MECHANICAL SERVICES SPECIFICATION

FOR

EDMONDS PARK OUTDOOR SERVICES DEPOT

TENDER ISSUE

ISSUE TRACKER

Edmonds Park Outdoor Services Depot – Mechanical Services Specification

Issue Ref	Date	Issued For	Approved By	Notes
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1 Definitions

Installer - The contractor, or where a named installation not specified to be in the contract, the company, firm or person appointed to execute that installation.

Tenderer - Any company, firm or person invited to submit a tender for the contract works.

Works - Plant, materials to be provided and all work to be performed.

Contract Administrator - The person or persons appointed by the employer to inspect or monitor the progress of the works.

Clerk of Works - The person or persons appointed by the employer to act as his inspector.

Site - The land and/or buildings in which the works are to be executed.

Provide/Install - Obtain, deliver, fix into position, make all connections, test and commission, - unless any part of this is specifically excluded.

Equal or Equivalent - The equal as specified in all respects and, except where stated by tenderer at time of tender, only where approved - and approval will NOT normally be given.

Specified - As specified in this document and/or elsewhere in any other sub-contract document including where indicated on drawings.

Approved/for Approval - Submit for written approval from the supervising officer and, if not approved, submit such alternative as will obtain approval - which will not unreasonably be with-held.

Suitable/Agreed - Agree with the Contract Administrator on site and, where requested, submit for approval

Directed/Authorised - A written instruction. The name of the employer and any other contractual parties and their advisors are given in Part 2, Section 2.

2 Tender Conditions

Submit tenders for the Works by completing the form of tender and schedules all to instructions given on the forms and schedules and delivering these as stated in letter of invitation to tender.

Submission of tender will imply acceptance of all conditions, full knowledge of specification, drawings, all requirements, site and all local and existing conditions. Any other available and applicable document may be inspected by arrangement and should there be any matter which may be obscure written replies will be circulated to all written queries received not later than 7 days prior to tender submission date.

A tender not so submitted, signed and in all respects completed may not be considered and no subsequent claim for any alleged deficiency of description will be allowed.

No payment will be made for any expenses or losses incurred in a tender submission.

The lowest or any tender will not necessarily be accepted.

Tender to be **EXCLUSIVE** of Value Added Tax but INCLUSIVE of all other taxes, establishment charges, profit, fares and allowances, travelling time and any other charge, any provisional sum specified and for compliance with any applicable trade

and/or national agreements relating to employment including rates of pay, working hours and conditions of labour not less favourable than those established for the local trade or industry and including employment of workmen for more hours per week than the standard number of hours per week in order to recruit them.

3 Contract Conditions

The work to be carried out under this contract will be subject to the form of agreement and schedule of conditions in the tender documents.

The terms of the contract will be in terms equivalent to those stated in the JCT Form of Contract. If there is any conflict in this obtain direction but base tender price on this specification.

4 Contract Price Basis

The contract will be let on a fixed price basis.

5 Defects Liability Period

For a defects liability period of 12 months replace any part which is proved defective through bad workmanship or faulty materials.

The defects liability period will commence from the date of certification of Practical Completion of the main contract as a whole irrespective of whether the whole or any portion of the works have been completed prior to the completion of the main contract.

6 Incompetence

Upon receipt of direction that any representative of the Installer is guilty of misconduct, incompetence and/or negligence the Installer will take immediate measures to remove the basis of complaint.

7 Engineer

Reference to the engineer and/or Consulting Engineer will mean the person or persons acting in the capacity of authorised representative of the employer and/or his supervising officer in respect of the engineering services described in this specification.

8 CDM

Implementation of the Construction (Design and Management) Regulations, 2015, with respect to Health & Safety, is a requirement of this contract. This specification must be read in conjunction with the Health & Safety Plan.

The Health & Safety Plan forms a separate part of the tender documentation.

9 Priced Schedule of Quantities

Upon being advised that your tender is receiving consideration, prepare and, within **2 working days**, submit in duplicate, priced schedules of quantities sub-divided as summary of tender to provide unit rate for each item to be provided showing make-up of tender price. Not more than two tenderers will be asked to do this. The rates will be used for pricing variations. Where there is no directly applicable rate, a rate having the same tender additions is to be produced with evidence to prove the method of calculation. The priced schedule of quantities will have no other use and no adjustment will be made to the tender price in respect of any alleged inaccuracies or exclusion in the priced schedules.

10 Standards

The works described within this specification and drawings shall be installed fully in accordance with the following standards.

a) Regulations under the Health and Safety at Work Act (including CDM, the Approved Code of Practice for the Prevention of Legionellosis and the Control of Legionellosis Disease (HS(G)70).
b) Electricity at Work Regulations.
c) BS 7671 IEE Wiring Regulations.
d) Water Supply (Water Fittings) Regulations 1999.
The tenderer shall include for notifying the water supply company of the alterations to the water services, in accordance with clause 5 of the Regulations.
e) Water By-Laws and Local Authority Requirements.

f) Special Requirements of Local Electricity, Water and Gas Authorities.
g) CIBSE Regulations.
h) COSSH Regulations.
i) Relevant British Standards (including BS 8558 Design, Installation, Testing and Maintenance of Services Supplying Water).
j) PSA Standard Specifications M&E No.1.
k) Heating, Hot and Cold Water, Steam and Gas Installations for Buildings, Specification 036 (formally PSA Standard Specification M&E No. 3).
l) Air Conditioning, Air Cooling and Mechanical Ventilation for Buildings, Specification 037 (formally PSA Standard Specification M&E No 100).
m) HVCA Standard Specifications for Ductwork Installations DW143, DW144.
n) HVCA Specification for Kitchen Ventilation Systems DW172.
o) Gas Safe Regulations.
p) Control of Pollution Act.
q) Building Regulations.
r) FGas Regulations.
s) CIBSE Technical Memorandum TM13 (Minimising the Risk of Legionnaires Disease).
t) All other Statutory Requirements.

11 Management of Works, Site Supervision and General Safety

The Contractor shall ensure that adequate supervision necessary for the satisfactory completion of the Works is provided. In particular, the Contractor shall include in his tender for suitably experienced management personnel to manage and direct the whole of the sub-contract works in an appropriate and suitable manor. In addition it is a requirement that the Contractor must provide a full time person whose role will be to co-ordinate the works on site, and liaise directly with the Contract Administrator and the Architect and/or Client on day-to-day matters.

The foreman and management personnel will be empowered to accept instructions concerning all matters in connection with the Works.

12 Working Hours

The available working hours shall be as those stated in the pre-start meeting with the successful contractor. For the purpose of tender allow for normal working hours, 8.00am until 5.00pm Monday to Friday.

Any overtime necessary shall be arranged in agreement with the Contract Administrator in advance of the works.

13 Progress Meetings

The Contractor's Project Engineer & Site Manager shall attend site progress meetings to be held on site as requested by the Consulting Engineer to report on work completed to date, works to be completed, issues arising and the like.

14 Restrictions and Security

The following restrictions will be imposed on the Contractor during the contract period:

4.1 No smoking within the building and grounds.

4.2 No radios or recorded music within the building and grounds.

4.3 Access shall be limited to the areas of work within the building.

15 Temporary Electricity Supplies

Temporary electricity supplies to hand held appliances shall be at 110v 50Hz supplied by a transformer with the secondary winding centre tapped to earth. The 230V supply shall be protected by a residual current device with a tripping current not greater than 30mA.

Allow for temporary lighting and power supplies as necessary to facilitate the construction works detailed in this specification.

No use of electricity metered to the Employer will be permitted for any purpose prior to handover and connection to the permanent supply will only be made when final testing

for handover has been accepted.

16 Storage Workshop and Offices

Provide safe and dry storage of all equipment, plant and materials and adequate temporary stores, workshops, office and other accommodation, each fully equipped with such lighting and heating as required and that may be needed. No equipment, plant, materials, etc., will be allowed to be deposited other than in the stores, etc., except as may be agreed. The stores, etc., are to be removed immediately the works are sufficiently completed, the site to be left clean to the satisfaction of the Engineer. The Contractor shall be responsible for the safe keeping of tools and equipment. All in accordance with the main contract preliminaries.

17 Existing Services

Avoid any action which will disrupt or otherwise effect any existing installations except:

Where any existing installations are made redundant by the new installations dismantle entirely and remove from the site the whole of the redundant installations except where otherwise later specified.

Where redundant installations cannot be removed due to being buried within structure or like reason cut back as far as possible, seal and make safe, and provide small labels as appropriate to describe the presence of redundant work.

Where any existing installations need to be modified, diverted or otherwise affected by the new installations and/or building works obtain approval to all such modifications, including from the Contract Administrator and/or appropriate statutory authority or any other organisation as may be affected.

In the event of existing installations or services being damaged or modified, other than as excepted, repair fully or reinstate as appropriate at no additional charge to approval including from the appropriate statutory authority or any other organisation as may be affected.

18 Delivery, Cases & Containers

Unpack all cases, containers, and such like in which materials are delivered to the site, and return empty such, cases, containers, etc., carriage paid. etc.

The Contractor shall arrange delivery in compliance with the main contract preliminaries. No charge for out of hour's delivery and administration.

19 Materials and Procurement

The Contractor shall be responsible for material procurement to meet the program. Late delivery of material does not justify delay to the Contract.

20 Cleanliness on Site

The site is at all times to be kept free from obstruction and all surplus materials, temporary works, packing cases, drums, etc., which are to be removed from the site as soon as they are no longer required. On completion the site is to be left in a thoroughly clean and tidy condition.

For the purpose of this clause, the word 'site' is to mean each and every building of the premises, yards, passage ways and any other means of access to or egress from the site.

21 Completion Procedure

On completion of the works, or any agreed section, notify in writing to this effect, and provide a list of any outstanding matters together with draft record documents. An examination will then be made and instructions issued for remedial action to such defects as are apparent.

Take remedial action as necessary, commission all sections of the installations not already in commission, fully adjust, regulate and test these as far as is possible and submit detailed test results.

When the Engineer is satisfied that the design performance has been obtained, he will advise the employer who may carry out a further examination, at which time all

installations must be in fully regulated and adjusted operation. Any further defects becoming apparent will be made known for remedial action.

The Employer will not accept handover or provide any operating staff until the works are in full tested operation, which must therefore be before the completion date of the building or section of the building as a whole.

The Contractor shall submit detailed programmes covering:

a) Full test and inspection of electrical services to BS 7671 to include manufacturer's certification as appropriate.

b) Demonstration to Users of all equipment and services installations.

c) Record documents.

d) Final snagging inspections.

22 Completion Certificates

Where work is phased, as required in the programme produced by the Main Contractor, individual completion certificates shall be provided for each phase of the contract, e.g. one room or group of rooms. These shall be issued to the Contract Administrator representative before the handover date of that particular phase.

Practical completion will not be considered before the date when all the record documentation is approved and in place.

23 Handing Over

Immediately prior to handover of the works provide a completion certificate certifying the overall completion of the works in accordance with the specification, drawings and variation instructions.

This certificate should be provided on the date agreed upon for completion but, in the event of the Works not being complete on that date, a statement of outstanding work is to be provided, stating the date on which the Works will be completed and the completion certificate will be provided on the date that the Works are actually completed.

The completion certificate should state, wherever applicable, that the installations conform to the appropriate Regulations such as BS 7671 in the case of electrical installations.

1 Tender Drawings

The tender drawings to be read with this specification are listed in Part 2, Appendix 1 which also gives the basic symbols and abbreviations used.

The tender drawings are to some extent diagrammatic and will NOT give full installation details. Read with the specification, and other relevant drawings and documents. Obtain all detail of every description required to provide complete and operable systems.

The tender drawings comprise the engineering systems layout drawings (which are generally A1 size) and the A3/A4 sketch details and schedules.

Give written notice of any discrepancy discovered and take in order of precedence the details given in the specification, by figure dimension, by large scale and finally by small scale drawings.

For the engineering drawings the drawing numbers have particular significance in general:

M***: Mechanical Engineering Services.
E***: Electrical Engineering Services.
PH***: Public Health Engineering Services/Above Ground Drainage.

The NUMBER is a straight sequence number for the particular system and usually has no locational significance.

The ISSUE reference for the drawing will depend on the circumstances and will be one of:

P: Preliminary Issue for comment/approval.
T: Tender Issue for pricing.
Ct: Contract Issue.
Cn: Construction Issue.

Construction Issue revisions are then denoted Cn1, Cn2 etc., with details of the revisions given in the revisions column, although, there may be P1, T1 etc. issues where there is such as a second tender issue, and for each details are given in the revisions column.

2 Working Drawings

Provide detailed information to augment the tender drawings so that these together provide a set of working drawings and details adequate to provide all information needed to set out and effect installation of the works and to inform the Engineer of such installation parameters as he may reasonably require.

To prepare working drawings obtain at an early stage all necessary current details of the architectural, structural, other engineering systems parameters, and of any other items that will affect the engineering systems specified and read in conjunction with this specification and the tender drawings. Note that the tender drawings may not precisely agree with the current architectural and structural drawings owing to continuance of the detailing of these subsequent to finalisation of the tender drawings.

Provide detailed information in the form of working drawings for all shop fabricated components, major plant areas at a scale of not less than 1:20, equipment wiring diagrams, and as necessary to provide a complete set of working drawings not less in scope than the contract drawings plus the installation drawings.

Within 1 week of appointment submit a schedule listing the working drawings proposed annotated with dates for production for approval of each with details and

latest date for receipt of any further design information required. At the same time give written notice as to which of the contract drawings it is proposed to use as a working drawing so that negatives of these may be issued. Note that further drawings are NOT required where the information given on the available drawings is adequate for use as working information.

Check site dimensions and modify working drawings as may be required due to discrepancies, site tolerance and/or building layout and/or detail variation based on any modification design drawings issued showing that modification only.

Submit for acceptance in principle as directed 2x copies of each working drawing, allowing at least 2 weeks for comment. Note that acceptance in principle will not relieve the Contractor of any responsibility for accuracy in respect of errors or omissions on the working drawings.

Working drawings should include, but not be limited to:

- Plans showing all systems.
- Builder's work details.
- Mechanical Services distribution layout drawings.
- Detailed plantroom layout drawings.
- Details of mechanical service supports and fixings.
- Drawings to be co-ordinated between M&E and the building structure.

The Contractor shall issue a further 2x copies of the approved working drawings to the Engineer.

Within 7 days of the issue of an Engineer's Instruction the Contractor shall amend his working drawings and re-issue 2x copies. The Contractor shall maintain on site a set of working drawings which shall be kept updated to record all as installed details.

3 Record Drawings

The format, presentation and issue of the record drawings shall be as detailed below:

3.1 **Format**

- Mechanical systems - routes, sizes, locations and reference.
- Positions of fire barriers.
- Positions of all incoming services and supplies.
- Cross reference each drawing to the manual by stating "refer to the manual section 'x' for further information".

3.2 **Presentation**

- The drawings shall be prepared in AutoCAD version 2014 minimum.
- Dated and clearly marked 'As installed Drawing' with Contractor's title block.
- Each service shall be shown on a separate layout drawing i.e. Heating, ventilation, water services, external services etc. In addition a drawing showing the gas distribution is required in accordance with the Gas Safety (in use) Regulations.
- All layout drawings shall be A1 size.
- The drawings shall be neatly folded and each one contained within an A4 size transparent drawing wallet - Rexel NPR/A4 or equivalent and placed in the appropriate section of the manual.

3.3 **Issue**

A draft copy of the drawings shall be submitted to the Engineer for approval.

Upon approval of the draft record drawings the Contractor shall issue the following to the Engineer, Main Contract Preliminaries take precedence:

- 2x full size prints of each drawing - contained within the manual.
- 2x discs of the completed drawings in AutoCAD file compatible with AutoCAD 2014.

4 O&M Manual

The format, presentation and issue of the record drawings shall be as detailed below:

4.1 Contents of Operating and Maintenance Manual

The format of the manual shall be in accordance with the following sections after a preface and index.

1. Section 1 shall include an introduction, a general description of the System(s), safety matters, warning notices, etc.

2. Section 2 shall comprise a full description of the system together with the main plant components and locations, and the mode of the operation of automatic control systems associated with the system.

3. Section 3 shall comprise a schedule of the complete plant technical data of each item of mechanical and electrical equipment. Schedule details shall include the manufacturers name and address, type and size of the equipment, serial number, contractor's order number, bearing, pulley and belt details, motor details, equipment performance and duty details and location of the equipment.

4. Section 4 shall describe in detail the operating procedures necessary for starting up, running and shutting down the system. This shall include the control panel starter and selection facilities together with any alarm and safety interlocks as identified on the control panel/panels.

5. Section 5 shall comprise the recommended maintenance operations on a daily, weekly, monthly, etc. basis for each item of plant. The preparation of this section shall be carried out by obtaining from the manufacturer his advice and recommendations for lubrication, adjustment and routine maintenance.

6. Section 6 shall comprise the emergency procedures to be adopted by personnel engaged on the operation and maintenance of mechanical and electrical services, with respect to fire, first aid, general failures to water and electrical systems, gas lines, chiller refrigerant pipework, and call out procedures for the Contractor's maintenance personnel in working hours and out of working hours.

7. Section 7 shall comprise a recommended action on plant malfunction to assist both the user and maintenance engineer in the event of a fault developing in a system by indicating the nature of the fault and recommended action.

8. Section 8 shall comprise a List of Recommended Spares and Lubricants. The preparation of this section shall be carried out by obtaining the manufacturers' recommendations, and also incorporating the client's requirements regarding spares.

9. Section 9 shall comprise a schedule of the mechanical and electrical record drawings together with reduced copies (A4 size) of the record drawings in numerical order. The reduced copies of the record drawings shall be printed on good quality paper identical to the paper used for the remainder of the manual.

10. Section 10 shall comprise mechanical and electrical test certificates and commissioning reports.

11. Section 11 shall comprise a list of manufacturers including addresses and telephone numbers and equipment supplied. The manufacturers list shall be arranged in alphabetical order. The manufacturer's literature shall also be included within this section and arranged in alphabetical order to match the manufacturers list.

12. Section 12 shall consist of copies of all orders placed, if necessary with prices deleted.

13. Section 13 shall consist of chemical product data sheets where necessary for the Client to comply with his obligations under the Control of Substances Hazardous to Health Regulations.

4.2 Preparation of the Manual

1. The manuals shall be prepared within the contract and shall be particular to the mechanical/electrical services of the contract.

2. The manual shall be of A4 size and arranged with an index and referencing system.

3. The paper to be used in the final issue of the manual shall be good quality high white 120g/m², and the reproduction method shall be by dry photocopy.

4. The material of the manufacturer's literature shall be as supplied by the manufacturers and the number of sets shall be in accordance with the number of manuals required.

5. The covers shall be hard bound with a four post loose leaf system. A matching flysheet will give the name and address of the principals involved on the contract and agreed with the Client.

6. Numbered card dividers shall be inserted between sections.

4.3 Issue

A draft copy of the manual shall be submitted to the Engineer for approval. Upon approval of the draft manual the Contractor shall issue 3xcopies to the Client one week before Practical Completion.

The practical completion certificates will not be issued until the operating and maintenance manuals have been issued to the client.

5 Health & Safety File

The Contractor should allow for providing assistance to the CDM Co-ordinator in the production of the Health & Safety File, as required under the CDM Regulations.

In particular the Contractor should allow for providing 2x copies of all record drawings to the CDM Co-ordinator for inclusion in the Health & Safety File.

Part 1 **Preliminaries**
Section 3 **Standards - Mechanical**

1 Scope

Provide and demonstrate all materials, fittings, accessories, for complete working systems as specified including whole of plant, tackle, tools, instruments, scaffolding ladders, hoists, fencing, temporary guards and other equipment and labour, both skilled and unskilled, to unload, store, hoist ad fix all materials, including standing scaffolding and hoists where required.

Include any fitting or accessory obviously necessary for completion of the works always provided that there will be no responsibility for design discrepancies, errors or omissions.

2 Standard

The Contractor shall be responsible for ensuring that all materials used on the works comply in every respect with the relevant codes of practice and specifications issued by the British Standards Institution current at the date of Tender. The Contractor shall be held responsible for any consequence or expense resulting from his failure to comply therewith and shall be required to correct any such failure at this own cost.

Where alternatives are permitted by the BS and this Specification does not identify the option required, the most durable materials shall be used and the most onerous set of tests shall be applied.

3 Improvement

Make known any ideas of design or detail changes that may lead to improved performance, ease of installation and/or reduced cost.

4 Layout

Install materials neatly, unobtrusively and without interference with other items, with runs, equipment, etc., adjusted from the positions shown on drawings to suit final arrangement, room layouts, architectural features, etc., as shown on the current architects and/or structural engineer's drawings and/or as otherwise advised by the Engineer. Notify the Engineer of any difficulties.

Arrange to facilitate inspection, testing, cleaning and repairing, only excepting trunking or similar buried in building structure, in which case arrange for access, inspection, testing, replacement, etc., of all wiring.

Provide and submit for approval dimensioned layout drawings for all runs of cable, conduit, duct, trunking, cable tray, etc., not precisely detailed on the tender drawings and also to give details of all holes, chases, etc.

5 Regulations

5.1 The standards of workmanship, materials, equipment and concepts of installation employed within the Mechanical Works shall comply with:

5.1.1 Water Supply (Water Fittings) Regulations 1999.
The Tenderer shall include for notifying the Water Supply Company of the alterations to the water services, in accordance with clause 5 of the Regulations.

5.1.2 COSHH Regulations.

5.1.3 Applicable British Standards and Codes of Practice.

5.1.4 Health and Safety at Work Act 1974.

5.1.5 Statutory Rules and Regulations relating to the site to which the Employer is subject.

5.1.6 Electricity at Work Regulations: 1989, the Health and Safety Executive Memorandum and Statutory Instrument No. 635: 1989 relating thereto.

5.1.7 The IEE Wiring Regulations for Electrical Installations - 17th Edition (Including all current amendments thereto).

5.1.8 CIBSE commissioning codes.

6 Alternatives

Use materials, components and equipment that conform in every detail to the specified requirements which may be at variance with information lodged with certain manufacturers and suppliers in respect of particular items of plant and equipment, or, where not so specified, conform to the appropriate British Standard Specification.

Put forward in the tender, in the Alternatives Schedule or by separate letter, any specific alternative price required and any preferred alternative make by submitting full details of the alternatives and the associated variations to the tender price. It is stressed that the actual tender price must be based on the materials, components and equipment specified.

7 Information Notation

Provide to the recommendation of the Chartered Institution of Building Services on plant labels, instrument graduations, test certificates, as fitted drawings, etc., with both SI Metre, Kilogram, Second and Imperial Foot, Pound, Second units other than linear dimensions of plans, cables, etc., for which use SI only.

8 Identify

Identify all provided items, pipes, ducts, etc. except where use and connection is reasonably obvious for operation and maintenance, to BS 1710 with also direction of flow, with labels engraved with as applicable name, number, manufacture name, reference number and date, capacity, rating, speed, frequency, voltage, full load and starting current, phase (s) and all relevant details for operation and maintenance. Include all valves in plant rooms, crawl ways and main ducts.

Labels to be 4mm thick clear plastic with 6mm high black filled letters on reverse side two screw fixed where an appropriate 'cold' surface, or 2mm thick brass with white filled letters on front side where surface is 'hot' or secured by brass chain where no suitable surface.

9 Painting and Corrosion Protection

All paints are to be suitable for their purpose, such as be heat resisting where necessary, and be of a colour approved prior to the commencement of painting.

Where a galvanised finish is specified and is found to be unobtainable within the time required obtain equipment of standard finish and galvanise or zinc spray. All equipment so treated is to be completely dismantled and afterwards re-assembled with special attention to earth contact surfaces to ensure metal contact without the intervention of the substance with which they have been treated.

Where dissimilar metals and/or materials are used together such further precautions are to be taken to avoid chemical or electrolytic action occurring. This particularly refers where copper with zinc and/or aluminium or aluminium alloys are used.

10 Equipment Connection

Connect equipment or apparatus not supplied as later specified or as may be later required as a variation during the currency of the contract and defects liability period. For all such equipment check thoroughly and test each item, and within 48 hours of delivery give written notification of the general results of the check and all tests made with a list of any parts missing or damaged or any other deficiency, after which the equipment will be deemed to have been accepted as complete and in good condition, subject only to any notified damage or efficiency and will then be considered as supplied under the Contract.

Where equipment to be connected is not complete with integral gas cock, governor, water stopcocks, etc., make final connections through suitable cocks,

etc., all as necessary.

11 Works Tests

Test at works all items for which this is required by the appropriate British Standard Specification, by this Specification and otherwise as may be directed.

12 Test & Commission

Test and commission each section of the works as appropriate and/or specified and demonstrate that each section will operate as specified having controls correctly set and free in operation and all instruments correctly calibrated. The contractor is to allow for all testing and commissioning associated with any sectional completion as required.

Provide for testing all fuel, electricity, water, media and equipment, with instruments having calibration certificate from any approved body dated not more than 3 months prior to use.

Arrange for test and commission assistance from equipment and/or control manufacturers.

Provide all test connectors and facilities needed and leave as a permanent feature.

Procedure to include pressure test of each:

Water system at its normal operating temperature. Demonstrate rate of pressure loss is not excessive and all joints are watertight. Following successful test flush system through, sterilise by chlorine for drinking water, refill and put onto service.

Oil system as water but using kerosene.

Gas system as water but using nitrogen and brush joints with soap solution.

Test pressures to be as specified, or, where not specified the greater of twice the working pressure.

13 Test Notice & Record

Give 14 days' notice of each test giving time and place and arrange for witness as directed. Submit for approval within 7 days of each test, and, for Works Tests before delivery, 3 copies of a test record certificate signed by all witnesses and include a copy of each approved certificate in the Instruction manuals.

14 Operation & Instruction

When installation is in satisfactory working order and so notified in writing put into normal service for seven days and from the date of building or building section completion instruction under skilled supervision and attention during the hours of 9.00am until 6.00pm During this period lubricate and maintain all moving parts and instruct the Employer's staff in the operation and indemnify against any damage or injury to the Works or to any person or to any property, and against all actions, suits, claims, demands, costs, charges and expenses arising in connection therewith occasioned by negligence, defective materials or workmanship, or by defective design, including the whole of the design.

The Employer may require to use any part of the installation which is suitable for use and, in the event of this involving additional attention and/or effecting defects liability, give detailed written notification and negotiate scales of charges and/or advise as to the reduction of defects liability period and the cost to effect a suitable insurance so as to avoid such reduction.

15 Instructions

Refer to Part 1 Section 5 for requirements.

16 Tools & Keys

Provide two sets of hardened black double ended spanners to fit all installed sizes of nuts and bolts, screwdrivers to fit all installed sizes of screws, keys to fit each type and size of installed emptying cock, air cock.

17 Welding & Brazing

All welding shall be undertaken to the requirements of HVCA code of practice TR/5. Welders shall hold current certificates of competency. Brazing shall be undertaken to the requirements of HVCA code of practice TR/3. Brazers shall hold current certificates of competency.

18 Foundation Bolts & Alignment

For each item of equipment supplied which has moving parts and wherever else specified and/or recommended by its manufacturer, provide, locate and supervise grouting in, approved foundation bolts of straight shank type threaded at each end with nut and square mild steel holding down plate at lower end with self-securing locknut at upper end, and align and level using steel shims as necessary.

19 Vibration Isolation

Mount and connect all pumps, fans, and other similar equipment containing rotating and/or reciprocating parts to avoid excessive transmission of vibration and connect no part of any item of vibrating equipment to the building structure other than through a resilient connection. The vibration isolation system is to comprise a suitable isolating base and/or isolating mountings of characteristics matched to the machine concerned together with flexibly arranged and/or supported connections.

Vibration isolating bases to comprise a concrete slab on a hardwood base all supported on a fibreglass slab enclosed in heavy gauge polythene sheet. The fibreglass slab to be retained by a brick or similar wall and to be turned up round the edges to separate fully the concrete slab from the wall. Provide details to construct.

Isolating mountings to be of the 'spring in compression' type made by Cementation (Muffelite) Ltd, Allaway Acoustics Ltd, or the 'rubber-in-shear type made by Dunlop Ltd. (Metalistik) or equal.

20 Guards

Provide guards to all moving parts including where no permanent means of access.

21 Pumps & Pump Drains

Pump capacities later specified have been calculated by aggregating the specified resistance of valves, equipment etc., with the pipe resistance calculated to the factors of the CIBSE Guide. Check the resistance of the installed system and provide pumps with duties as needed to produce the specified flow rate. Notify if revised calculations are required.

Provide to each pumping set, except those fitted with mechanical seals, an open tundish to take gland leakage, approximately 150mm across the top, 225mm long and made from 1.25mm thick galvanised sheet steel with 20mm discharge pipe taken to nearest gully. A larger bore bus drain may be used to collect drains for several pumps adjacent to each other.

Drain pipework to be galvanised medium quality to BS 1387 with screwed joints. Provide upstream of each pump a 'Y' type strainer having gunmetal body and perforated stainless steel screen, and valves to isolate pump and strainer.

22 Vessel & Fittings

Provide all appropriate mountings and fittings to each hot water boiler, calorifier, indirect cylinder or any other similar vessel including one each of:-

Safety valve, spring loaded enclosed type of a pattern approved by the National Boiler Insurance Company, 'NABIC' with padlock and two keys with discharge of the same bore taken in galvanised medium grade tubing to within 150mm of the floor and terminated in a splayed end, except where less than 225 litres capacity and to which an open vent is fitted.

Altitude gauge graduated so that the maximum graduation is not more than twice the working head.

Thermometer with rigid stem and separable pocket, straight or angle as required, graduated with a suitable range, to be not less than 0-105°C installed in the main flow or so as to provide a true flow temperature indication.

Draw-off cock with hose union to each low point.

23 Altitude Gauges & Valves

Provide to all main flow and return pipes in plant rooms and to hydraulic equipment where specified, altitude gauges having a red line marked on to the scale at the normal safety static head value.

Where safety valves are specified to be provided in hydraulic systems the valves are to be of an approved type and to be set to relieve all pressure in excess of 0.9 bar more than the normal working head.

Determine heads by site measurement prior to setting altitude gauges and safety valves.

24 Thermometers

Provide to all mixed temperature flow pipes and to all main return pipes in plant rooms and wherever else later specified, suitably graduated dial thermometers made by Rototherm Limited, and fitted with separable bronze pockets.

25 Electric Motors

Provide electric motor drives and starters for all fans, pumps, etc.

Unless otherwise specified to be screen protected, fan cooled, squirrel cage, super silent machines with ring or wick lubricated roller or ball bearings, or, where needed to meet the requirements in respect of noise, sleeve bearings, constructed to the dimensions of BS 2960 or 2048 as applicable, wound for the electricity supply available complete with all necessary supporting rails, brackets, bolts, etc. and a substantial terminal box arranged for not less than 20mm flexible conduit, fixed into position ready for electrical connection.

Generally the electricity supply will be three phase but check before placing orders. Base tender on three phase except as later specified.

Motor speeds are not to exceed 24.2 rev/s (1450 rpm) and the nominal continuous rating is not to be less than 10% or more than 20% greater than the maximum brake H.P. demand of the driven appliance and as given in BS 2613.

Provide to the Electrical Installer with 1 copy as directed, a schedule of motors listing type, number of phases, horse power, starting and running current and methods of starting.

26 Motor Starters

Provide for each electric motor a suitable starter of common manufacture made by the MTE Ltd, or other equal. Except where otherwise specified, to be of the air break contractor type with facilities for the separate excitation of the operating coil by external connection to terminals with local push button control, two auxiliary contacts, in addition to any maintaining contact, one normally open and one normally closed, equipped with integral on-load isolating switch having a separate pole for each phase way and a neutral link, with method of starting:

Up to 5.6kW (7.5HP) - Direct on Line.
5.6kW to 11.2kW (7.5 to 15HP) - Automatic Start.

Provide and set ambient temperature compensated overload protection device incorporating single phasing prevention and undervoltage release. Dashpots, where supplied, to be filled with oil or silicone fluid to the manufacturers recommendations.

Electric motor starters to include steel dust proof cases with adequate labelled terminal for each connection and front cover label giving details of the motor controlled, and conduit standard for mounting singly adjacent to the motor. Where

standards are impracticable or undesirable the starters are to be for wall mounting.

Provide the Electrical Installer, against signed receipt, all local starters for erection and electrical connection.

Where specified to be accommodated in control panels starters to be suitable for logical accommodation in the panel and as later specified. Starters accommodated in control panels or otherwise grouped together, are each to be equipped with one green 'Motor Run' lamp and one red 'Overload Tripped' lamp.

Where the motor starter is fixed at a distance of more than 1.8m from the motor arrange with the Electrical Installer to fix and connect a suitable 'Lock Off' isolator immediately adjacent to the motor.

27 Electrical Equipment & Wiring

Provide, supply only or supply and erect only, electrical equipment and wiring as specified and provide details and equipment co-operate with the electrical installer who will provide all other electrical equipment and wiring.

Provide equipment specified in a single casing or panel in a works fabricated and tested mild steel rolled section frame with mild steel plates to cover face, sides, back, top and bottom, except omit any panel, particularly bottom and rear, where total enclosure is given by adjoining structural surface. Arrange one panel, to access interior, hinged with lockable handle, others removable as needed for occasional access, stiffeners as needed to produce a stable construction and finished stoved enamel to approved colour and texture with stainless steel angle strips to cover all edges, or as specified or approved alternative construction, access and finish.

Lamps, pushbuttons, instruments, etc. to be suitably coloured, matched one with another, labelled as to function and connected with internal equipment by 1.0mm² minimum coloured PVC insulated wires with outgoing circuits to a labelled terminal strip at a point to suit external connections behind a 3mm mild steel plate to accept conduits or similar.

Provide panel distribution circuitry with HRC fuse for each power and control circuit and 25% spare and 'on load' rotary isolator interlocked with access door with contacts to break all panel 'line' connections, power and control backfeeds, EXCEPT where panel isolation would cause a device connected to another panel to activate for which provide protective shields and warning label. Where the maximum current exceeds 30 amps panel circuitry to be rated to withstand a fault level of 15 MVA for one second by measures such as mounting fuses onto PVC taped and phase colour identified copper busbars on 'Tufnol' supports.

Provide on each panel 25 volt switched socket outlet with double wound centre tapped transformer and 15 Watt woven wire protected hand lamp, 20 metres of tough rubber flexible cable and rubberplug.

Connect equipment to give 'fail safe' as reasonably possible with alarm circuitry to panel bell cancel push and warning light (not cancelled by push) with facility to connect to a remote alarm point.

Submit for approval panel face and interior arrangement drawings, power and control, line AND connection diagram to BS 3939 sequence left or right and top to bottom showing all electrical, pneumatic and hydraulic circuitry, both external to and within panels and equipment, giving types, capacities and sizes of cables, pipes, switches, contractors, fuses, etc. and terminal numbers mutually consistent between drawings. Provide one copy of each diagram under perspex on inside of panel access door and with each set of 'as fitted' drawings.

Provide all wiring specified to the electrical specification.

28 Pipework

Install of specified type pipe runs rectilinear to adjacent surfaces of clean bore through-out free of excessive tool marks, distortion of section and other defects and with straight runs incorporating full random delivered lengths and having no short cuttings or long screw connectors and backnuts, having continuous gradients not less than 1 in 480 for pipes of 50mm bore and over and 1 in 240 for pipes of smaller bore for all runs of normal operating temperature exceeding 40°C and 1 in 720 for all other runs.

Fabricate pipe assemblies on bench wherever possible and make available any assembly for inspection. Pipe jointing to be non-toxic with minimum of hemp or tape and all surplus jointing cleaned off threads and fittings. Reducing pieces to be eccentric unless otherwise specified. Ream all pipe ends before fixing to remove burr.

Fit purpose made metal screwed caps, formed wood plugs or blank counter flanges only to open ends of pipework during erection. Under no circumstances fit plugs of rough wood or waste to prevent rubbish entry.

Fix pipework to be insulated to leave 25mm between the insulation of one pipe and the covering of another and to permit subsequent access without disturbing other pipes etc. and without joints in the thickness of walls, floors or ceilings or in vertical ducts without permanent access, and for finished surface to clear ceilings and floors by 75mm, walls by 25mm and any electrical conduit or appliance by at least 150mm.
Provide means to enable sections of pipework to be subsequently dismantled and refixed without disturbing the building fabric and in any event at intervals not exceeding 12m on straight runs. To be unions in screwed and soldered pipework of 50mm bore and under and flanges in pipework of 65mm bore and over and in flanged pipework.

29 Pipe Protection

All tubes to be delivered with one coat of an approved preservative only. Store on site in covered racks to prevent rusting. No installed tubing showing evidence of corrosion will be permitted to be put into service.

30 Pipe Supports

Support pipes, at points which will not obstruct access to valves etc., within 150mm on each side of all changes in direction and, for all pipes exposed at low level at intervals not exceeding 1.2 metres, for pipes up to 20mm bore, 1.8m for pipes over 20mm bore, otherwise:

1 Mild Steel Pipes

Pipe Bore (mm)	Horizontally (metres)	Vertically (metres)
15	2.0	2.5
20 - 32	2.5	3.0
40 - 50	3.0	3.5
65 -100	3.5	4.5
125	4.0	6.0
150	4.5	6.5
175 & over	5.0	7.0

2 Copper Pipes

Pipe Bore (mm)	Horizontally (metres)	Vertically (metres)
15	1.40	1.80
20 - 25	1.50	2.00
32 - 50	1.75	2.25
65 - 100	2.00	3.50
125 & over	3.00	4.00

3 Polythene Pipes

Pipes of polythene and similar high plasticity material to be continuously supported unless otherwise specified.

4 Support Details

Support pipes of 75mm bore and under operating at 90°C or less, running singly or in pairs, vertically or horizontally, on built-in type brackets of the long shank type, or, where this is impracticable, on screw-on type fixed by at least two screws, in wither case with single screw secured top 'half hoop' fixed to give clearance for free axial movement and, for pairs, 'in line' on both pipes at centres for the smaller pipe.

Materials to be, for mild steel pipes, malleable iron, galvanised for galvanised pipes and chrome plated for chromed pipes, and for copper pipes, cast (not stamped) brass, polished where exposed, or, for light gauge up to 25mm bore not exposed, approved plastic.

Supports for pipes exceeding 75mm bore and all multiple runs at spacings for smallest pipe and dimensions for largest pipe to be fabricated from mild steel rolled sections, flats and rods as needed arranged as specified, or where not specified to approved detail, of sizes needed to give adequate support but not less than, in millimetres:

Pipe Bore	Angle Bearers	Sections Vertical	Flats	Rod Ø
35 or less	35x25x4	50x35x4	45x6	10
36 -65	50x25x4	75x50x8	50x8	12
66 -80	65x50x6	100x75x8	65x10	16
81 -110	75x50x8	125x75x10	65x12	18
111 -160	75x50x12	125x75x12	75x11	20
161 - 210	100x75x16	150x75x12	100x12	25

Provide guide to each pipe at each support with rod 'U' bolt giving l.5mm clearance to pipe secured by nuts to threaded ends.

Provide support at base of all vertical pipes or as specified or needed to avoid weight being carried by branches.

For pipes of 75mm bore and over, and multiple runs, where hung below concrete, take support rods through to top of slab and fix to 100 x 100 x 12mm mild steel back plate by nuts to threaded end.

For pipes operating in excess of 90°C provide also means to permit free expansion at supports - case iron or fabricated mild steel chain and roller beneath pipe or as specified or approved.

Alternatively support from any concrete inserts specified to be provided by others or, where not so specified, provided under this section subject to approval, and provide all needed purpose made nuts, springs, supporting rods, etc. as appropriate to support from concrete inserts.

For all supports provide non animal based soft pads as needed to eliminate movement noises and risk of electrolytic action such as between copper and steel.

31 Pipe Sleeves & Cover Plates

Individual pipe sleeves shall be provided and securely built in at all points where pipes pass through walls, ceilings and floors including where pipework is in voids.

The pipe sleeves shall be the same material and finish as the pipe and shall leave a clearance of 1.5 mm to 3 mm between the pipe and the pipe sleeve and shall be

cut to finish flush with the finished surface of the building fabric. The space between the pipe and the pipe sleeve shall be lightly caulked with a malleable material.

All sleeves shall allow pipes to pass freely and allow for expansion. The successful contractor shall be responsible for any damage caused to the building or the apparatus through leakage etc., due to neglect of this.

Pipes passing through sleeves in external walls of buildings, ducts sub-ways etc., shall be caulked between pipe and sleeve with an approved material such as lead wool, to form an effective vermin and weather proof seal. Where a water seal is required in external walls a puddle flange shall be provided.

Pipes passing through floors and fire compartment walls/partitions shall be packed with 3 rings of suitable material to reduce fire risk and water penetration.

The contractor shall be responsible for ensuring that all pipe sleeves are located correctly both before and after building-in by the building contractor

Where pipes pass through walls, floors, ceilings and fixed room fittings and are normally visible, they shall be fitted with zinc alloy die cast, polished aluminium finish wall, floor or ceiling plates. All floor and ceiling plates shall be attached to the pipe by means of spring clips and not set-screws.

Provide where sleeve ends exposed in user areas approved polished chromium plated set-screw fixed plates.

32 Pipe Air Release & Draining

Provide at all high points, and wherever air may collect or water runs, air release unit or 'bottle' comprising tee of line bore and 75mm vertical with 6mm tube to an air cock accessibly located, or, where specified, an automatic float type air release valve (not wooden float) with lockshield isolating valve, discharging to the nearest drain or to atmosphere, through 15mm drip pipe terminated with mitred end.

Provide drain valve to BS 2879, type A bronze gland cock with hose union, l5mm bore, except in plant rooms 25mm bore, at all low points downstream of all isolating valves and wherever else specified or required so that all sections which may be isolated may also be drained.

33 Pipe Expansion & Anchoring

Provide means for thermal expansion in pipework of any service likely to operate at 40°C or over, as specified, or where not so specified by change of direction or installation a loop or joint at intervals of not more than 24m in any internal run, as necessary for any external run.

Provide loops and joints of solid drawn seamless tubes of the same metal, gauge, and finish as the piping in which they are inserted and, between provide free guided movement with static points arranged by the installation of anchors, by:-

1 Expansion at changes of direction - bends to be opened during erection to the full extent of their cold draw and where expansion is to take place through a change in the direction omit guides as needed to permit lateral movement.

2 Expansion joints - to be of the corrugated stainless steel bellows type having outer sliding sleeves and ends flanged to the appropriate BS Table, made by the Power Flexible tubing Company Limited, Derby Works, Vale Road, London N.4., Teeding Aircraft Controls Limited, or other equal opened during erection the full extent of their cold draw. Provide guides on each side to ensure expansion takes place in correct alignment and install to maker's instructions especially for the hydraulic testing.

3 Expansion loops - to comprise straight lengths of pipe and bends of the depths and widths specified or, where not specified:

Pipe Size (mm)	Width (metres)	Depth (metres)
Up to 50	1.20	1.80
65	1.35	2.10
75	1.60	2.40
100	1.95	3.00
125	2.25	3.45
150	2.65	4.35
175	3.60	5.50

Install opened to full extend cold draw and where occurring in multiple pipe runs form loops with equal spacing's between the pipes arranged so that the pipe having the largest expansion loops is correct, provided no loop is smaller than specified.

4 Anchors - to be similar to pipe brackets specified with, in addition, a small piece of RS channel shorter in length than the diameter of the pipe and cut to the radius of the outside surface of the pipe fixed to the bracket and clamped in position with locknuts on 'U' bolts or both otherwise anchored as may be approved.

34 Mild Steel Pipework

Install in quality tubing with joints later specified except that all concealed pipework and pipework in subways and service areas is to be welded throughout unless otherwise specified.

Screwed joints to be made with approved graphite compound and fine threaded hemp or with PTFE-tape. Red lead will not be allowed.

Flanged joints to be made by screwing on screwed pipework or welding on welded pipework mild steel drilled flanges turned on edge full across fitted flush with pipe ends and mild steel bolted with Klingerite or other approved jointing material, full faced, especially stamped and cut from sheets on site.

For screwed pipework fix malleable iron long and easy sweep, beaded or banded fittings. Square tees will not be used except where open vents are taken off and for non-circulatory branches in the hot water supply services. Unions to comprise two screwed halves, with ground spherical faced joints, one to be bronze.
For welded pipework fix fittings generally as for screwed pipework except:

Tee branches of smaller bore than the main to be welded on site, otherwise to be prefabricated with ends for butt welding.

Bends to be purpose made seamless of same grade as line with ends for butt welding. Springs and sets to be purpose made on site, cold drawn to a radius not less than six times the nominal bore to pipes of 50mm bore and under, and hot bent to a radius not less than three times nominal bore if 65mm or over. In pipes of 75mm bore and under seams to be on the sides of the springs and sets where possible, or where not possible along the inside radii.

Reducing pieces may be either prefabricated or cut, swaged and welded on site, in either case butt welded into the lines.

For galvanised pipework no heat is to be employed to effect bends, sets or joints.

35 Copper Pipework

Install in quality of tubing with joints as later specified.

Screwed joints to be made similarly to mild steel pipework with gunmetal sockets.
Flanged joints to be made with brass bolts to flanges fixed by screwing and brazing or by bronze welding copper alloy flanged to pipe ends - otherwise as for steel

flanged joints.

Joints in pipes of 50mm bore and over may be made by bronze welded butt joints if suitable skilled work person available. Bends, sets and springs to be either prefabricated or cold drawn on site by machine to a radius of not less than six times the nominal pipe bore, with branches connected to gunmetal tees.

All bends whether prefabricated or made on site to be annealed before fixing.

Where light gauge copper tube to EN 1057 – R250 is specified the tube to be of de-oxidised non-arsenic copper to BS EN 1254 - 1.

Fittings for light gauge tube to be to BS 864 of the "Yorkshire" capillary type having an internal solder ring, and additional tinned tapered ring as necessary or be "Securex" compression fittings made by J H Lamont & Co. Ltd. as later specified.

Light gauge copper tubes and fittings to be installed in accordance with the manufacturer's directions using any special tools or fluxes, etc. recommended.

No old or re-drawn copper tube may be used.

Where light gauge tube connects to iron or gunmetal valve or apparatus, use straight through adaptor, where screwed, or flanged adaptor where flanged.

36 Anti-Electrolytic Couplings

Fix between any copper pipe and all galvanised steel and steel plate vessels non-ferrous couplings of an approved type to prevent electrolytic action. If connecting to an existing installation check existing will not be affected by new, particularly that there are no galvanised sections in a system to which copper sections are to be connected.

37 Underground Pipes

Except as later specified or directed lay underground pipes for 750mm minimum cover with even gradients to follow ground contours having continuous support and, where passing through structural foundations, below hard surfaces or would be subjected to superimposed load, run through sleeves or equal, of adequate strength and clearance so that no structural movement is transmitted to the pipe. Temporary supports of brick piles or similar may NOT be used but, to facilitate making joints, may be run on concrete blocks, resting on the excavated bottom and located behind each socket or joint or at not more than 2700mm intervals, provided that concrete is then poured around and compacted to the underside of the pipe.

Pipe trench excavations to be bottom lined with 75mm of gravel or equal (max 20mm) except the lining is to be concrete where in hardcore, fill or soft ground.

Test underground pipes in sections and arrange cover as soon as practicable with fill of minimum bas and cover of 300mm gravel or equal (max 20mm) followed by excavated material all well compacted.

Provide anchor at all changes of direction in water and similar pressure mains by a mild steel rod loop clamp bolted pipes to a rolled steel channel section (of dimensions as bearers, clause 30.4) set into a concrete block, the whole arranged to withstand a thrust force equal to the pipe cross-sectional area x the test pressure x configuration factor (tee = 8, blank end = 8, 90°C bend = 12, 45°C set = 6) or as recommended by the pipe fitting manufacturer

All pipes, supports anchors, etc. are to be protected against corrosion attack by wrapping with 'Denso' or equal tape or, where not appropriate, by an approved bituminous covering.

Part 2 Technical Specification
Section 1 Outline of Works

1 Location

The proposed works are to take place at Edmonds Park Outdoor Services Depot, Park Road, Didcot, Oxfordshire, OX11 8QX.

2 Contract Preliminaries

Comply with all main contract particulars and preliminaries.

The Contractor is to make allowance for their own Welfare and WC provision.

3 Builder's Work

Precisely locate all holes, bases, chases and builders work in connection with the proposed works on to builder's work drawings and submit such for comment as specified, making due allowance for the time required within the programme.

4 Programme Particular Requirements

It is proposed that the main contract works commence in 2018, exact programme is to be agreed with the successful contractor. As part of their tender submission the contractor is to submit a draft programme of works covering all elements of the proposed project.

5 Extent of Works

The works covered under this specification consist of the provision of mechanical services to the proposed areas. The works generally comprise but are not limited to the following:

- Air source heat pump heating.
- LTHW heating services.
- Mechanical extract ventilation.
- Domestic hot and cold water services.
- Above ground drainage.
- Automatic controls.
- Thermal insulation.
- Testing and commissioning.
- Record documentation.
- Demonstration of systems to users.

6 Co-ordination of Services

In order that the best use can be made of the space available for the disposition of services, it is of the utmost importance that the Contractor shall co-ordinate his work with the work of others carrying out installation works on the site.

The Contractor will be required to prepare such detailed drawings of the proposed positioning of plant and equipment as may be required to enable his work to be co-ordinated in the general construction of the building and to attend any meetings that may be called for this purpose.

The Contractor shall be responsible for final co-ordination of the services with other trades and building site constraints.

All works shall be installed so as to cause no delay or hindrance to other trades.

7 Setting Out of Works

The drawings are indicative of the design intent. The Contractor shall verify, take measurement on site as necessary, taking into consideration existing site constraints for the setting out of works and adjust proposals accordingly.

8 Health and Safety at Work Act and General Safety Standards

The Contractor shall maintain as required on site competent personnel who shall be responsible for directing all site operations and ensuring that standards of safety and workmanship are being satisfied.

The Contractor is to liaise on a daily basis with the architect and/or client providing an update on the works that have been completed and are to be completed within the immediate programme.

9 **Fire Stops**	All penetrations through walls/floors shall be made good to maintain the integrity of the fire barriers. It is the responsibility of the mechanical services contractor to obtain the latest fire strategy drawing/s and to ensure all fire dampers, fire stopping etc. is allowed for.
10 **Site Visit**	Arrangements to visit the site should be made via the architect. No claims arising from lack of site visit at the time of tender shall be entertained.
11 **Programme**	To be agreed with the successful Contractor, generally the main contract works are to be commenced during 2018.

Part 2 Technical Specification
Section 2 Schedule of Mechanical Services Work

1.0 Method

The schedule of work which follows shall be read in conjunction with the rest of this specification and tender drawings.

Unless otherwise stated allow in each item for providing facilities described or for supply, erecting, connecting and testing the goods and materials specified.

Include for everything necessary for the proper and satisfactory execution of the work to the approval of the Consulting Engineer and true intent of the specification and drawings.

2.0 Stripping Out &Services Diversions

The contractor is to allow to safely disconnect, drain down as required and remove from site all existing plant and equipment that becomes redundant as a consequence of the proposed works and to enable the demolition of the existing building.

The contractor shall offer all removed items of plant and equipment to the client prior to disposal off site.

3.0 General Description

The project comprises the construction of a new services depot building on the site of the existing building that is to be demolished.

4.0 Incoming Services

4.1 Incoming Water Supply

The contractor is to note that there is at present a 'live' incoming mains cold water supply to the current building. The contractor is to allow for connecting onto this incoming mains cold water supply and extending to serve the proposed new building, all generally as indicated on the drawings.

Prior to commencement of the works the contractor is to take flow and pressure readings at the existing incoming water main. The results of these readings are to be made know to the client and the consulting engineer.

4.2 Incoming Gas Supply

The contractor is to note that currently there is no gas supply to the existing facility and it is not proposed to provide a new gas supply as part of the proposed works.

5.0 LTHW Heating System

5.1 Introduction

The new facility is to be heated by means of an Air Source Heat Pump arrangement (hereinafter referred to as ASHP), all generally as indicated on the drawings and detailed within this specification.

LTHW heating pipework is to be distributed from the ASHP plant to serve the underfloor heating, fan convectors and primary coil within the domestic hot water cylinder, all generally as indicated on the drawings.

The Contractor shall allow to liaise with the Main Contractor and Electrical Contractor to ensure that all electrical power supplies are allowed for and are fully co-ordinated with regards to all plant and equipment associated with the LTHW heating installation.

5.2 ASHP Plant

The contractor is to allow to supply, deliver, install and commission the complete ASHP system as indicated and specified on the tender drawings. For further details and refrigerant pipework sizes etc. please contact Mr Val Belz at Toshiba on Tel: 07967 598286.

The external ASHP unit is to be located on and be securely fixed to a 150mm high level concrete base, generally in the position as indicated on the drawings.

The contractor shall allow to supply and fit a full protective cage to the external ASHP unit. The protective cage is to be fully lockable and be securely fixed to the 150mm high concrete base and masonry wall.

The Contractor is to ensure that all future maintenance and servicing of the ASHP plant can be completed without undue risk to the engineer.

The external and internal ASAP units are to be positioned to ensure the minimum clearances are maintained to allow free air movement around the units and also adequate access for future servicing and maintenance.

The internal ASHP unit is to be complete with a 3.0kW electric boost unit.

The ASAP plant shall be complete with its own integral circulating pump. It is the responsibility of the contractor to calculate the system resistance of the entire heating system upon completion of the working drawings and allow for a replacement circulating pump as may be required to overcome the system resistances and give a complete and operational installation.

The ASAP plant shall be complete with its own integral expansion vessel. It is the responsibility of the contractor to calculate the water content of the entire heating system upon completion of the working drawings and allow for any additional expansion as may be required to give a complete and operational installation.

Include dial temperature gauges on the flow and return header pipework.

The ASHP plant and equipment is to be set up and set to work to achieve the following temperatures:

- LTHW Flow Temperature = 50°C.
- LTHW Return Temperature = 40°C.

The ASHP manufacturer shall fully commission the plant and equipment upon completion of the works.

The ASHP plant overall control is to be via a two channel 7day/24 hour timeclock, please refer to Section 9.0 of this specification for further information.

5.3 Mains Distribution Pipework & Valves

The extent of the heating system is generally as indicated on the drawings and as detailed in Section 5.1 above. All main distribution heating pipework is be to the routes and sizes as indicated on the drawings and shall be installed in black mild steel heavy grade to BS1387 with all joints being screwed taper thread to BS21. All brackets shall be back plates with Munsen rings.

All pipework passing through walls shall be sleeved.

The contractor shall provide isolating valves at all branch heating pipework, these shall be of the quarter turn ball valve as manufactured by Hattersley Ltd. Provide commissioning valves of double regulating type with measuring station at all branch heating pipework as manufactured by Hattersley Ltd.

Provide automatic air vents at all high points and drain cocks at all low points to facilitate complete draining and venting of the system.

All commissioning stations on return main branches are to be complete with orifice plate measuring devices.

The heating system is generally as indicated on the tender drawings, however, tenderers shall allow for additional bends and sets as required for the actual installation to account for building constraints and local services.

5.4 Underfloor Heating

The contractor is to allow for a complete and operational wet underfloor heating system to serve the proposed areas of the building as indicted on the drawings.

The contractor is to employ the services of a specialist underfloor heating manufacturer to design, supply, install and commission the wet underfloor heating system. The contractor is to approach one of the following, or an approved alternative:

- Ambiente Ltd (Tel: 01707 649118).
- Warmafloor Ltd (Tel: 01489 581787).

The contractor is to allow to fully co-ordinate the underfloor heating installation with any electrical services, base units, sanitary ware, partitions etc. that is to be set within/secured to the floor screed. Allow to liaise fully with all other trades to ensure that all installations are fully co-ordinated.

Provide a manifold complete with circulating pump, isolating and regulation valves, control system and control valves all as required to give a complete and operable system. Allow to provide a line size heating bypass on the manifold to be used at times of no heat requirement.

All areas are to be individually controlled via wall mounted sensors/controllers as indicated on the drawings. Final locations of all wall mounted sensors/controllers are to be agreed on site prior to installation.

The specialist underfloor heating sub-contractor shall prepare detailed floor coil layout drawings for approval, prior to installation of the system and shall allow for one return visit to site to balance the system, once the main plant has been commissioned.

The contractor is to allow for all control and power wiring associated with the underfloor heating installation. The contractor is to allow, at an early stage in the contract so as to not cause disruption to the project programme, to liaise with the underfloor heating sub-contractor and obtain all latest control and power wiring diagrams required to allow for the complete and operable installations.

5.5 Fan Convector Heating

The contractor is to allow for the installation of the fan convectors as indicated and specified on the drawings.

All fan convectors are to be complete with low temperature cut out (LTC), pencil proof grilles and have fully lockable front covers.

Prior to ordering the fan contractors the contractor is to measure all wall dimensions, recesses, cill heights etc. to ensure the specified fan convectors can physically be installed within the proposed locations.

Each fan convector is to be complete with an adjustable thermostat located within the casing.

Each fan convector is to be controlled via return air sensors located within the units and associated common wall mounted thermostat/controller, all generally as detailed on the drawings.

The fan convector heating circuit is to be complete with a 2-port control valve as indicated on the drawings. The intention of the 2-port control valve is to hold off the

heating to the fan convector circuit at times when the underfloor heating circuit is in demand. Please refer to Section 9.0 of this specification for further information.

It is proposed that the fan convectors serving the Vehicle Store and Workshop are to be controlled in such a way as to ensure they are only operated when the internal space temperature drops to +10°C.

6.0 Domestic Hot & Cold Water Services

6.1 Introduction

The contractor is to allow for the installation of the domestic hot and cold water services installations as indicated on the drawings.

The Contractor shall allow to liaise with the Main Contractor and Electrical Contractor to ensure that all electrical power supplies are allowed for and are fully co-ordinated with regards to all plant and equipment associated with the domestic hot and cold water services installation.

6.2 Scale Prevention Devices

The contractor is to allow to supply, deliver and install the scale prevention devices on the incoming mains cold water and the hot water return service, generally as indicated on the drawings.

The scale prevention devices are to be supplied and installed in accordance with Appendix Two – Schedule of Equipment towards the rear of this specification.

6.3 Domestic Hot Water Cylinder

The contractor is to supply, deliver, install and set to work the domestic hot water cylinder as indicated and specified on the drawings.

The domestic hot water cylinder is to be supplied, delivered and commissioned in the location as indicated upon the drawings. The cylinder shall be installed strictly in accordance with the manufacturer's instructions, allowing for all access as recommended by the manufacturer around the unit for future maintenance, servicing etc.

The domestic hot water cylinder is to include all necessary valves, safety devices, insulation etc., and be complete with unvented kit to take up the expansion of the water and be connected in such an arrangement as indicated on the drawings and to the manufacturer's recommendations.

The cylinder is to be complete with a 3.0kw immersion heater. The contractor is to note that a fused spur electrical supply is to be left adjacent to the cylinder by the electrical contractor and it is the responsibility of the mechanical contractor to wire from this fused spur to the domestic hot water cylinder.

6.4 Hot & Cold Water Pipework, Valves & Fittings

The contractor shall include to install all hot and cold water pipework to the routes and sizes as indicated on the drawings.

Water Supply (Water Fittings) Regulations 1999.
The Contractor shall include for notifying the water supply company of the alterations to the water services, in accordance with clause 5 of the Regulations.

The systems shall be installed in accordance with BS8558.

All distribution pipework and final connections to draw off points shall be run in copper tube to EN1057-R250. This is with the exception of any pipework which is to be cast within a floor screed, run within a trench etc. in this situation the pipework is to be run

using a ‘pipe in pipe’ system.

Where domestic water services are drop to serve shower valves these are to be installed using chrome finish pipework and associated fittings.

All pipework and fittings shall be suitably kitemarked and be WRC approved for wholesome water.

All fittings 54mm and below shall be capillary type solder ring (lead free) to BS EN1254-01 dezincification resistant.

Allow for the installation of:

- Drain cocks at all low points.
- Air vents at all high points.
- Thermal insulation to be installed on all concealed pipework.
- Pipe sleeves - Where pipes pass through wall floors and ceilings compatible pipe sleeves shall be provided. After installation pack both ends with mineral fibre and sealed with fire retardant mastic.

Include final connections to sinks etc, all to include a quarter turn isolating valve.

Provide regulation valves on all branches. These shall be of Hattersley manufacturer or equivalent.

Isolating valves/stopcocks/drain cocks shall be of Hattersley manufacture or equivalent.

The hot and cold water systems are generally indicated on the tender drawings, however, tenderers shall allow for additional bends and sets as required for the actual installation to account for building constraints and local services.

6.5 Thermostatic Mixing Valves

The contractor shall supply and fit thermostatic mixing valves to the outlet as indicated on the drawings. Generally the thermostatic mixing valve shall be to the following specification:

- Model: Premix Nano 15mm inline thermostatic mixing valve, TMV3 approved with adjustable temperature setting. Valve to be factory pre-set to 38°C.
- Finish: Polished chrome.
- Product Ref.: 732116.
- Manufacturer: Delabie Ltd, Tel: 01491 824449.
- Notes: Length of blended water pipework (dead-legs) to be <900mm.

6.6 Commissioning

The contractor is to allow to hydraulically pressure test the installed systems to 1.5 times the normal working pressure.

On completing the installation of the hot and cold water pipework the contractor shall chlorinate the system in accordance with BS 8558.

The systems shall be flushed by using a disinfecting agent as manufactured by a specialist. This shall be circulated through the pipework systems for a period recommended by the specialist, then the system drained. The systems shall then be flushed until the water quality is within the following parameters:

- Total dissolved solids equivalent to the incoming water main.
- Iron in solution, below 10ppm or equivalent to the incoming water whichever is greater.
- That the water is visibly clear and bright and free from suspended solids.

These readings shall be witnessed by the Engineer.

Upon completion the Contractor shall carry out a complete Legionellosis Risk assessment to the requirements of HASAWA, COSHH, ACOPL8, HSG70 and provide the necessary documentation prior to handover.

The complete installation shall be commissioned and tested by the Contractor and set to work to the satisfaction of the Engineer.

7.0 Mechanical Ventilation

7.1 Introduction

The contractor is to allow for all mechanical extract ventilation plant as indicated and specified on the drawings.

The Contractor shall allow to liaise with the Main Contractor and Electrical Contractor to ensure that all electrical power supplies are allowed for and are fully co-ordinated with regards to all plant and equipment associated with the mechanical ventilation installation.

7.2 Mechanical Extract Plant

The Contractor is to allow to supply, deliver and install all the mechanical extract fan units as indicated and specified on the on the drawings. Refer also to NuAire Ltd's latest equipment selection, contact Mr Jim Collings on 07767 298249.

All extract fans are to be installed and connected in full accordance with the manufacturer's recommendations allowing for all required access for future maintenance and all required valves etc.

All mechanical extract fans are to be complete with full speed control to assist in final commissioning.

It is the contractor's responsibility to check the ductwork system resistances upon completion of the ventilation working drawings and prior to ordering the mechanical extract fans.

The manufacturer shall fully commission the extract fans as may be required upon completion of the works to protect the full warranty of the installed plant.

The contractor is to note that fused spur electrical supplies are to be left adjacent to each of the mechanical extract fans by the electrical contractor and it is the responsibility of the mechanical contractor to wire from this fused spur to each of the units.

7.3 Sheet Metal & Plastic Ductwork

7.3.1 Requirements

Air ductwork shall be detailed, manufactured and installed in accordance with Building & Engineering Services Association Specification for Sheet Metal Ductwork – Low, Medium and High pressure/velocity - DW 144 (galvanised sheet steel, mild steel, aluminium).

Unless otherwise indicated on the drawings all bends, branches, tees, expansion, contraction, change shape pieces and other fittings shall conform to DW/144 illustrations and descriptions.

The ductwork systems are generally indicated on the tender drawings, however, tenderers shall allow for additional bends and sets as required for the actual installation to account for building constraints and local services.

7.3.2 Construction

Ductwork shall be correctly constructed using appropriate material thickness, jointing, stiffening, fasteners, connections and fittings complete with all necessary access openings, regulation and control dampers, fire dampers, fresh air inlet and exhaust connections, supply and extract grilles and diffusers and to incorporate all other plant and equipment described elsewhere to form a continuous system. The whole system shall be correctly described elsewhere to form a continuous system. The whole system shall be correctly supported and stiffened to prevent distortion and stress, transmission of vibration 'oil canning' and cold bridges.

7.3.3 Hangers and Supports

Separate ducts shall be independently supported and correctly spaced to allow installation to be applied and to prevent metal-to-metal contact.

All hangers, supports and brackets shall be adequately protected against corrosion.

Hangers for ducts to be thermally insulated shall be spaced to provide clearance for the insulation.

Vapour seal treatment shall be as detailed in DW144.

7.3.4 Bends

Where space allows, long radius bends shall be used in preference to short radius bends, and short radius bends in preference to square bends, except where otherwise indicated. All square bends shall incorporate double skin turning vanes.

7.3.5 Access Openings

Access openings shall be provided in accordance with the B&ESA document 'Cleanliness in Ventilation Systems' and at all equipment or plant items requiring periodic adjustment, cleaning and maintenance and particularly at:

- Fire and/or smoke dampers.
- Control dampers.
- Heat recovery units and extract fans.
- Filters.
- Attenuators.

Periodic cleaning of the ductwork shall require access doors within main runs of ductwork every 6 meters.

Openings shall be of a suitable size and in a suitable location to allow these functions to take place as identified in DW/144 appendix M, Table 25. They shall be of the size and at the locations indicated on the drawings. Where not shown they are nevertheless to be provided and be of suitable dimensions and not less than 450x330mm except where duct dimensions restrict the size in which case the opening shall be as large as practicable.

On very small ductwork it may be necessary to provide multiple openings on adjacent duct faces in order to satisfy proper access requirements.

Access openings shall be rigidly framed with air tight covers designed for easy removal and accurate relocation and fixing. Openings shall be double skin one piece moulded gasket type as manufactured by Advanced Air or other approved.

Duct Sealing

All ducts shall be properly sealed to avoid leakage losses and pressurisation of vapour barrier covered insulation.

Self-adhesive tapes will not be permitted nor used on any ductwork as a means of sealing.

Test Points

Test points for air flow scanning purposes shall be provided in all sections of the ductwork as required. On low pressure ductwork these shall take the form of simple drilled holes 15mm diameter with neoprene plugs. On medium and high pressure ductwork 15mm BSP sockets welded to the duct with BSP plugs shall be used.

7.3.6 Leakage Testing

All ductwork shall be fully pressure and leak tested in accordance with DW 143, Low Pressure, and a test certificate issued.

7.3.7 Manufacturing Drawings

Prepare complete detailed manufacturing drawings based on the arrangement drawings, the architectural drawings, and the structural drawings and certified drawings of equipment to be installed in the system.

All ductwork shall incorporate appropriate construction allowances to accommodate building tolerance differences between drawings and complete structures. Where ductwork is to be installed within the newly constructed building all necessary site dimensions shall be taken prior to construction.

Information on the drawings shall include all relevant dimensions to show location and physical sizes, construction standards to B&ESA DW references, support methods, terminal fixing details to ductwork, method of fixing terminals in ceilings, all access doors and all induct furniture (turning vanes, etc.).

Description:	Supply and extract ductwork system having no fire insulation.
Material:	Hot dip galvanised sheet to BS 2889, Grade Z2.
Duct Types:	Rectangular/Circular.
Classification:	General HVAC supply and extract air ducts; Low pressure Class A. Positive pressure limit 500 Pa. Negative pressure limit 500 Pa. Maximum air velocity 10 m/s.
Temperature Range:	-4ºC to +50ºC.
Sheet Thickness:	As DW/144 specification.

7.4 Volume Control Dampers

Volume control dampers shall be fitted at each branch from a main or sub-main duct and where indicated upon the drawings and as required to enable the air systems to be properly balanced.

In rectangular and circular ductwork up to 0.8m² cross sectional area and maximum blade length 1000mm dampers shall be Actionair air/shield stainless steel aerofoil dampers or other approved with external lockable operating knob. Above these sizes Senior Coleman type DD or other approved opposed blade dampers shall be installed. All dampers shall have an external facility for securely locking in the set position.

In circular ducts up to 350mm diameter iris type balancing dampers shall be used.

7.5 Non Return Dampers

Non return dampers are to be installed as required to ensure back contamination is not encountered.

7.6 Fire Dampers

The contractor shall supply and install fire dampers as required to maintain the fire integrity of the building. Refer to the architect's latest fire strategy drawings in order to obtain all relevant information.

7.7 Flexible Ductwork

Provide insulated connections with ½ hour integrity to all extract grilles. All flexible ducts are to be class 'O' fire rated and be no more than 500mm in length between the main duct and the grille plenum box. All flexible ducts serving extract air grilles shall be insulated.

7.8 Grilles, Diffusers & Louvres

The contractor is to provide and external louvres as indicated on the drawings and to be of the same manufacturer as the mechanical extract fan plant.

All louvres are to be finished to a BS/RAL approved colour, final colour to be confirmed by the architect prior to ordering of louvres.

7.9 Acoustic Attenuation

The contractor is to provide acoustic attenuation to all air systems by means of internal ductwork acoustic lining and silencers as indicated on the drawings. The Contractor shall be responsible for achieving the following design noise levels:

- WC Areas– NR30.

Provide acoustic vibration control to all equipment, including but not limited to the MVHR unit and extract fans to prevent the breakout of vibration and noise.

Employ the services of a specialist acoustic company to analyse the systems to provide the necessary attenuation to meet the above requirements.

7.10 Cross Talk Attenuation

The contractor is to provide acoustic cross talk attenuation to all air systems by means of internal ductwork acoustic lining and silencers as indicated on the drawings. The Contractor shall be responsible for ensuring no noise transfer is realised between the spaces.

Employ the services of a specialist acoustic company to analyse the systems to provide the necessary attenuation to meet the above requirements.

8.0 Above Ground Drainage

8.1 Introduction

The work to be carried out is to include the installation and commissioning of all above ground drainage systems.

Layout and schematic drawings to illustrate the above ground drainage system proposals shall be submitted to the consulting engineer for approval prior to commencement of the works.

The contractor prior to installation is to confirm all connections to proposed waste pipes. Under no circumstances is waste pipework to be connected to the rainwater system or vice versa.

All above drainage pipework shall be laid to a minimum fall at a gradient of 45mm/metre run.

Where it is not possible to run pipework to the routes indicated on the drawings or to the gradient specified inform the consulting engineer in writing giving sufficient time for any changes to the design that may be required.

The contractor is to inform the consulting engineer of any additional waste stacks, from those shown on the drawings, which may be uncovered during the course of the works.

All materials shall comply with the requirements of the latest Editions of the appropriate British Standard Specifications, including the amendments current at the commencement of the Contract.
Materials shall be subjected to such tests as the consulting engineer may direct.

The Contractor shall provide samples of materials/fittings and/or proposed source of same, as may be required or selected by the consulting engineer.

All works are to comply with the Building Regulations and Health & Safety Regulations.

8.2 UPVC Branch Waste and Vent Pipes

Branch waste and ventilating pipes and fittings shall be manufactured from UPVC by the injection moulding process as Gerberit Terrain or equivalent complying with the relevant requirements of BS 5255 and shall, where appropriate, bear the British Standard Kite Mark and jointed with solvent welded joints and seal ring expansion joints where necessary.

8.3 UPVC Stacks

All proposed vertical discharge stacks shall be UPVC complying with the relevant requirements of BS 4514 and shall where appropriate bear the British Standard Kite Mark and shall be jointed with solvent welded joints and seal ring expansion joints where necessary.

Main soil and ventilation pipes/fittings shall be manufactured in UPVC. The installation must comply with BDEN 12056:2 Code of Practice.

Fittings for connections of waste and ventilating pipes shall consist of waste bosses fitted to pipe or integral moulded boss adaptors on fittings. Alternatively connections may be solvent jointed to branch fittings utilising socket reducer fittings where necessary.

Pre-fabricated pipe assemblies made up by the UPVC system manufacturer may be used.

8.4 UPVC Tube WWP Overflows

Individual pipes and fittings 19mm (3/4") size shall be UPVC overflow pipework with solvent welded joints.

Combined overflow pipes and fittings incorporating a range of pipe sizes shall be UPVC complying with the relevant requirements of BS 3505 bearing the British Standard Kite Mark, with solvent welded joints.

10.5 Plastic Traps

Plastic tubular traps shall be deep seal two-piece pattern complying with the relevant requirements of BS 3943, with universal compression outlet connection.

Plastic bottle traps shall be deep seal with adjustable sliding inlet tube, removable base with universal compression outlet connection, complying with the relevant requirements of BS 3943.

Generally P traps shall be used with bottle type on basins and tubular type on sinks. Trap depths shall generally be as follows:

- Wash Hand Basins: 40mm.
- Sinks: 50mm.

8.6 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 cross flow, back fall, leakage or blockage.
- Air from the drainage system does not enter the building.
- Pressure fluctuations in pipework do not vary by more than ±38mm water gauge and traps retain a water seal of not less than 25mm.

The system can be adequately tested, cleaned and maintained.

8.7 Installation Generally

Before commencing work specified in this section, ensure that any specified painting of surfaces which will be concealed or inaccessible is completed.
Install pipes, fittings and accessories in accordance with BS 5572.

Obtain all components for each type of pipework from the same manufacturer unless specified otherwise.

Form junctions using fittings intended for the purpose.

Fix pipes at centres not greater than those specified in BS 5572, provide additional supports as necessary at junctions and changes in direction.

Where not specified otherwise use plated sherardized, galvanised or non-ferrous fastenings, suitable for the purpose and background, and compatible with the material being fixed or fixed to.

Inspect components carefully before fixing and reject any which are defective.

Cut ends of pipes to be clean and square with burrs removed.

Allow for thermal and building movement when jointing and fixing.

Provide access covers and cleaning/rodding eyes as necessary in convenient locations to permit adequate testing and cleaning of pipework, and as indicated on the drawings.

Do not bend plastic pipes.
Adequately protect pipework from damage and distortion during construction.

Prevent entry of foreign matter into any part of the system by sealing openings during construction. Fit all access covers and cleaning/rodding eyes as the work proceeds.

8.8 Pipework Routes

Pipe routes to be the shortest practical, with as few bends as possible and no bends in wet portion of soil stacks, unless specified otherwise, pipe routes not shown on drawings to be approved before commencing work.

Installation and routes of pipework to be co-ordinated with the other mechanical services, electrical, architectural installations etc.

8.9 Fixing Pipework

Make changes in direction of pipe runs only where shown on drawings unless otherwise approved.

Provide additional supports as necessary to support junctions and changes in direction.

Fix every length of pipe at or close below the socket or coupling.

Provide a load bearing support for vertical pipes at not less than every storey level.

Tighten fixings as work proceeds so that every storey is self-supporting and undue weight is not imposed on fixings at the base of the pipe.

Isolate from structure where passing through walls/floors etc. and sleeve pipes.
Provide for thermal and building movement when fixing and jointing, and ensure that clearances are not reduced as fixing proceeds.

Fix expansion joint pipe sockets rigidly to the building; elsewhere use fixings that allow the pipe to slide.

8.10 Prior to Handover

Ensure that temporary caps have been removed and that permanent blanking caps, access covers, cleaning/rodding eyes and the like are secured complete with all fixings.

8.11 Cleaning

After completion of the installation and before final handover ensure that all ducts, voids etc. are cleaned out of builder's debris. Remove from site all surplus materials after final completion.

9.0 Automatic Controls

9.1 Introduction

The Contractor is to allow for all controls as required to drive the proposed mechanical services installations, generally as noted on the drawings and detailed below.

9.2 ASHP Plant

The Contractor is to allow to supply and install a two channel seven day timeclock to control the ASHP plant, pumps and domestic hot water cylinder.

For tender purposes allow to install the seven day timeclock in the Office, final location to be agreed on site with the successful contractor prior to commencement of the works.

9.3 Underfloor Heating

The underfloor system is to its own control box which is to be linked to the ASHP control installation.

Each individual underfloor heating zone is to be controlled via its own dedicated wall mounted controller/sensor which is to be wired back to the relevant corresponding port on the underfloor heating manifold.

9.4 Fan Convector Heating

Each fan convector is to be complete with built-in on/off fan speed switch and summer/ winter switch.

Each fan convector is to be complete with three speed setting and have built-in low temperature cut out (LTC).

The fan convector heating circuit is to be complete with a 2-port control valve as indicated on the drawings. The intention of the 2-port control valve is to hold off the heating to the fan convector circuit at times when the underfloor heating circuit is in demand.

It is proposed that the fan convectors serving the Vehicle Store and Workshop are to be controlled in such a way as to ensure they are only operated when the internal space temperature drops to +10°C.

9.5 Ventilation Plant

The Contractor is to allow to supply and install all controllers, sensors etc. as specified and detailed on the drawings to control the proposed mechanical ventilation installations.

9.6 Domestic Hot Water Services

The hot water cylinder is to be complete with an adjustable integral stat which is to be controlled via a 2-port valve as indicated on the drawings.

Overall control is to be provided by the two channel seven day timeclock as noted in Section 9.2 above.

10.0 Builderswork

As part of the works the Contractor is to allow to liaise with the Main Contractor to ensure all builderswork is completed to facilitate the installation of the mechanical services. The builderswork elements include but are not limited to the following:

- All external trenching for incoming services.
- 150mm high concrete base for the external ASHP unit.
- All holes through roofs, walls, ceilings, slabs etc. as required to facilitate the proposed installations.
- Chasing of existing floor slabs to run new services.
- Boxing in of pipework where run at high level.
- Boxing in of extract ventilation ductwork.
- Making good of all holes and penetrations to ensure the fire integrity of the building is not compromised.
- Painting of all exposed pipework to match wall finish.

The above buildersworks list is not exhaustive and the Contractor is to allow for all buildersworks elements as may be required to facilitate the proposed installations.

11.0 Thermal Insulation

11.1 Introduction

All insulation works shall be carried out by skilled workmen employed by a specialist firm which is a member of the Thermal Insulation Contractors Association (TICA).

Do not apply thermal insulation until the system has been fully tested, all joints proved sound and the surface to be insulated.

Thermal insulation materials and installation methods shall be strictly in accordance with the relevant sections of the following British Standard Specifications and Codes of Practice:

Terminology:	BS 3533 – Glossary of thermal insulation terms.
Performance Standards:	BS 5422 (2001) – Method for specifying thermal insulating materials on pipes, ductwork and equipment (in the temperature range -40°C to 700°C).
Materials Specification:	BS 3927 – Specification for rigid phenolic foam (PF) for thermal insulation in the form of slabs and profiled sections. BS 3958 – Thermal insulating materials. Part 3: Metal mesh faced man-made mineral fibre mattresses. Part 4: Bonded preformed man-made mineral fibre pipe sections. Part 5: Specification for bonded man-made mineral fibre slabs.
Application Methods:	BS 5970 – Code of Practice for thermal insulation of pipework and equipment (in the temperature range -100°C to 870°C).
Material Testing:	BS 476 – Fire tests on building materials and structures. Part 4: Non-combustibility test for materials. Part 6: Method of test for fire propagation for products. Part 7: Surface spread of flame tests for materials. Part 12: Method of testing for ignitability of products by direct flame impingement (superseded Part 5).

11.2 General

All materials delivered to site shall be new and dry and be maintained in a good condition throughout the progress of the works.

Insulating materials, coverings and coatings shall be of a uniform thickness throughout.

The insulation shall have a smooth lineable finished surface and rigid sections shall be concentric and accurately matched. The Engineer will not accept insulation sections having damaged ends or edges or irregularities in the thickness of materials. To ensure that the correct thickness has been applied the Engineer reserves the right to cut our specimen sections of each type of duct or pipe insulation for inspection. If the inspection reveals that the insulation is not in accordance with this specification all insulation shall be stripped off and reinstated at the Contractors expense.

Each pipe shall be insulated separately so that adjacent parallel pipes are not married together in one insulation covering. There shall be a minimum clearance of 25mm between adjacent insulation surfaces.

11.3 Ductwork Insulation

The contractor is to note that all supply and extract heat recovery ventilation ductwork is to be fully insulated in accordance with this clause.

Material Specification

Insulation Material:	Kooltherm Phenolic Foam duct insulation.
Thickness:	In accordance with BS 5422:2001 table 11.
Density:	40kg/$m^{3.}$
Thermal Conductivity:	0.020 W/m K @ 20^{o}C.
Manufacturer:	Kingspan Insulation Ltd or other approved.

Where support pins/hangers puncture the foil they shall be cropped back to the washers and sealed using an aluminium foil tape to maintain the vapour barrier.

On the exposed edges of the slab, e.g. corners, provision shall be made to carry the aluminium foil to the adjoining slab to maintain the integrity of the vapour barrier.

11.4 Pipework Insulation

The system is to be fully insulated in accordance with the appropriate sections of BS 5422:2001 according to the type of mechanical service installation (eg heating, hot water supply, cold water supply etc).

(a) Type of Insulant/Manufacturer

The insulation shall be Kooltherm pre-formed bore-coated sections of rigid phenolic foam with a factory applied reinforced aluminium foil jacket. As manufactured by Kingspan Insulation Ltd or equal and approved.

(b) Thickness of Insulation

Insulation thicknesses shall be in accordance with BS 5422:2001.

(c) Method of Application

To be applied in accordance with the manufacturer's recommendations. All joints to be close butted and sealed with 500mm wide aluminium foil adhesive tape, Idenden T303 or equal. Each section of preformed insulation shall be firmly secured to the pipe by two additional circumferential bands of 50mm wide aluminium foil adhesive tape. On chilled and cold water pipes the vapour barrier to be fully sealed at all joints, terminations and protrusions through the insulation. Kooltherm high density insulation insets to be installed at pipe supports to facilitate the provision of a continuous vapour barrier.

(d) Finish

Insulations hall be finished in a rigid plastic Isogenopak casing in the plantroom only. Insulation elsewhere shall be factory applied aluminium foil finish.

(e) Labelling

All pipework shall be labelled with colour coding and directional arrows.

11.5 Thickness Tables In Accordance With BS 5422:2001

11.5.1 Heating Installations

Environmental thickness of insulation to control heat loss in accordance with BS 5422:2001 - Table 12.

Steel Pipe Size (mm) NB	Hot Face Temperature of Installation +75°C Thickness of Phenolic Foam Insulation (mm)
15	15
20	15
25	20
32	20
40	20
50	20
65	25
80	25
100	25

11.5.2 Domestic Cold Water Installations

Thickness of insulation to prevent condensation on a low emissivity outer surface with ambient air conditions of 25°C and 80% RH in accordance with BS 5422:2001 - Table 8.

Copper Pipe Size (mm)		Hot Face Temperature of Installation +10°C
NB	OD	Thickness of Phenolic Foam Insulation (mm)
15	15	15
20	22	15
25	28	15
32	35	15
40	42	15
50	54	15
65	67	20

11.5.3 Domestic Hot Water Installations

Environmental thickness of insulation in accordance with BS 5422:2001 - Table 13.

Steel Pipe Size (mm)		Water Temperature of 60°C
NB	OD	Thickness of Phenolic Foam Insulation (mm)
15	15	15
20	22	15
25	28	20
32	35	20
40	42	20
50	54	20
65	67	25

11.5.4 Ventilation Ductwork Carrying Warm Air

The contractor is to note the requirement for all supply and extract heat recovery ventilation ductwork to be fully insulated in accordance with this clause.

Environmental thickness of insulation in accordance with BS 5422:2001 - Table 11.

Temperature Difference Between Air Inside Ductwork & Ambient Air 10°C
Environmental Thickness of Phenolic Foam Insulation (mm)
20

12.0 Testing & Commissioning

12.1 Introduction

This section of the Specification includes:

- Works prior to commissioning.
- Commissioning.
- Performance testing.

The CIBSE and BSRIA publications referred to are as follows:

CIBSE Commissioning Codes:

- Series A – Air Distribution.
- Series B – Heat Sources.
- Series C – Automatic Controls.
- Series R – Comfort Cooling.
- Series W – Water Distribution.

BISRIA Application Guides:

- Manual for Regulating Air Conditioning Installations.
- Manual for Regulating Water Systems.

The following definitions shall apply to the activities associated with the Commissioning of the Works.

12.2 Pre-Commissioning

Pre-commissioning is the phase of work which takes into account the activities necessary to advance an installation from static completion to the commissioning phase.

14.3 Commissioning

In accordance with the Commissioning Codes, commissioning is defined as 'the advancement of an installation from static completion to full working order to specified requirements'. Commissioning includes the setting to work and regulation of an installation. Commissioning is deemed to be complete when all regulation work has been completed.

12.4 Performance Testing

Performance testing is the evaluation of a system which has been commissioned to ensure that it is operating within the tolerances as set out in the Specification and the relevant Commissioning Codes and Guides.

12.5 Scope of Works

The scope of the commissioning works includes the provision of all labour, apparatus, instruments, materials, tools, plant and equipment required to carry out and record the commissioning and performance testing of all systems and all associated electrical and automatic controls systems. The mechanical services installation shall be commissioned in accordance with the relevant Commissioning Codes, Guides and this specification.

12.6 Additional Tests

The Engineer will have powers to instruct tests at site or at the supplier's premises on all or any of the plant and equipment intended to be used in the Works in any manner he may deem necessary to demonstrate conformity with this Specification. The results of such tests or any other tests will in no way relieve the Contractor of his responsibilities to ensure that all plant and equipment installed in the Works are entirely suitable for the application and conditions of operation.

Any defects or other irregularities which become apparent during commissioning and performance testing must be rectified and the exercise repeated until the installation is proved complete and in accordance with the specified requirements.

12.7 Copies of Codes

One copy of the relevant CIBSE Commissioning Codes and BSRIA Application Guides shall be provided by the contractor and be made available on site for the sole use of the Engineer.

12.8 Exchange Pulleys and Belts

The Contractor shall include for one set of exchange pulleys and belt drives for each belt driven fan and pump installed in the building. Pulleys and drives shall be sized and fitted as determined by test results at the time of commissioning in order to satisfy the specified performance criteria.

12.9 Works Prior to Commissioning

12.9.1 Tests

Commissioning and performance testing shall only be carried out after the installation has been tested and certified as detailed elsewhere in this Specification. This includes:

(a) Hydraulic pressure testing of pipework
(b) Works testing of plant items
(c) Air leakage tests of ductwork

12.9.2 Pre-Commissioning Checks

Pre-commissioning checks shall be carried out to ensure that all system components are correctly installed. Cleanliness of air and water distribution system is essential.

All statically complete systems shall be correct with regard to the details indicated on the drawings and as described in this specification and clean and safe to operate.

To ensure that each system is in a satisfactory and safe condition before start-up carry out the checks in accordance with the recommendations in the relevant CIBSE Commissioning Codes.

Where a defect has a bearing on the commissioning of a system or systems it shall be rectified prior to commissioning.

12.9.3 Pre-Commissioning Work

All hydraulic systems shall be thoroughly flushed through to ensure removal of any debris in the pipeline systems.

When chemical cleaning is applied, procedures shall be implemented to ensure that all residual chemical deposits are removed from the system prior to commissioning.

All strainers shall be removed and cleaned during and after flushing and immediately prior to balancing of the system.

Advance notice shall be given to the Engineer prior to removal and cleaning of strainers.

Flushing and cleaning of the hydraulic systems shall continue until it can be demonstrated that the system has been cleared of all debris and contamination.

Flushing water shall be released and drained away in an approved manner as rapidly as possible through adequately sized drain valves.

No hydraulic system shall be left empty once the chemical cleaning and flushing procedures have been completed.
No solid or liquid polluting matter shall enter water courses, water supplies etc.

All ventilation systems shall be completely clear of any obstructions, debris and superfluous matter prior to commissioning. Ensure that all fire dampers are secured in the open position.

All control panel wiring shall be checked for loose connections, correct terminations and compliance with the wiring diagrams.

Wiring terminations to control equipment and interlocks with other equipment shall be checked for compliance with the HVAC wiring diagrams.

Faults shall be rectified as soon as they are discovered unless associated with wiring carried out by others, in which case they shall be recorded and notified to the Main Contractor.

12.10 Personnel

Commissioning and performance tests shall be carried out using trained and experience Commissioning Engineers. The Supervising Commissioning Engineer must have a minimum of five years' experience in the commissioning and performance testing of mechanical services installations.

Commissioning and performance testing of major items of equipment including boilers, pressurisation units, air handling units, booster units and automatic controls systems etc. shall be carried out by the manufacturer's personnel.

The Contractor shall co-ordinate and supervise the manufacturer's commissioning engineers during the commissioning and performance testing of major items of equipment.

12.11 Instrumentation

12.11.1 Calibration

Current calibration certificates shall be submitted for all instruments that require periodic recalibration immediately prior to the beginning of measurement work on site.

12.11.2 Test Instrument Detail

The commissioning reports shall give details of the test instruments used indicating the manufacturer's name, model number, serial number, certificate of calibration and correction factors.

12.11.3 Commissioning

The Contractor shall commission the complete mechanical services installation and shall submit a programme of works for approval prior to commencement of commissioning. The programme shall be updated and amended as and when directed.

A commissioning method statement shall be submitted for each system to be commissioned.

All air and hydraulic systems shall be balanced to the tolerances detailed in the specification, commissioning codes and guides.

All distribution systems shall be balanced with due regard to noise generation.

Where system noise generation exceeds the acceptance levels specified the Contractor shall provide all relevant information to the Engineer.

All measurements and operational details shall be recorded as commissioning work proceeds and subsequently incorporated into the commissioning manual.

All air distribution system dampers shall be clearly marked in an approved manner when the individual system has been balanced.

All hydraulic regulating devices shall be locked in their final regulated position in an approved manner.

The final balance of all air and hydraulic systems shall be demonstrated to the Engineer.

System performance tests shall not proceed until the certified commissioning results have been submitted.

13.0 Demonstration

On completion of the works the contractor is to demonstrate the operation of all installed systems and the maintenance routines to the building users and site facilities personnel.

The contractor is to allow for 2x days for the demonstration of the installed systems.

APPENDIX 1 - DRAWING SCHEDULE

Drawing Number	Drawing Title	Drawing Size	Drawing Scale
1320.01/M001	Proposed Heating Layout	A1	1:50
1320.01/M002	Proposed Ventilation Layout	A1	1:50
1320.01/M003	Proposed Domestic Water Services Layout	A1	1:50
1320.01/M004	Proposed Above Ground Drainage Layout	A1	1:50

APPENDIX 2 - SCHEDULE OF EQUIPMENT

Item	Specification	Manufacturer	Notes
Scale Prevention Device (Incoming MCW)	WK2	Lifescience Products Ltd Tel: 01608 811707	Dimensions: 220mm x 155mm x 67mm Power Consumption = 1.0W
Scale Prevention Device (DHW Return)	Sentry	Lifescience Products Ltd Tel: 01608 811707	Dimensions: 140mm x 85mm x 50mm Power Consumption = 1.0W
HWS Secondary Pump (P.01)	UPS15-50N	Grundfos Ltd Tel: 01942 263600	Single Head Pump 3-Speed 230v/1ph/50hz

PART 3 TENDER DOCUMENTS – EDMONDS PARK OUTDOOR SERVICES DEPOT

The following is an analysis of the quoted figure as entered on the Form of Tender and must be completed by the Tenderer at the time of Tender and must be arithmetically correct.

The Contractor shall note that if after receipt of tenders there is a shortfall of funding, various elements of the work will be omitted to comply with the funding limit. Accordingly the Contractor shall price each element of the work on the above basis including any loss of profitability consequent on a reduced contract value.

Each sum shall include for all work necessary to complete that particular section of work.

Edmonds Park Outdoor Services Depot - Mechanical Services

1	Compliance with Preliminaries and Standard Specification	£	
2	Stripping Out and Removal of Redundant Services	£	
3	Provision of Temporary Services (As Required)	£	
4	Incoming Mains Cold Water Supply	£	
5	Air Source Heat Pump Plant & Equipment	£	
6	LTHW Heating System, Pipework & Valves	£	
7	Fan Convectors & Underfloor Heating	£	
8	Mechanical Ventilation	£	
9	Domestic Hot & Cold Water Services	£	
10	Above Ground Drainage	£	
11	Automatic Controls		
12	Builderswork	£	
13	Thermal Insulation	£	
14	Testing and Commissioning	£	
15	Demonstration	£	
16	Record Documentation	£	
17	Any other items not included but above but required to complete the contract, please list:		
	_____	£	
	_____	£	
18	Provisional Sum for Contingency	£	4,000.00

Total to be Carried Forward to the Main Contract Tender **£** _____

Signed: _____ Date: _____

Position: _____

Company: _____

Address: _____

Section 2 Daywork Details

State percentage additions to be added to the nett cost of variations carried out under daywork instructions inclusive of profit, overhead charges, insurance, supervision, employer's liability, provision of tools, plant and scaffolding and all other incidental expenses and "on costs" including all taxes and discounts, including that to the main contractor where appropriate.

Labour

For which the nett cost will be the actual nett sums paid to workpeople inclusive of guaranteed overtime travelling, holidays with pay and employer's contributions for National Insurance always provided that all such do not exceed the sums generally payable in the district concerned _____%

Materials

For which the nett cost will be the actual nett sum paid to supplies after deducting discounts other than that for early cash settlement _____%

Fares and Allowances

For which the nett cost will be the actual nett sums paid to workpeople _____%

Sub Contractors

For which the nett cost will be the actual nett sum paid to approved sub-contractors after deducting all discounts _____%

Note: Work people means all site and/or shop workers but excludes supervision, draughting, store, secretarial, and similar personnel who are to be included in the overhead charges.

Signature: _____

Date: _____

Section 3 Tradespeople, Rates & Hours

State the various categories of tradespeople proposed to be employed, the actual hourly rates payable and as would be applicable for net daywork costs, the actual net hours the tradespeople would be engaged on the works unless specifically working outside normal hours, and the rates and hours applicable to authorised overtime. It will not be sufficient to state "in accordance with national agreements", etc., unless a full copy of such agreement is submitted with the Tender.

The tradespeople are to include foremen, charge-hands, fitters, welders, electricians, joiners, mates, apprentices, labourers, etc.

	Tradespeople	**Rate - £/hour**
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____
9	_____	_____

My/our tradespeople would normally be engaged on the works and would require additional payment for any authorised overtime I/we are instructed to work as follows:

Day	**Monday - Thursday**	**Friday**	**Saturday**	**Sunday**	**Bank Holiday**
Start					
Finish					

Section 4 Materials, Delivery Periods & Basic Prices

State details of all materials proposed to be employed, whether or not these are specified to a particular pattern and/or manufacture, with a note of the delivery period from date of order and, for variable price tender only, the basic price or reference to this. Materials not listed will not be considered for price fluctuation adjustment.

The delivery periods must be suitable to suit the installation programme and no change of specification will be allowed unless the tenderer makes suitable reservation at the time of tender.

Item	Manufacturer	Cat No or type	Delivery weeks	Basic price
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____

Where there is inadequate space for all details to be inserted they may be given separately.

Signature: _____

Date: _____

Section 5 Alternatives

State any alternative material the tenderer would wish to put forward, the cost effect on his Tender, particularly for any items mentioned in this Section or elsewhere but is invited to mention any item that would lead to mutual advantage.

Item	Increase	Decrease

Signature: _____

Date: _____

Section 6 Details

Reservations

In the preparation of my/our tender the following is my/our interpretation of the information submitted to me/us and/or the reservations I/we have are:

_____

_____

_____

_____

Sub Letting

The specialist firms that I/we propose to employ are:

_____

_____

Site Electricity

The electricity supply that I/we wish to have made available is:

Number of phases: _____ Capacity-amps per phase: _____

Signature: _____

Date: _____