'. Where agreed with the Services Engineer and the CA certain detailed information may be provided in schedule form. Prepare electrical drawings in accordance with BS EN 61082-1.
Provide reduced scale copies for inclusion in the operating and maintenance manuals as detailed in clause A37.150.000.
Record Drawings and Schedules must include, but are not limited to:

- Location, including level if buried, of Utility Service connections, including those provided by the appropriate Authority, indicating points of origin and termination, size and material of service, pressure and/or other relevant information.
- Disposition and depth of all underground systems.
- Schematic drawings of each system indicating principal items of plant, equipment, zoning, means of isolation, etc. in sufficient detail to make it possible to comprehend the system operation and the inter-connections between various systems.
- Details of the principles of application of automatic controls and instrumentation.
- Identification of all terminals/cables etc. by size/type and duty/rating as recorded from the approved commissioning results.
- 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.
- Dimensioned plans and sections at a scale of 1:20 of plantrooms, service subways, trenches, ducts and other congested areas where in the opinion of the CA smaller scale drawings cannot provide an adequate record. Indicate the location, identity, size and details of each piece of apparatus.
- Manufacturers' drawings of equipment indicating
- general arrangement and assembly of component parts which may require servicing.
- internal wiring diagrams together with sufficient physical arrangement details to locate and identify component parts.
- schedules as required to locate, reference and provide details of ratings and duty of all items incorporated into the Works together with all fixed and variable equipment settings established during commissioning.
- For each programmable control item, schedules indicating for each input and output point connected, full data in respect of that point including reference, type of input/output, connected equipment reference, set values of temperature or pressure etc., set values of start/stop/speed change times, alarm priority, control specification reference and any other such parameters as are applicable.

Each spare input and output point including reference, type of input/output and space for future entry of appropriate parameters as listed above.

- 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.

130.000 PLANT ROOM AND SWITCH ROOM DRAWINGS, SCHEDULES AND SCHEMATICS:
Provide good quality plant and switch room drawings, schedules and schematics.
Hang the following in each plant room and switch room, any other appropriate location or where directed by the Services Engineer or the CA.

- Schematic drawings of circuit layouts showing identification and duties of equipment, numbers and locations, controls and circuits.
- Schedules in the form of printed sheets showing the number, type, location, application/service and symbol, and normal operating position of each means of isolation.
- Control schematics.
- Location of all plant and equipment items including plans and elevations of main switchgear showing physical disposition of switches.
- First aid instructions for treatment of persons after electrical shock.
- All other items required under Statutory or other regulations.
- Location of all incoming service isolating and metering facilities.
- Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
- Prepare electrical drawings in accordance with BS EN 61082-1.

Protect surface of drawings by

- pressure lamination

145.000 OPERATING AND MAINTENANCE MANUAL FORMAT:
The operating and maintenance manuals shall be prepared in the following format:

- PC based word processing software tool.

150.000 OPERATING AND MAINTENANCE MANUALS:
The operating and maintenance manuals must include:

- A full description of each of the systems installed, written to ensure that the Employer's staff fully understand the scope and facilities provided.
- A description of the mode of operation of all systems including services capacity and restrictions.
- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- Details of how to re-commission so that complex plant services within the building can be re-commissioned by an engineer without any historic knowledge of the systems.
- Full size copies of "As Built" record drawings

Legend of all colour-coded services.

- Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.
- The name, address and telephone number of the manufacturer of every item of plant and equipment together with catalogue list numbers.
- Manufacturer's technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.
- A copy of all Test Certificates, Inspection and Test Records, Commissioning and Performance Test Records (including, but not limited to, electrical circuit tests, corrosion tests, type tests, start and commissioning tests) for the installations and plant, equipment, valves, etc., used in the installations.
- A copy of all manufacturers' guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturers.
- Copies of Insurance & Inspecting Authority Certificates and Reports.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.
- Procedures for seasonal change-overs and/or precautions necessary for the care of apparatus subject to seasonal disuse.

- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- Details of regular tests to be carried out (e.g. water cooling towers etc.)
- Details of procedures to maintain plant in safe working conditions.
- Details of the disposal requirements for all items in the works.
- A list of normal consumable items.
- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- A list of any special tools needed for maintenance cross referenced to the particular item for which required.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.
- Back-up copies of any system software.
- Instructions for the creation of control procedure routines and graphic diagrams.
- Details of the software revision for all programmes provided.
- Two back-up copies of all software items, as commissioned.
- 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.

155.000 BUILDING USER GUIDE:

The Building User Guide must include the following information:

101. Building Services Information
    - General User – Information on heating, cooling and ventilation in the building and how these can be adjusted, e.g. thermostat location and use, implications of covering heating outlets with files, bags etc., and use of lifts and security systems.
    - Facilities Manager – As above, plus a non-technical summary of the operation and maintenance of the building systems (including BMS if installed) and an overview of controls.

102. Emergency Information
    - General User – Include information on the location of fire exits, muster points, alarm systems and fire fighting systems.
    - Facilities Manager – As above, plus details of location and nature of emergency and firefighting systems. Nearest emergency services, location of first aid equipment.

103. Energy & Environmental Strategy

    This should give owners and occupiers information on energy-efficient features and strategies relating to the building, and also provide an overview of the reasons for their use, e.g. economic and environmental savings. Information could include:

    - General User – Information on the operation of innovative features such as automatic blinds, lighting systems etc., and guidance on the impacts of strategies covering window opening and the use of blinds, lighting and heating controls.
    - Facilities Manager – As above, plus information on airtightness and solar gain (e.g. the impact of leaving windows/doors open in an air conditioned office, or use of blinds in winter with respect to solar gain); energy targets and benchmarks for the building type, information on monitoring such as the metering and sub-metering strategy, and how to read, record and present meter readings.

104. Water Use
    - General User – details of water saving features and their use and benefits, e.g. aerating taps, low flush toilets, leak detection, metering etc
    - Facilities Manager – As above, plus details of main components (including controls) and operation. Recommendations for system maintenance and its importance, e.g. risk of legionella.

105. Materials & Waste Policy
    - General User – Information on the location of recyclable materials storage areas and how to use them appropriately.

- Facilities Manager – As above, plus information on recycling, including recyclable building/office/fit out components, waste storage and disposal requirements; examples of Waste Management Strategies and any cleaning/maintenance requirements for particular materials and finishes.

106. General

Where further technical detail may be required by the Facilities Manager or Practice Manager there should be references to the appropriate sections in the Operation and Maintenance Manual.

160.000 PRESENTATION OF THE OPERATING AND MAINTENANCE MANUALS:

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

180.000 RECOMMENDED TOOLS:

Before practical completion submit to the CA a schedule of tools and portable instruments as called for in individual Sections and any others that the Subcontractor recommends should be obtained and kept in stock by the Employer for maintenance of the services installations included in the Subcontract. Time scale

- 2 Weeks before Practical Completion

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

181.000 SUPPLY OF TOOLS:

Provide all tools detailed within individual Sections.

- Submit to the CA a quotation, priced in detail, for the initial supply to the Employer of the additional tools identified under clause A37.180.000.

Time scale

- Within 2 weeks of request

190.000 TRAINING OF EMPLOYER'S STAFF:

Before practical completion explain and demonstrate the purpose, function and operation of the installations including all items and procedures listed in the Operation and Maintenance Manual:

- to the End Users maintenance staff.

Training:

- Include for the training of 6 people (2 per user group)
- Include for not less than 1 operating days for this purpose and demonstrate the safe day to day running and maintenance of all systems, plant and equipment.
- Provide training for the operation of the controls, monitoring or BMS installations for one or more of the following levels of operator.
  - Basic operator
  - Intermediate operator
    - Ensure that the operator is also trained for testing and routine inspection of sensors and actuators.
  - Advanced operator
  - Ensure that each trained operator signs a training acceptance certificate(s).
  - Provide appropriate reference and training manuals for the operator.
  - Include for training operating staff (no) 6
- 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.

200.000 READING OF METERS:

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

210.000 OBLIGATIONS DURING DEFECTS LIABILITY PERIOD:

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

Notify the Main Contractor of damage, failures or malfunctions to the Subcontract Works demonstrably caused by incorrect operation of the installations, vandalism or other actions by a third party.
Inform the CA, via the Main Contractor, in writing when all defects are finally rectified so that an inspection may be carried out prior to the issue of a Final Certificate.

BS APPENDIX

BS 6701:2004
Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance

BS 7671:2008
Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition with all current amendments

BS EN 50131-1:2006
Alarm systems. Intrusion and hold-up systems. Part 1 System requirements

BS EN 61082-1:2006
Preparation of documents used in electrotechnology. Part 1 Rules

C90 ALTERATIONS - SPOT ITEMS

100.030 SYSTEM DESCRIPTION

100.031 DRAINAGE AND DOMESTIC WATER
There are existing LTHW, drainage and domestic water connections located within the fourth floor void to serve the new offices and tea area. These shall be utilised for this phase of the works and due care and attention should be taken to keep disruption to the existing building to an absolute minimal. The remaining new systems (heating (excluding trench heating), cooling and ventilation) will remain separate to the buildings existing systems with separate plant items to be installed on the roof.

R19 RAINWATER AND FOUL DRAINAGE ABOVE GROUND (SELF CONTAINED SPECIFICATION)

100.000 SYSTEM DETAILS

100.010 SYSTEM DESCRIPTION

The Contractor shall design, supply and install the new above ground drainage system to serve the new tea area. The new waste system shall extend and connect into the existing above ground drainage as detailed on drawings.

Equipment shall be design and installed to meet the requirements detailed in this specification to British Standards, HTM, Client briefing document and all relevant Codes of Practice and the requirements of the Local Authority.

The Contractor shall provide rodding eyes at all changes of pipe direction on soil and waste pipework. All bends, branches and couplings are to be installed to enable easy access to all parts of the system.

All sinks shall be installed with trap assemblies to the required size and depth of seal to meet British Standards. Traps to sinks to be 32mm and 40mm respectively deep seal anti-siphon type to BS EN 12056 as detailed on the drawing.

The contractor shall allow for all above ground drainage pipework to be concealed within wall, behind panelling, etc so as to not be on accessible to tenants. The contractor shall allow for access panels where required for maintenance purposes which will require a bespoke tool to gain access.

Where soil/vent pipework and condensate pipework passes through fire compartmentation, intumescent collars shall be used.

Gravity stack systems shall be employed, in accordance with BS EN12056. The Contractor shall gain approval of the proposed systems from the Building Control Officer, District Surveyors, Environmental Health Department and all other relevant bodies.

Liaise with the main contractor to co-ordinate socket locations for all soil and vent pipes and stub stacks.

Provide and install a weather cowl to terminate all soil stacks which terminate above roof level. Establish which soil stacks are required to vent to atmosphere and which soil stacks can terminate above the spill-over level of the highest appliance with air admittance valves.

Provide and install a trapped connection to all sinks and dishwashers to discharge via a waste float pipe to a new stub stack or soil and vent pipe.

Provide and install intumescent fire collars where each soil stacks penetrate the floor slab and where all soil and waste pipework penetrates fire barriers.

Make adequate allowance for the mastic pointing between units and wall tiling, shower trays, sink taps etc.

100.020 DESIGN PARAMETERS

Basin: 32mm waste $\leq$ 1.7m from SVP, 40mm waste > 1.7m $\leq$ 3m from SVP
50mm waste > 3m from SVP
Sink and shower: 40mm waste $\leq$ 3m from SVP, 50mm waste > 3m from SVP

Any situation with two or more waste appliances on one float - 50mm waste

Refer to BSEN1329 for design of drainage

Refer to BSEN1566 for design of sanitary ware pipework

- Refer to Building Regulations approved documents H Drainage and Waste Disposal
- Refer to Institute of Plumbing Guide

- 100.030 SYSTEM DRAWINGS
  - As schedule reference A11-Drawings

200.000 DRAINAGE PIPELINES AND FITTINGS

200.010 PIPES AND FITTINGS - UNPLASTICIZED PVC TO BS 4514:
- Type soil and waste pipework
- Application discharge of soil and waste water from sanitary appliances
- Manufacturer Osma or Geberit
  - Or approved equivalent.
- Kitemark certified
  Material - UPVC to BS 4514
- Finish
  - Grey
  - White
- Jointing
  - Solvent welded
  - Push fit

200.020 PIPES AND FITTINGS - PLASTICS TO BS 5255:
- Type soil and waste pipework
- Application discharge of soil and waste water from sanitaryware appliances
- Manufacturer Osma or Geberit
  - Or approved equivalent.
- Kitemark certified
  Material - Plastics to BS 5255
  - ABS
  - MUPVC
  - PP
  - PE
- Finish
  - Grey
  - White
- Jointing
  - Solvent welded
  - Push fit

200.050 PIPEWORK ACCESSORIES:
- Pipe rings and clips
  Select type according to the application and material compatibility.
- Pipe supports

200.060 PIPE SLEEVES/FIRE COLLARS:
- Manufacturer Osma or Geberit
  - Or approved equivalent.
- Supply intumescent sleeves where pipes pass through floors for fire separation.

300.000 DRAINAGE ACCESSORIES

300.040 PLASTICS TUBULAR TRAPS:
- Application to basins and sinks
- Manufacturer and reference Osma or Geberit
  - Or approved equivalent.
- Standard - BS EN 274-1, BS EN 274-2, BS EN 274-3.
- Use
  - For sanitary appliances excluding baths.
- Material
  - Polypropylene.

- Pattern
  - P.
  - S.
- Seal depth (mm) 75

300.060 PLASTICS BOTTLE TRAPS:
- Application to basins and sinks
- Manufacturer and reference Osma or Geberit
  - Or approved equivalent.
- Standard
  BS EN 274-1, BS EN 274-2, BS EN 274-3 - for sanitary appliances excluding baths.
- Material
  - Polypropylene.
- Seal depth (mm) 75

300.120 PLASTICS WC PAN CONNECTOR:
- Manufacturer and reference Osma or Geberit
  - Or approved equivalent.
- For horizontal outlet and shrouded pans.
- BS 5627 for pans to BS EN 33, BS EN 37, BS EN 997.
  - Figure 1 'S' or turned 'P' traps.
  - Figure 2 'P' traps new installations.

400.000 DRAINAGE WORKMANSHIP

400.010 PERFORMANCE CRITERIA:
Install pipework fittings and accessories to ensure that
- appliances drain quickly, quietly and completely at all times without nuisance or risk to health.
- discharge is conveyed without crossflow, backfall, leakage or blockage.
- air from drainage system does not enter building.
- pressure fluctuations in pipework do not vary by more than plus or minus 38mm water gauge and traps retain a water seal of not less than 25mm.
- system can be adequately tested, cleaned and maintained.

400.020 PIPE ROUTES:
Ensure pipe routes are shortest practicable, with as few bends as possible and no bends in wet portion of soil stacks, unless indicated otherwise on drawings.

400.030 COATED PIPES:
Make good damaged coatings and cut ends, or recoat, as recommended by manufacturer.

400.040 INSTALLATION GENERALLY:
Install pipes, fittings and accessories in accordance with BS EN 12056-2 and manufacturer's recommendations. Obtain all components for each type of pipework from the same manufacturer, unless otherwise indicated.
Inspect components carefully before fixing and reject any which are defective.
Ensure cut ends of pipes to be clean and square with burrs removed.
Allow for thermal and building movement when jointing and fixing.
Form junctions using fittings intended for the purpose, ensuring that jointing material does not project into bore of pipes, fittings and appliances.
Fix pipes at centres not greater than those specified in BS 8000-13. Provide additional supports as necessary at junctions and changes in direction. Fix every length of soil vent pipe at, or close below the socket collar.

Use plated, sheradized, galvanized or nonferrous fastenings, suitable for the purpose and background, and compatible with the material being fixed or fixed to.
Avoid contact between dissimilar metals and other materials which would result in electrolytic corrosion.
In convenient locations, provide access covers and cleaning eyes as necessary and in accordance with Local Authority requirements to permit adequate testing and cleaning of pipework.
Prevent entry of foreign matter into any part of system by sealing openings during construction. Fit all access covers and cleaning eyes as work proceeds.

400.050 CONNECTIONS BETWEEN PIPES OF DIFFERENT MATERIALS:

- Plastic
  - Connect plastics pipework to pipework of other materials using approved connectors and methods in accordance with plastics pipework manufacturer's recommendations, to form a watertight joint.

400.060 WASTES:
Bed in waterproof jointing compound and fix with resilient washer between appliance and backnut.

400.070 WASTE CONNECTORS:
Join to traps as manufacturer's recommendations.

400.080 WC PANS:

- Plastic
  - Connect to soil pipe spigots with plastic connectors in accordance with connector manufacturer's recommendations.

400.090 ACCESS POINTS:
Provide rodding and access points at all changes of direction to enable whole system to be maintained.
Provide square door type access points as indicated on drawings at foot of all soil and ventilation pipes.
Where practicable, locate access points and horizontal anti-syphon pipes above fitment flood level.
In general make WC connections to drain points and soil pipes via flexible connectors.

400.100 PRESSURE TESTING - SOIL, WASTE, VENTILATION, AND ANTI- SYPHON PIPEWORK:
Test section by section as the work proceeds and subsequently on completion with all sanitary fittings fixed and working. Submit systems to two separate tests, Air test and Hydraulic Performance test in accordance with BS EN 12056.

BS APPENDIX

BS 4514:2001
Unplasticized PVC soil and ventilating pipes of 82.4mm minimum mean outside diameter, and fittings and accessories of 82.4mm and of other sizes. Specification

BS 5255:1989
Specification for thermoplastics waste pipe and fittings.
Partially replaced by BS EN 1329-1:2000, BS EN 1451-1:2000, BS EN 1566-1:2000 but remains current

BS 5627:1984

Specification for plastics connectors for use with horizontal outlet vitreous china WC pans

BS 8000-13:1989
Workmanship on building sites. Part 13 Code of practice for above ground drainage and sanitary appliances

BS EN 12056-2:2000
Gravity drainage systems inside buildings. Part 2 Sanitary pipework, layout and calculation

BS EN 274-1:2002
Waste fittings for sanitary appliances. Part 1 Requirements

BS EN 274-2:2002
Waste fittings for sanitary appliances. Part 2 Test methods

BS EN 274-3:2002
Waste fittings for sanitary appliances. Part 3 Quality control

BS EN 33:2003
Pedestal W.C. pans with close-coupled flushing cistern. Connecting dimensions

BS EN 37:1999
Pedestal W.C. pans with independent water supply. Connecting dimensions

BS EN 681-1:1996
Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Part 1 Vulcanized rubber

BS EN 681-2:2000
Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Thermoplastic elastomers

BS EN 997:2003
WC pans and WC suites with integral trap

S12 HOT AND COLD WATER (SELF CONTAINED SPECIFICATION)

100.000 SYSTEM DETAILS:

100.010 SYSTEM DESCRIPTION:

Mains Cold Water Services
Design, provide and install a new metered branch from the existing mains cold water supply within the existing 4th floor void. Design, provide and install at the meter location a stopcock, draincock and pressure reducing valve arrangement.

From the new mains cold water branch on the fourth floor, design, provide and install a complete mains cold water installation to serve the sink, water boiler and water cooler.

The distribution system shall be carried out in copper tube to BS EN 1057. Pipework shall be distributed via ceiling voids and low level boxing where required. All pipework shall be thermally insulated throughout the building.

Design, provide and install screwdriver operated, quarter turn, ballofix valves for isolation purposes on the mains cold water supply to each appliance served.

Design, provide and install all necessary tees, bends, valves, backflow prevention devices etc. necessary to provide a complete working installation in compliance with all regulations and codes of practice. Dishwashers and washing machines to be fitted with a double check valve.

All mains cold water pipework subject to heat gain or requiring protection from frost shall be thermally insulated.

Design, provide and install fire stopping where all mains cold water pipework passes through a fire barrier.

The contractor shall make adequate allowance within his programme for the submittal of working drawings and relevant details to the water authority for approval under the Water Supply (Water Fittings) Regulations 1999.

Installation to include all pipework, valves, fittings, and insulation to provide a complete installation.

Hot Water Service
Design, provide and install a new branch from the existing hot water flow and return pipework within the existing the 4th floor void complete with a heat meter to serve the new sink within the tea area New pipework to be carried out in copper tube.

Design, provide and install screwdriver operated, quarter turn, ballofix valves for isolation purposes on the hot water supply to each appliance served.

Design, provide and install all necessary tees, bends, valves, backflow prevention devices etc. necessary to provide a complete working installation in compliance with all regulations and codes of practice.

All hot water pipework subject to heat gain or requiring protection from frost shall be thermally insulated.

The hot water service will be supported by a pumped return loop to ensure that the water temperature delivered to the valves does not drop below 55 ^{O}C.

Design, provide and install fire stopping where all hot water pipework passes through a fire barrier.

The contractor shall make adequate allowance within his programme for the submittal of working drawings and relevant details to the water authority Water for approval under the Water Supply (Water

Fittings) Regulations 1999.

All water meters to be Ofgem approved.
Any exposed domestic water services pipework (hot and cold water) that is visible (i.e. not concealed behind kitchen units or vanity units) shall be installed in chromium plated copper.
100.040 SYSTEM DRAWINGS:
As schedule reference A11-Drawings

200.000 PLANT AND EQUIPMENT:

200.001 PRESSURE EQUIPMENT DIRECTIVE/PRESSURE EQUIPMENT REGULATIONS:
All equipment and assemblies which fall within the scope of The Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through The Pressure Equipment Regulations 1999, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.
Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

200.106 THERMOSTATIC MIXING VALVES:
- Type TMV3
- Application shower and wash basins
- Manufacturer and reference Douglas Delabie
  - Or approved equivalent
- Install thermostatic mixing valves in accordance with manufacturer's recommendations.

200.120 WATER TREATMENT:
- Type In Lime Scale Inhibitor
  - Manufacturer and reference Liff 15mm Magnetic Limefighter
    - Or approved equivalent

200.120 WATER BOILER:
The Mechanical Contractor shall supply, install and test water boiler for drink preparation as shown on the drawings. Over sink water boiler shall be installed in the Tea area. In all instances the water boiler shall be installed above the draining board of sink.

The water boilers shall be as Zip Hydroboil (or approved equivalent) wall mounted instant water boilers with classic taps and corrosion resistant stainless steel casing. The units shall be WRAS approved and CE endorsed.

The boilers shall comprise of a twin boiling chamber covered with compressed high temperature thermal insulation panels and have integral capillary control thermostats. The units shall be installed to the manufacturer’s recommendations.

The Tea area unit shall be as the HS003 model equal and approved for an 18 cup delivery.

Zip Heaters (UK) Limited, Bertie Ward Way, Dereham, Norfolk, NR19 1TE, telephone 0845 602 4533.

200.135 APPROVALS:
Ensure all water fittings and materials are listed in the Water Fittings and Materials Directory published by WRAS.

200.140 WATER METERS:
- Application cold water metering

Install a water meter to the new branch serving the areas covered within this specification. Locate the meters to allow for easy access for meter reading by the building's occupants/water board.
- Standard - BS EN 14154.
- Provide isolating valves on either side of each meter, and full-bore valved by-pass installed around meter assembly.
- Provide flanged connections to BS EN 1092-4 on each meter. Where meters are of smaller bore

than connecting pipework, install flanged reducers.
- Provide a link back to the existing building's BMS for monitoring purposes only.

600.000 PIPELINES AND ANCILLARIES - MATERIALS:

600.015 PIPES - COPPER TO BS EN 1057:
- Application hot and cold water services
- Kitemark certified
- Material - Copper to BS EN 1057.
  - R220 annealed.
  - R250 half hard.
- Finish - Uncoated.
- Jointing
  - Capillary fittings as clause 600.040.
    - Compression fittings for connections to equipment - as clause 600.050.
  - Compression fittings as clause 600.050.

600.040 COPPER FITTINGS - CAPILLARY, FOR COPPER TUBING:
- Application hot and cold water services
- Kitemark certified.
- Material
  - Copper (dezincifiable resistant).
  - Copper alloy (dezincifiable resistant).
  - Copper/copper alloy (lead- and cadmium-free).
- Standard
  - BS EN 1254-1.
- Jointing materials - capillary joints.
  Solder - BS EN ISO 9453.

600.050 COPPER FITTINGS - COMPRESSION, FOR COPPER TUBING:
- Application hot and cold water services
- Kitemark certified.
- Material
  - Copper (dezincifiable resistant).
  - Copper alloy (dezincifiable resistant).
  - Copper/copper alloy (lead- and cadmium-free).
- Standard
  - BS EN 1254-2.
- Type
  - Type A - non-manipulative.
  - Type B - manipulative.
- Ends - Socket.
- Finish - Cast.

600.070 STOP VALVES TO BS 1010-2:
- Application hot and cold water services isolation
- Manufacturer and reference Crane or Hattersley
  - Or approved equivalent
- Kitemark certified.

Material -Bronze or DZR copper alloy body.
- Ends
  - Threaded to BS 21 and BS EN 10226-1.
  - With connections for capillary fittings to BS EN 1254-1.

600.080 STOP VALVES TO BS 5433:
- Application hot and cold water services isolation
- Manufacturer and reference Crane or Hattersley
  - Or approved equivalent

- Kitemark certified.
  Material - Bronze or DZR copper alloy body.
- Ends - Threaded to BS 21 and BS EN 10226-1.

600.085 STOP VALVES - BALL TYPE:
- Application hot and cold water services isolation
- Manufacturer and reference Crane or Hattersley
  - Or approved equivalent
  Bronze or DZR copper alloy body; chrome or nickel plated sphere.
- Ends
  - Threaded to BS 21 and BS EN 10226-1.
  - Capillary to BS EN 1254-1.
  - Compression to BS EN 1254-2.
  - Compression to BS EN 1254-3, or BS 864-5.
- Operation
  - Screwdriver operated.
  - Lever operated.

600.090 CHECK VALVES - SWING CHECK TYPE TO BS 5154:
- Application hot and cold water services
- Manufacturer and reference Crane or Hattersley
  - Or approved equivalent
  Straight lift pattern.
- Material
  - Manufacturer's standard.
  - Suitable for potable water.
- Ends
  - Threaded to BS 21 and BS EN 10226-1.
  - Capillary to BS EN 1254-1.
  - Compression to BS EN 1254-2.
  - Compression to BS EN 1254-3, or BS 864-5.

600.100 DRAIN COCKS - SCREWDOWN COCK TYPE TO BS 2879, TYPE 1:
- Application hot and cold water services
- Bronze body threaded male to BS 21 and BS EN 10226-1.
- Screw down plug with square shank for loose lever.
- Serrated outlet to accept hose pipe, fixed or union pattern.

600.120 WALL, FLOOR AND CEILING MASKING PLATES:
- Application all hot and cold water wall penetrations
  - Manufacturer
- Material
  - Copper alloy, chromium plated.
- Style
  - Heavy, split on the diameter.
- Fixing
  - Chrome raised head fixing screws.

600.130 VALVE LABELS:
Supply and fit engraved plastic labels to all valves (except isolating and regulating valves on heat emitters).
Engrave with
- description of function.

600.140 PIPEWORK IDENTIFICATION:
Colour code and label to BS 1710.
- Apply 300mm wide colour bands to each pipe at intervals not exceeding fifteen metres.

• Apply 50mm wide colour bands and superimpose a legend identifying circuit and direction of flow. Apply legends to colour bands by transfers of an approved type.

600.150 TRACE HEATING:
• Application hot water distribution pipework to maintain water temperature
• Supply electric trace heating complete with fixing tape, shrink sleeves, crimps, junction boxes and controls.
  • Tape
    • Constant power heating cable.
    • Self regulating heating tape.
  • Insulation
    • Modified polyolefin electrical insulation.
  • Jacket
    • Tinned copper braid.
    • Modified polyolefin jacket.
  • Electrical protection
    • Protect circuits with MCB's.
    • Provide RCD protection.
    • Isolators.
• Installation
  Install electric surface heating in accordance with BS 6351-3 and manufacturer's instructions. Ensure pipe is cleaned of all abrasive material prior to application.

700.000 PIPELINE WORKMANSHIP:

700.010 INSTALLATION GENERALLY:
Install, test and commission systems to comply with BS 6700, BS EN 806-4, Water Supply (Water Fittings) Regulations 1999 and Water Supply (Water Fittings) (Amendment) Regulations 1999, and equipment manufacturer's recommendations.
• Install thermoplastics pipework in accordance with BS 5955-8.

700.020 APPEARANCE:
Arrange all exposed pipe runs to present neat appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting.
Ensure all vertical pipes are plumb or follow building line.

700.030 SPACING:
Space pipe runs in relation to one another, other services runs and building structure, allow for thermal insulation and ensure adequate space for access to pipe joints, etc.
Minimum clearances to pipe or pipe insulation:-

From	Minimum Clearance (mm)
Wall	25
Ceiling	50
Floor	150
Other pipes	25
Electrical cables, conduit, switchgear, etc.	150

700.040 GRADIENTS:
Install pipework with gradients to allow drainage and air release.

700.050 EXPANSION AND CONTRACTION:
Arrange supports and fixings to accommodate pipe movement caused by the thermal changes. Isolate pipes from structure to prevent noise or abrasion due to thermal movement / changes in direction.

700.060 BENDS, SPRINGS AND OFFSETS:
Machine bend and ensure that machine guides and formers are smooth and clean, free from any

scores, or other damage. Deformed bends will not be accepted.

700.070 PIPES THROUGH WALLS AND FLOORS:
Enclose pipes passing through building elements, (walls, floors, partitions, etc.) concentrically within purpose made sleeves.

700.080 PIPE SLEEVES:
Cut sleeves from material same as pipe one or two sizes larger than pipe. Do not use sleeves as pipe supports. Install sleeves flush with building finish.

700.090 TEMPORARY PLUGS AND CAPS:
Seal all open ends as installation proceeds by metal, plastic or wooden plugs or caps, to prevent ingress of foreign matter.

700.100 CAPILLARY JOINTS, COPPER/STAINLESS STEEL PIPES:
Preparation
Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool.
Making and sealing
Use specified flux ensuring no excess material used. Make joint in accordance with manufacturer's instructions. Clean off traces of flux when joint is completed. Protect building fabric from heat when forming joints.

700.110 COMPRESSION JOINTS, COPPER/STAINLESS STEEL/POLYETHYLENE PIPES:
Preparation
Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper. Then if using:
Type 'A' fitting - no further preparation.
Type 'B' fitting - in accordance with fitting manufacturer's instructions.
Making and Sealing
In accordance with fitting manufacturer's instructions.

700.130 PIPE RINGS AND CLIPS:
Select type according to the application and material compatibility.

700.140 PIPE SUPPORTS:
Arrange supports and accessories for equipment, appliances or ancillary fitments in pipe runs, so that no undue strain is imposed upon pipes.
Ensure that materials used for supports are compatible with pipeline materials.

700.150 PIPE SUPPORT SPACING COPPER/STAINLESS STEEL PIPE:

PIPE BORE (mm)	MAXIMUM SUPPORT SPACING (mm)	
Nominal	Horizontal	Vertical
Up to15	1200	1800
22	1400	2100
28	1800	2400
35	2400	3000
42	2400	3000
54	2700	3000

700.170 MAINTENANCE AND RENEWAL:
Arrange pipework, valves, drains, air vents etc., for convenient routine maintenance and renewals.

800.000 THERMAL INSULATION:

800.010 THERMAL INSULATION TO PIPELINES:
- Type foil faced phenolic foam

- Application any concealed domestic water services pipework in ceiling voids, floor voids or risers
  Finish
  - Unfaced.
  - Reinforced aluminium foil with at least 25mm overlap.
- Protection
  Ensure that where protection is applied to insulation, the joints fall blind side and that all joints are made to shed water and sealed with waterproof tape, adhesive or joint sealant where appropriate.

800.030 THERMAL INSULATION WORKMANSHIP:
Do not apply thermal insulation until installation has been fully tested and all joints proved sound.
Ensure that all materials are kept dry.
Ensure clearance between insulated pipes.
Apply insulants, facings, coatings and protection strictly in accordance with manufacturer's instructions.
Neatly finish joints and corners, and ensure continuity over fittings and supports, with longitudinal split concealed.

800.035 CALCULATION OF INSULATION THICKNESS - BUILDING REGULATIONS (ENGLAND AND WALES):
Provide insulation thickness conforming with the values given in the tables below. These figures are derived from the requirements of the Building Regulations (England and Wales) Part L Approved Documents, and the calculation methods given in BS EN ISO 12241.

800.055 NON-DOMESTIC HOT WATER SERVICE AREAS, BUILDING REGULATIONS - PHENOLIC FOAM:
Environmental insulation thickness for non-domestic hot water service areas to control heat loss, in accordance with the requirements of the Building Regulations (England and Wales) Part L2 Approved Documents.

Outside diameter of steel pipe (mm)	Thickness of phenolic foam (mm)
17	15
21	15
27	15
34	20
42	20
48	20
60	20
76	25
89	25
114	25
140	25
168	25
219	30
273 and above	30

- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

800.080 CHILLED AND COLD WATER SUPPLIES TO PREVENT CONDENSATION - PHENOLIC

FOAM, HIGH EMISSIVITY:
Minimum insulation thickness for chilled and cold water supplies to prevent condensation on a high emissivity outer surface (0.6) with an ambient temperature of 25^0C and a relative humidity of 80%.

Outside diameter of steel pipe (mm)	Temperature of contents ^{0}C		
	10	5	0
	Thickness of phenolic foam insulation (mm)		
17	15	15	15
21	15	15	15
27	15	15	15
33	15	15	15
42	15	15	15
48	15	15	15
60	15	15	15
76	15	15	15
89	15	15	15
102	15	15	20
114	20	20	20
140	20	20	20
168	20	20	20
219	25	25	25
245	25	25	25
273	25	25	25
324	25	25	25
356	25	25	25
406	25	25	25
456	25	25	25
508	25	25	25
610	25	25	25
Flat surfaces	25	25	25

- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

800.085 CHILLED AND COLD WATER SUPPLIES TO PREVENT CONDENSATION - PHENOLIC FOAM, LOW EMISSIVITY:
Minimum insulation thickness for chilled and cold water supplies to prevent condensation on a low emissivity outer surface (0.05) with an ambient temperature of 25^0C and a relative humidity of 80%.

Outside diameter of steel pipe (mm)	Temperature of contents ^{0}C		
	10	5	0
	Thickness of phenolic foam insulation (mm)		
17	15	20	20
21	15	20	20
27	15	20	25
33	15	20	25
42	15	20	25
48	15	25	30
60	20	25	25
76	20	25	30
89	20	25	35
102	20	25	35
114	20	30	35
140	20	30	40
168	25	30	40
219	25	35	40

245	25	35	40
273	25	35	45
324	25	35	45
356	25	35	50
406	25	35	50
456	25	35	50
508	30	40	50
610	30	40	55
Flat surfaces	30	40	55

- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.

900.000 COMMISSIONING AND TESTING:

900.010 PRESSURE TESTING:
Advise appropriate personnel, at least 3 days in advance, of the time that pressure tests may be witnessed.
Test concealed or buried pipework before any permanent covering is applied.
Complete pressure testing before applying thermal insulation.
Thoroughly flush out the whole system, fill system, vent all air from system and check for leaks, repair any leaks and re-check.
- Pressure test the system for a period of one hour, and check for and repair any leaks. Repeat pressure test if leaks have been found.
  - Test at twice the working pressure.
- Disconnect incoming service pipe from mains, fill with potable water, pressure test for a period of one hour, and check for and repair any leaks. Repeat pressure test if leaks have been found.
  - Test at twice the working pressure.

900.020 STERILIZATION - GENERAL:
After flushing process, carry out sterilization in accordance with BS 6700 and BS EN 806-4.
Prior to sterilization ensure each system is flushed, cleaned and drained.
Provide temporary connections to system terminal points suitable for introduction of sterilization chemicals and fluids and 22mm minimum valved drain connection on incoming main immediately downstream of mains isolating valve.
Fill system with clean, fresh water.

900.030 STERILIZATION - MAINS WATER SYSTEM:
Carry out the following operations in accordance with BS 6700 and BS EN 806-4.
Flush system and introduce sterilisation chemical, take samples to ensure correct chlorine concentration.
Leave system to stand for
Repeatedly flush system with clean water until all traces of chlorine have been removed - leave system filled.
- Submit samples to registered laboratory for microbiological analysis and report.

BS APPENDIX

BS 1710:1984
Specification for identification of pipelines and services

BS 2879:1980
Specification for draining taps (screw-down pattern)

BS 5154:1991
Specification for copper alloy globe, globe stop and check, check and gate valves.
Partially replaced by BS EN 12288:2003

BS 5970:2001
Code of practice for thermal insulation of pipework and equipment in the temperature range of -100°C to +870°C

BS 6351-3:1983
Electric surface heating. Part 3 Code of practice for the installation, testing and maintenance of electric surface heating systems

BS 6700:2006+A1:2009
Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Specification
Partially superseded by BS EN 806-4:2010

BS 7671:2008
Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition

BS 7697:1993
Nominal voltages for low voltage public electricity supply systems

BS 864-5:1990
Capillary and compression tube fittings of copper and copper alloy. Part 5 Specification for compression fittings for polyethylene pipes with outside diameters to BS 5556.
Obsolescent. Replaced by BS EN 1254-3:1998 but remains current.
BS EN 10226-1:2004
Pipe threads where pressure tight joints are made on the threads. Part 1 Taper external threads and parallel internal threads. Dimensions, tolerances and designation

BS EN 1057:2006+A1:2010
Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications

BS EN 1254-1:1998
Copper and copper alloys. Plumbing fittings. Part 1 Fittings with ends for capillary soldering or capillary brazing to copper tubes.

BS EN 1254-2:1998
Copper and copper alloys. Plumbing fittings. Part 2 Fittings with compression ends for use with copper tubes

BS EN 1254-3:1998
Copper and copper alloys. Plumbing fittings. Part 3 Fittings with compression ends for use with plastics pipes

BS EN 14597:2005
Temperature control devices and temperature limiters for heat generating systems

BS EN 14743:2005+A1:2007
Water conditioning equipment inside buildings. Softeners. Requirements for performance, safety and testing

BS EN 15161:2006
Water conditioning equipment inside buildings. Installation, operation, maintenance and repair

BS EN 60335-2-21:2003+A2:2008
Specification for safety of household and similar electrical appliances. Part 2-21 Particular requirements. Particular requirements for storage water heaters

BS EN 60730-2-9:2010
Automatic electrical controls for household and similar use. Part 2-9 Particular requirements for temperature sensing controls

BS EN 806-4:2010
Specifications for installations inside buildings conveying water for human consumption. Part 4

Installation

BS EN ISO 12241:2008
Thermal insulation for building equipment and industrial installations. Calculation rules

BS EN ISO 228-1:2003
Pipe threads where pressure-tight joints are not made on the threads. Part 1 Dimensions, tolerances and designation

BS EN ISO 9453:2006
Soft solder alloys. Chemical compositions and forms

T32 LOW TEMPERATURE HOT WATER HEATING (SELF CONTAINED SPECIFICATION)

100.000 SYSTEM DETAILS

100.010 SYSTEM DESCRIPTION
The existing LTHW heating circuit is to be extended to serve trench heating to offset the glazing losses within the new offices on the fourth floor.

Low temperature hot water is generated by existing gas fired condensing boilers.

From the existing heating pipework design provide and install a new heating circuit to serve the trench heating within the 4 new offices as detailed on the tender drawing. The new heating circuit shall run within the floor void. All pipework shall be of steel construction and shall be thermally insulated where routed within the floor, ceiling void or bulkheads.

At this stage it has been assumed that the existing infrastructure is sufficiently sizes to serve the fourth floor The contractor shall make allowances to check that this is the case prior to the works being carried out and to notify the engineer of their findings

Design, provide and install commissioning sets and flow measurement valves on the heating pipework to enable accurate commissioning of the heating system. The valves shall be installed strictly in accordance with the manufacturer's recommendations, with the requisite length of straight pipe of the same bore as the valve on either side; ten diameters upstream, five diameters downstream of all measuring stations and double regulation valves.

Note that all exposed heating pipework shall be painted gloss white as part of this contract.

100.030 CONTROL REQUIREMENTS
Design, provide & install 2-port valve arrangement (complete with isolating valves either side) to provide heating zone control to the new fourth floor area. The new fourth floor zone should be separately sub metered and connected to the existing building's BMS for monitoring purposes only.

All meters to be Ofgem approved.

300.000 HEAT EMITTERS

300.030 TRENCH HEATERS
- Application
  - Heating to offset glazing losses
- Standards
- Manufacturer and reference
  - Fraser Engineering, NNN 400x300 Cantilever Type
  - Or approved equivalent
- Location
  - As detailed on tender drawing
- Accessories
  -

000 HEAT EMITTER WORKMANSHIP

400.010 INSTALLATION:
Install heat emitter equipment in accordance with manufacturer's recommendations to give a neat appearance, with supports out of view where possible. Ensure equipment is firmly fixed and level.

400.020 RADIATOR REMOVAL:
Allow for removing and re-fitting radiators once to permit decorating.

400.030 HEAT EMITTER ISOLATION:
Fit an isolating valve on flow and a regulating valve on return unless otherwise indicated.

BS APPENDIX

BS 143 and 1256:2000
Threaded pipe fittings in malleable cast iron and cast copper alloy

BS 1453:1972
Specification for filler materials for gas welding.
Partially replaced by BS EN 12536:2000

BS 1710:1984
Specification for identification of pipelines and services

BS 21:1985
Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions).
Partially superseded by BS EN 10226-1:2004

BS 2767:1991
Specification for manually operated copper alloy valves for radiators

BS 2879:1980
Specification for draining taps (screw-down pattern)

BS 2971:1991
Specification for class II arc welding of carbon steel pipework for carrying fluids

BS 5154:1991
Specification for copper alloy globe, globe stop and check, check and gate valves.
Partially replaced by BS EN 12288:2003

BS 5854:1980
Code of practice for flues and flue structures in buildings

BS 6956-1:1988
Jointing materials and compounds. Part 1 Specification for corrugated metal joint rings

BS 6956-5:1992
Jointing materials and compounds. Part 5 Specification for jointing compounds for use with water, low pressure saturated steam, 1st family gases (excluding coal gas) and 2nd family gases
BS 7697:1993
Nominal voltages for low voltage public electricity supply systems

BS 864-5:1990
Capillary and compression tube fittings of copper and copper alloy. Part 5 Specification for compression fittings for polyethylene pipes with outside diameters to BS 5556.
Replaced by BS EN 1254-3:1998 but remains current.

BS EN 10226-1:2004
Pipe threads where pressure tight joints are made on the threads. Part 1 Taper external threads and parallel internal threads. Dimensions, tolerances and designation

BS EN 10242:1995
Threaded pipe fittings in malleable cast iron

BS EN 10253-1:1999
Butt-welding pipe fittings. Part 1 Wrought carbon steel for general use and without specific inspection requirements

BS EN 10255:2004
Non-alloy steel tubes suitable for welding or threading. Technical delivery conditions
BS EN 1092-1:2007
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 1 Steel flanges

BS EN 1092-2:1997
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 2 Cast iron flanges

BS EN 1092-3:2003
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 3 Copper alloy flanges

BS EN 1092-4:2002
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 4 Aluminium alloy flanges

BS EN 1151-1:2006
Pumps. Rotodynamic pumps. Circulation pumps having a rated power input not exceeding 200 W for heating installations and domestic hot water installations. Part 1 Non-automatic circulation pumps, requirements, testing, marking

BS EN 1151-2:2006
Pumps. Rotodynamic pumps. Circulation pumps having a rated power input not exceeding 200 W for heating installations and domestic hot water installations. Part 2 Noise test code (vibro-acoustics) for measuring structure and fluid-borne noise

BS EN 1171:2002
Industrial valves. Cast iron gate valves

BS EN 12831:2003
Heating systems in buildings. Method for calculation of the design heat load
Partially replaces BS 5449:1990 which remains current

BS EN 13166:2001
Thermal insulation products for buildings. Factory made products of phenolic foam (PF). Specification

BS EN 13190:2001
Thermal insulation products for buildings. Factory made products of phenolic foam (PF). Specification
BS EN 1514-1:1997
Flanges and their joints. Dimensions of gaskets for PN-designated flanges. Part 1 Non-metallic flat gaskets with or without inserts

BS EN 60335-2-51:2003+A1:2008
Specification for safety of household and similar electrical appliances. Part 2-51 Particular requirements for stationary circulation pumps for heating and service water installations

BS EN 751-2:1997
Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water. Part 2 Non-hardening jointing compounds

BS EN 837-1:1998
Pressure gauges. Part 1 Bourdon tube pressure gauges. Dimensions, metrology, requirements and testing

BS EN ISO 12241:1998
Thermal insulation for building equipment and industrial installations. Calculation rules

U19 VENTILATION (SELF CONTAINED SPECIFICATION)

100.000 SYSTEM DETAILS

100.010 SYSTEM DESCRIPTION
The ventilation strategy for the fourth floor offices remodelled areas shall be a combination of natural ventilation and mechanical supply and extract as follows.

100.011 NATURAL VENTILATION SYSTEMS
Fresh air ventilation to the new offices and corridor shall be provided via the existing manually openable windows.

100.012 HEAT RECOVERY SUPPLY & EXTRACT VENTILATION SYSTEM
Design, provide and install a new heat recovery unit to serve the tea area. This shall be located on the roof on the floor above, as indicated on the drawing.

Supply and extract ducts from the heat recovery unit shall be routed into the building via the existing services opening and then run within the ceiling voids and bulkheads where required. Air will be supplied and extracted via high level extract grilles, as indicated on the tender drawings. Flexible ductwork for final connections shall be limited to 500mm in length to avoid unnecessary pressure losses

Fire dampers complete with access panel shall be installed into any new ducts passing through fire barriers.

All new supply fresh air ductwork above the ceilings and within bulkheads on each floor shall be installed with foil faced thermal insulation.

All new supply ductwork branches shall be fitted with volume control dampers to allow adequate commissioning.

The contractor shall allow for proprietary support for the outdoor heat recovery unit, such as Big foot roof pro or approved equivalent.

100.030 CONTROL REQUIREMENTS
The new heat recovery unit shall be linked back to the existing building's BMS for monitoring purposes only.

100.040 SYSTEM DRAWINGS
As schedule reference A11-Drawings

200.000 PLANT AND EQUIPMENT

200.001 PRESSURE EQUIPMENT DIRECTIVE/PRESSURE EQUIPMENT REGULATIONS:
All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through the Pressure Equipment Regulations 1999, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.

Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.
200.010 AIR HANDLING UNITS:
- Application Air supply and extract
- Motor
    - Electrical supply to BS 7697
- Motor starter in control panel
- Vibration isolation AVMs and flexible connections on fans
- Fan section

- Provide frame for motor and fan and comply with fire regulations.
- Ensure frame is isolated from casing.
- Mount motor internally.

Installation
Ensure air is straightened as it leaves unit discharge.
Ensure ductwork connection is long enough to maintain the aerodynamic performance of the fan.
Seal panels around electrical cable and pipework service entry points to prevent air leakage. Provide flexible cables between fan motor and local isolator.

200.080 GRILLES AND DIFFUSERS:
- Type louvred face 4 way blow
- Application office supply and extract grilles
- Manufacturer and reference Gillberts DG and GECA
  - Or approved equivalent
- As indicated on drawings

200.090 PLANT AND EQUIPMENT WORKMANSHIP:
Install all plant and equipment in accordance with manufacturer's instructions.

300.000 DUCTLINES AND ANCILLARIES

300.010 DUCTWORK FABRICATION:
Prepare fabrication drawings and carry out fabrication of ductwork in accordance with DW 154 as appropriate.

300.020 DUCTWORK DIMENSIONS:
Sizes of ductwork are internal dimensions. Where applicable make allowance for any internal lining.

300.030 INSTALLER SELECTION:
- Use a member of the HVCA specialising in the trade of manufacturing and installing ductwork.

300.040 DUCTWORK AND FITTINGS:
- Design Information
  Extract ductwork in accordance with classification in DW 144 Table 1.
  Ductwork Classification and Air Leakage limits
  - Low pressure - Class A - Positive.
  - Low pressure - Class A - Negative.
- Ductwork air leakage testing
  - Carry out ductwork air leakage testing on high pressure ductwork in accordance with DW 144 as procedures set out in DW 143.
  - Test medium pressure ductwork in accordance with DW 144, A5.
  - Testing plant items, DW 144, Part 8, A.8.
- Plant connections.
  Make connection between air handling assembly and ductwork system in accordance with DW 144.

300.100 DUCTWORK WORKMANSHIP:
Install ductwork in accordance with DW 144, and DW 154 as appropriate. Ensure that there are no sharp edges or corners on cut edges on ductwork, flanges and supports. Arrange ductwork to drain any entrained moisture and ensure the lapping of joints minimises moisture leakage.
Connection to builder's work. Comply with DW 144 Part 7 Section 28.
Space supports in accordance with DW 144 Part 6 or DW 154 Part 5 as appropriate.
- Internal cleanliness
  - Provide the level of cleanliness and protection as defined in HVCA document DW/TM2.
    - Basic.
- Weatherproofing

    - Fit ductwork with trimming angle and weather cravat, skirt, flashing plate and cowl where ductwork passes through or terminates in roof, to ensure a weatherproof seal to building structure
- Enclose ducts passing through building elements, (walls, floors, partitions, etc.) within purpose made sleeves. Cut sleeves of the same material as the duct and pack with mineral fibre or similar non-flammable and fire resistant material to form a fire/smoke stop of adequate rating and to prevent air movement and noise transmission between duct and sleeve.
- Provide test holes in ductwork system to allow complete testing and balancing of system in accordance with CIBSE Commissioning Code A.
- Site drill test holes on site in accordance with DW 144 Part 7 Section 20.6.
- Provide holes in metal ductwork, in accordance with DW 144 Part 7, paragraph 20.7, to accommodate thermostats, humidistats and other control sensors in positions and sizes indicated on drawings.
- Install sensors and test points in plastics ductwork to suit specialist control and sensing equipment in positions and fixing configurations shown on drawings.
- Fit sensors, damper motors and other control equipment as indicated on drawings.
- Provide instrument connections where indicated on drawings.

500.000 THERMAL INSULATION

500.010 THERMAL INSULATION - MATERIALS:
- Application supply air ductwork, supply and extract

Standards

Comply in general with BS 5970. Description of terms as BS 3533.

Thermal conductivity

Ensure values are in accordance with BS EN 12664, BS EN 12667, BS EN 12939 or BS EN ISO 8990.

Fire rating

Employ materials that comply with BS 476-4, non-combustibility test, or obtain a Class 'O' fire rating to Building Regulations.

When finished, comply with BS 476-7.

Material
- Mineral fibre duct insulation
    - Rigid
    - Flexible
    - Finish
        - Reinforced aluminium foil.
- Adhesives.

  Comply with the recommendations of clause 8.2 of BS 5970, section 2 for insulation bonding adhesives, lagging adhesives, facing and film attachment adhesives.
- Protection
    - Polyisobutylene
        - Minimum thickness 0.8mm.
- Reinforcement
    - Aluminium bands at 300mm centres.
    - Aluminium bands at 450mm centres.
    - 50mm x 19g galvanised wire netting to BS EN 10223.
    - 50mm x 22g galvanised wire netting to BS EN 10223.

500.012 CALCULATION OF INSULATION THICKNESS - BUILDING REGULATIONS (ENGLAND AND WALES):

Provide insulation of thickness conforming with the values given in the tables below. These figures are derived from the requirements of the Building Regulations (England and Wales) Part L Approved Documents, and the calculation methods given in BS EN ISO 12241.

500.018 ENVIRONMENTAL THICKNESS ON DUCTWORK, BUILDING REGULATIONS:

Environmental insulation thickness for ductwork, in accordance with the requirements of the Building Regulations (England and Wales) Part L2 Approved Documents.

Application	Heated duct	Dual purpose	Cooled duct
Environmental thickness of mineral wool insulation (mm)	40	50	50
Environmental thickness of phenolic foam insulation (mm)	25	35	35
Environmental thickness of nitrile rubber insulation (mm)	40	62	62

- The above thicknesses for nitrile rubber insulation relate to Class 0 rated insulation. The thicknesses may vary for other ratings.

500.020 THERMAL INSULATION WORKMANSHIP:
Carry out thermal insulation work using one of the scheduled firms employing skilled craftsmen conversant with class of work.
Do not apply thermal insulation until installation has been fully tested and all joints proved sound.
Ensure all materials are kept dry.
Insulate each unit separately. Do not enclose adjacent units together.
Apply insulants, facings, coatings and protection strictly in accordance with manufacturer's instructions.
Neatly finish joints, corners, edges and overlaps and, where possible, arrange overlaps to fall on blind side.
Ensure overlaps are neat and even and parallel to circumferential and longitudinal joints.

500.030 INSTALLATION OF FOIL FACED INSULATION ON DUCTWORK:
Secure the insulation with adhesive in accordance with manufacturer's recommendations.
Use insulation hangers spaced at maximum 300mm centres on the underside of ducts.
Seal joints and pin penetrations using 100mm wide class `O' aluminium foil tape. Where cut outs for test holes, etc. occur tape over insulation membrane and return to the duct surface.
Foil faced semi-rigid slab
Cut slabs so that the top and bottom pieces overlap the sides.
Where insulation abutts duct support inserts that have integral vapour barriers seal using class `O' foil tape to continue vapour barrier.

500.040 INSTALLATION OF PROTECTION:
Ensure that where protection is applied to insulation, the joints fall blind side and that all joints are made to shed water and sealed with waterproof tape, adhesive or joint sealant where appropriate.

600.000 COMMISSIONING

600.010 COMMISSIONING REQUIREMENTS:
Application
- Clean ductwork before plant is first run, using access openings in ductwork.
- Put system to work and demonstrate that specified duties are attained plus or minus:
  - 10%
- Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guide for air systems to achieve the standards set in the CIBSE Commissioning Codes.
- Carry out checks and procedures as detailed in CIBSE Commissioning Code A, Section A1.
- Set to work and regulate air distribution systems in accordance with CIBSE Commissioning Code A, Section A2.
- Ensure that the control system functions in accordance with the requirements specified in clause 100.030.
- Keep a systematic record of commissioning results.

BS APPENDIX

BS 3533:1981
Glossary of thermal insulation terms

BS 476-24:1987
Fire tests on building materials and structures. Part 24 Method for determination of the fire resistance of ventilation ducts

BS 476-4:1970
Fire tests on building materials and structures. Part 4 Non-combustibility test for materials

BS 476-7:1997
Fire tests on building materials and structures. Part 7 Method of test to determine the classification of the surface spread of flame of products

BS 5970:2001
Code of practice for thermal insulation of pipework and equipment in the temperature range of -100°C to +870°C

BS 7697:1993
Nominal voltages for low voltage public electricity supply systems

BS EN 12664:2001
Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Dry and moist products of medium and low thermal resistance

BS EN 12667:2001
Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance

BS EN 12939:2001
Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Thick products of high and medium thermal resistance

BS EN 60335-2-80:2003
Specification for safety of household and similar electrical appliances. Part 2-80 Particular requirements for fans

BS EN ISO 12241:1998
Thermal insulation for building equipment and industrial installations. Calculation rules

BS EN ISO 8990:1996
Thermal insulation. Determination of steady-state thermal transmission properties. Calibrated and guarded hot box

BS ISO 14695:2003
Fans for general purposes. Method of measurement of fan vibration

U60 AIR CONDITIONING UNITS

PART 1 SYSTEM OBJECTIVES

100.030 SYSTEM DESCRIPTION
Design, provide and install a number of heat pump split systems to provide heating and cooling to the new offices, tea area and patch panel cupboard, as detailed on the tender drawings.

The indoor unit serving the patch panel cupboard should be wall mounted type and all the other indoor units shall be ceiling cassette type units. Each unit shall be piped back to separate outdoor unit for each room served, to allow each office to be separately sub metered.

The contractor is to ensure that the outdoor unit is positioned with the appropriate manufacturers' recommended clearance for service maintenance and air circulation purposes.

Design, provide and install a condensate drain system to discharge the condensate from the units into the existing soil pipe located within the tea area. Condensate drains will be connected via a HepVO or similar self-sealing trap to prevent odours from entering the condition space. Condensate drainage to be carried out in plastic pipework and shall terminate via a waterless trapped connection. Where gravity condensate system is not possible, provide and install a pumped gravity condensate system. Locate the pump in an easily accessible location for future maintenance.

The outdoor condensing units shall be located on the roof, as indicated on the tender drawings. The contractor should note that the maximum length of refrigerant pipework run is 80m.

The mechanical contractor shall be responsible for all power and control wiring associated with the installation of the heat pump systems indoor and outdoor units from the fused spur/isolator provided by the electrical contractor.

The contractor shall allow for proprietary support for the outdoor units so as not to cause ant damage to the roof membrane, such as Big foot roof pro or approved equivalent.

The contractor shall be responsible for all field electrical and inter connecting control wiring from the isolator supplied by the electrical contractor between the indoor and outdoor unit.

Each room served by the heat pump system shall have its own individual hard wired wall mounted controller to control the indoor unit and a thermostat, provided and installed as part of this contract.

The new heat pump systems shall be linked back to the existing building's BMS for monitoring purposes only.

All refrigerant pipework for each system described above shall be carried out in copper tube which shall be insulated with the appropriate thickness of Armaflex Class 'O' insulation, in accordance with BS378: Refcom and all relevant guides and standards.

All refrigerant pipework shall be installed neatly clipped to cable tray and protected to avoid damage from birds.

All condensate pipework shall be carried out in plastic tube.

The heat pumps shall be selected to operate with refrigerant R410A with C.O.P and EER of 3.6 minimum (class A+)

The heat pump systems shall be as manufactured by Mitsubishi or approved equivalent.

Where possible ensure that all components/equipment/plant for the heat pumps are not of a bespoke nature for future maintenance and repairs.

100.060 SYSTEM DRAWINGS

As schedule reference A11-Drawings

PART 3 SPECIFICATION CLAUSES SPECIFIC TO U60

300.000 PLANT AND EQUIPMENT

300.110 PIPEWORK:
- Application DX refrigerant systems
- Seamless, round copper tube to BS EN 12449.
- Seamless, round copper capillary tube to BS EN 12450.
- Jointing
  - High temperature solder.
  - Manipulative compression (flared).
  - Manipulative compression (flared) only at connection to equipment.
- Support
  Support all pipework and controls cabling throughout their length using cable tray, firmly fixed to the building fabric.
  - Perforated cable tray
    - Flanged.
  - Fittings
    Use factory made fittings throughout of same material type, pattern, finish and thickness as tray.
- Finish

300.120 DRAINAGE PIPEWORK
- Type condensate drainage from DX equipment

Provide condensate drainage pipework from all units to drain.
- Unplasticised PVC to BS EN 1452.
- Provide tundish and air break at units.
- Provide trap - depth minimum 1.5 times negative pressure on inlet and 0.5 times negative pressure at discharge.

300.130 PIPEWORK INSULATION
- Application all new DX refrigerant pipework

Insulate entire length of pipework for thermal insulation and to avoid contact between copper and galvanising of support tray.
- Closed cell nitrile rubber preformed flexible sections
  - CFC free.
  - Fire rating (class)
  - Install un-split wherever possible.
  - Use manufacturer's standard glue for jointing.
  - Ensure vapour barrier is maintained on
    - all pipework.
    - suction pipe only.
- Protection for outdoor insulation
  - Paint
    - Manufacturer's standard colour.
    - Paint chlorinated rubber colour
  - Colour
  - Wrap fittings and valves with same insulation as pipework.

310.010 PLANT AND EQUIPMENT INSTALLATION:
Install equipment in accordance with manufacturer's recommendations.

310.020 REFRIGERANT PIPEWORK INSTALLATION:
Arrange all exposed pipe runs to present neat appearance, parallel with other pipe or service runs and building structure.
Ensure all vertical pipes are plumb or follow building line.
Space pipe runs in relation to one another, other services runs and building structure, allow for

specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.
Take precautions to prevent the discharge of refrigerant gases to atmosphere.
320.010 COMMISSIONING REQUIREMENTS:
Application
Put the system to work.
- Demonstrate that specified air quantities are attained plus or minus:
  - 10%
- Ensure that the control system functions in accordance with the requirements specified in clause 100.030.
- Keep a systematic record of commissioning results.

BS APPENDIX

BS 7697:1993
Nominal voltages for low voltage public electricity supply systems

BS EN 1057:2006+A1:2010
Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications

BS EN 12449:1999
Copper and copper alloys. Seamless, round tubes for general purposes

BS EN 12450:1999
Copper and copper alloys. Seamless, round copper capillary tubes

BS EN 16147:2011
Heat pumps with electrically driven compressors. Testing and requirements for marking of domestic hot water units

BS EN 60335-2-40:2003+A2:2009
Specification for safety of household and similar electrical appliances. Part 2-40 Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers

BS EN 779:2002
Particulate air filters for general ventilation. Determination of the filtration performance

APPENDIX 1 TENDER SUMMARY

CLIENT: **Corby Borough Council**

PROJECT: **Corby Cube Fourth Floor Remodelling**

MECHANICAL SERVICES INSTALLATION COST

Item:	Element:	Cost:
1.0	**Preliminaries and Site Set Up**	£
	SUB-TOTAL:	£
2.0	**Above Ground Drainage Services:**	
2.1	Soil vent pipes and stub stacks	£
2.2	Soil pipework, waste pipework, traps and fittings	£
2.3	AAV's and soil pipe terminations	£
2.4	Fire stopping	£
	SUB-TOTAL:	£
3.0	**Domestic Water Services:**	
3.1	Pipework & valves for hot and cold water systems	£
3.2	Thermal Insulation	£
	SUB-TOTAL:	**£**
4.0	**Heat Pump Heating and Cooling:**	
4.1	Heat Pump System Installation	£
4.2	Refrigerant Pipework & Thermal Insulation	£
4.3	Cable Tray System	£
4.4	Condensate Pipework System	£
4.5	Power & control wiring	£
	SUB-TOTAL:	£
5.0	**Trench Heating**	
5.1	Trench Heating Installation	£
	SUB-TOTAL:	£
6.0	**Mechanical Ventilation Installation:**	
6.1	Heat Recovery Unit	£
6.2	Supply & extract ductwork inc. dampers	£
6.3	Grilles	£
6.4	Thermal Insulation	£
	SUB-TOTAL:	£
7.0	**Testing & Commissioning:**	**£**
8.0	**Health & Safety File:**	**£**
9.0	**As-installed Drawings:**	**£**
10.0	**Operating & Maintenance Manuals:**	**£**

MECHANICAL SUBCONTRACTOR TOTAL: **£**
(Carried forward to Main Contract Tender Summary)

FINAL TOTAL COST IN WORDS:

SIGNATURE:

COMPANY:

DATE: