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PSA WHOLESALE LIMITED
VERNON HOUSE, SICILIAN AVENUE, LONDON, WC1

REFURBISHMENT OF THIRD AND FOURTH FLOORS

**SPECIFICATION FOR THE
MECHANICAL ENGINEERING SERVICES**

CONSULTING ENGINEER:

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MECHANICAL ENGINEERING SERVICES

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REFURBISHMENT OF THIRD AND FOURTH FLOORS

MECHANICAL ENGINEERING SERVICES

PART 1 GENERAL

1.1 DESIGNATION

The designation 'Engineer' or 'Consulting Engineer' stated within this specification shall be deemed to read Project Manager's Representative with respect to Engineering Services. All communications shall therefore be addressed to the Project Manager.

1.2 DRAWINGS & SPECIFICATION

The specification and drawings shall form part of the Main Contract Bills of Quantities and therefore shall be read in conjunction with the said document. The whole of the Mechanical Engineering Services (hereinafter called the 'Services') shall be executed in accordance with the specification, contract drawings and such further instructions as may be issued from time to time by the Project Manager in the most substantial and workmanlike manner according to the true intent and meaning of the specification, and no advantage shall be taken of the outline drawings and specification, and shall be completed to the full satisfaction of the Project Manager.

The Mechanical Contractor shall include for all relevant items shown on the drawings, whether or not such items are referred to in the specification, and for relevant items referred to in the specification but not shown on the drawings.

Positions of plant shown on the drawings shall be used for the purposes of tendering but they may be reasonably varied by the Project Manager without extra cost, unless such alterations are made after the plant is installed.

The Mechanical Contractor shall be held to have carefully examined the site, specification and drawings and shall be held to concur, as a practical manufacturer and tradesman, with the methods and styles of construction to be adopted and the sufficiency of the material proposed to be used in the execution of the 'Services'.

Should anything be omitted from the said specification or drawings, which is fitting and usually considered necessary to be done for the due and proper completion of the 'Services', the Mechanical Contractor shall execute the same as if it had been particularly specified or shown on the drawings, and shall supply whatever may be necessary to complete the whole 'Services' without any claim for payment for such omissions. Should there be any item or items in the specification or on the drawings which the Mechanical Contractor has any doubt as to the true intent and meaning thereof, he shall satisfy himself by enquiring of the Project Manager before submitting his tender. The Project Manager's decision shall be final. After formal acceptance of the tender, the Project Manager's interpretation thereof will be binding on the Mechanical Contractor.

1.2 DRAWINGS & SPECIFICATION (Contd.)

In the event of any discrepancies in the scale approved to any plan or drawing and the figured dimensions thereon, the figured dimensions shall be taken and held as correct.

1.3 COSTS TO COMPLY WITH SPECIFICATION

Costs for the total of Mechanical Services shall be based on the specified fittings, articles and materials. No alternative scheme will be considered and the Mechanical Contractor shall conform strictly to the specification and associated drawings.

1.4 SCHEDULE OF RATES

The Mechanical Contractor shall, within 14 days of being so requested by the Project Manager, furnish a Schedule of Rates showing, in detail, the quantities, prices and extensions used in the calculation of his price and he shall accept responsibility for the accuracy of any quantity and extensions contained therein, which shall balance with the total cost of this. This Schedule shall form part of the Contract Documents.

1.5 MECHANICAL CONTRACTOR TO INFORM HIMSELF FULLY

The Mechanical Contractor shall be responsible for all measurements and for the compilation of quantities required and no allowance will be made for any alleged ignorance or insufficient knowledge, inaccurate measurements or error on his part. The drawings prepared in connection with the 'Services' diagrammatically indicate the position of the various runs, points and equipment, etc., but the actual runs and positions of equipment, etc. shall be fully determined on site and the Mechanical Contractor is required to obtain all information in respect of dimensions, door hangings, architectural features, furniture, etc. from the Project Manager's drawings and by enquiry of the Project Manager.

1.6 INSPECTION, TESTING & REJECTION

The 'Services' shall be carried out in accordance with the instructions which will be given from time to time by the Project Manager's Representative and to his satisfaction in all things. The Project Manager shall have full power to inspect and test the work or materials, at the sole cost and charge of the Mechanical Contractor, at the Mechanical Contractor's works during manufacture or construction, or at any place where any materials are being made or obtained therewith.

All other operations of the Mechanical Contractor, or any authorised subcontractor, manufacturer or tradesman, shall be open to the inspection of the Project Manager at all times. The Project Manager shall have full power either before or after delivery or erection, to reject any of the work which he may consider defective, either in material manufacture or workmanship, and to order removal of same, and his directions on such subjects are to be final and shall be promptly attended to by the Mechanical Contractor at his own expense.

Should compliance with such instructions be refused or neglected for three days, the Project Manager shall have power to have the rejected work taken down and removed without being answerable or accountable for any loss or damage which may arise or happen to the same and any consequential expense shall be paid to the Employer.

1.6 INSPECTION, TESTING & REJECTION (Contd.)

Except where otherwise specified, the Mechanical Contractor shall provide, free of charge, such assistance, labour, materials, electricity, fuel, stores, apparatus and instruments as may be required and as may be reasonably demanded to carry out the tests efficiently.

1.7 TESTS UPON COMPLETION

The Mechanical Contractor shall give the Project Manager 21 days' notice in writing of the date after which he will be ready to carry out tests on completion, hereinafter specified.

Unless otherwise agreed, the tests shall take place within 10 days after the said date on such day or days as the Project Manager shall, in writing, notify the Mechanical Contractor.

If the Mechanical Contractor fails to make such tests within the time aforesaid, the Project Manager may himself proceed to make tests, and all tests so made by the Project Manager shall be at the risk and expense of the Mechanical Contractor.

The Mechanical Contractor shall be required to provide all necessary testing equipment and instruments and to test the installation in the presence, and to the satisfaction, of the Project Manager, and to carry out such rectification to the plant and further tests as the Project Manager may direct and shall leave the installation in perfect working order, as specified. All such tests shall be carried out free of charge to the Employer.

To facilitate progress of the 'Services', it may be necessary to test sections of the 'Services' separately and no extra charge to the Employer will be allowed. If any portion of the 'Services' fails to pass the tests of the said portion, tests shall, if required by the Project Manager, be repeated within a reasonable time upon the same terms and conditions, and all costs arising from the repetition of the tests shall be met by the Mechanical Contractor.

1.8 MECHANICAL CONTRACTOR'S WORKING DRAWINGS

The Mechanical Contractor shall prepare his own working drawings. If any further instructions, details or drawings are required to enable these working drawings to be prepared or any work to be done, the Contractor shall apply in writing to the Project Manager for such information.

The Mechanical Contractor shall submit to the Project Manager, for approval, the following:

- a) On or before the dates named in the specification, such drawings as may be called for therein.
- b) During the progress of the 'Services' and within such reasonable times as the Project Manager may require, such drawings of the general arrangement and details of the 'Services' or any part thereof as the Project Manager may reasonably require.

Within a reasonable period after receiving such drawings, the Project Manager shall signify his approval or otherwise.

1.8

MECHANICAL CONTRACTOR'S WORKING DRAWINGS (Contd.)

Four copies of all drawings which require to be approved by the Project Manager shall be provided by the Mechanical Contractor and shall be signed by the Project Manager and the Mechanical Contractor.

Two of the copies so signed shall be retained by the Mechanical Contractor.

Drawings signed as above described shall not be departed from except as provided by an official Project Manager's Instruction.

The Project Manager shall appraise the drawings on a technical nature only in terms of the drawings being compatible with the intent of the design, and approval by the Project Manager shall not relieve the Mechanical Contractor in any way from his responsibilities under the Contract in respect of the accuracy of drawings or the relationship of the drawing content in terms of co-ordination of other trades.

The Project Manager shall have the right at all reasonable times to inspect, at the premises of the Mechanical Contractor, all drawings of any portion of the 'Services'.

In the event of any discrepancies in the scale approved to any plan or drawing and the figured dimensions thereon, the figured dimensions shall be taken and held as correct.

The Mechanical Contractor shall be responsible for, and shall pay the extra cost, if any, occasioned by any discrepancy, error or omissions in the drawings and other particulars supplied by him, whether they have been approved by the Project Manager or not, provided that such discrepancies, errors or omissions are not due to inaccurate information or particulars furnished in writing to the Mechanical Contractor by the Employer or Project Manager.

1.9

SETTING OUT OF WORKS

The Mechanical Contractor shall take his own dimensions for all plant and materials to be supplied and fixed, and shall be entirely responsible for their accuracy. All measurements are to be taken from actual buildings and plant and not from the drawings and specification.

1.10

BUILDER'S WORK

All excavation, backfilling, cutting away, making good and all incidental builder's work has been measured elsewhere and no cutting away will be allowed without the sanction of the Project Manager. The Mechanical Contractor shall mark out in advance and shall be responsible for the accuracy and size of all cut holes and chases required.

The Mechanical Contractor shall drill and plug all holes for securing services which require screw or bolt fixing. Builder's work requirements in sufficient detail to enable accurate setting out of holes, built-in sleeves and bases shall be supplied to the Main Contractor by the Mechanical Contractor well in advance so that exact positions can be agreed.

INSTALLATION LIAISON

Particular care shall be taken to ensure there is close liaison with other trades in installing services to prevent obstruction of mechanical service positions, etc.

Services through ducts shall be arranged to permit minimum access in the ducts and they shall be readily accessible for inspection. Any work which has to be re-done due to negligence in this respect will be the responsibility of the Mechanical Contractor.

The routes of services and the approximate positions of apparatus are shown on the drawings, but their exact position shall be determined by dimensional detail drawings, or on site by the Project Manager in consultation with the Main Contractor.

Where large items of plant and equipment, ductwork or long lengths of tube are to be installed, the Mechanical Contractor shall advise the Main Contractor in good time for access to be provided for installation, before construction work limits the access.

Particular care shall be taken to obtain uniform and tidy arrangements of wall and ceiling mounted equipment. The precise position of a piece of equipment shall be determined as follows:

- a) Single items of equipment which are visually remote from other electrical or mechanical equipment shall be erected at the mounting heights stated in the specification or shown on the drawings.
- b) Two or more items of equipment, whether mechanical or electrical, or both, which are to be erected on the same wall or ceiling, or which will be otherwise visually close to each other, shall be arranged in a neat and symmetrical group.

Symmetry of arrangement shall be obtained by horizontal and vertical alignment through the centre lines and not the edges of equipment, and for this purpose the mounting heights stated in the specification or on the drawings may be varied slightly.

In the planning of arrangements, the Mechanical Contractor shall co-operate as necessary with the Main Contractor and any other trades concerned. The proposed arrangements showing the outlines of all the electrical and mechanical equipment in each group shall be marked on the wall or ceiling and the approval of the Project Manager obtained before any holes or chases are cut.

SAMPLES, ETC.

The Mechanical Contractor shall include for submitting samples of materials, valves, cables, switches, fittings, etc., together with sketches, illustrations, leaflets or drawings, if required, to the Project Manager. The Mechanical Contractor shall clearly mark samples, etc. with his own name and address and the contract to which they refer.

Such samples and illustrations, etc. shall remain the property of the Project Manager until the termination of the Contract, when they will be returned to the Mechanical Contractor.

No material shall be ordered or used until it has been approved by the Project Manager.

'AS INSTALLED' DRAWINGS

During the progress of the 'Services', the Mechanical Contractor shall record, on drawings and in an approved manner, the information necessary for preparing the installation record drawings.

The marked-up drawings shall be made available to the Project Manager for inspection and checking at any time during the Contract.

Installation record drawings shall indicate:

- a) The position of all plant and apparatus.
- b) The size, type and date of laying of all underground cables and ductwork.
- c) The size, type and routes of all pipework and ductwork.
- d) The position of all valves; the valve reference numbers shall correspond to the reference numbers on the valve labels.
- e) Wiring diagrams for electrical equipment and control panels.

In addition to the record drawings, valve and instruction charts, reproduced on suitable plastic materials, shall be supplied and fixed in the boiler house, calorifier rooms or plant rooms, as required by the Project Manager, prior to final printing.

If requested by the Project Manager, the Mechanical Contractor shall provide printed instructions and record drawings of plant control systems and equipment to enable the Employer to operate, maintain, dismantle, re-assemble and adjust such plant and equipment.

The relevant marked-up drawings shall be produced before the date of practical completion. The final record drawings of the installation, together with any instructions relating to the plant and equipment shall be provided at the time of practical completion.

'As installed' drawings shall be provided both in hard copy form, on an approved transparent plastic material, and on a 3½" high density floppy disk (or disks) in Autocad Release 12 .DWG format. CAD drawings shall be produced at a scale of one drawing unit to one millimetre. Each service on the drawings shall be on it's own layer. Text shall be on separate layers.

Where relevant, copies of the Consulting Engineers' design drawings may be available to the Contractor on 3½" disks in Autocad Release 12 .DWG format. A charge of £10.00 per drawing will be payable, with a minimum charge of £50.00, excluding VAT and delivery.

If the Mechanical Contractor fails to produce the record drawings to the Project Manager's approval at the date of practical completion, the Employer may instruct the Project Manager not to issue the Practical Completion Certificate and to provide these drawings with whatever assistance the Project Manager deems necessary, and the cost of preparing such drawings shall be deducted from the outstanding payments due to the Mechanical Contractor.

1.14

MAINTENANCE MANUAL

The Mechanical Contractor shall furnish to the Project Manager, upon practical completion of the entire installation, three copies of a maintenance manual.

The manual shall be the loose leaf type, A4 size, having stiff covers, cloth bound with sub-divisions in cardboard for each section, a ready means of reference and a detailed index.

The manual shall contain full operation and maintenance instructions for each item of plant, and shall deal systematically with each system, including the following:

- a) Plant.
- b) Valve operation.
- c) Procedure to adopt in an emergency should any item fail to operate.
- d) Procedure for fault finding.
- e) Type of lubricant required for each item of equipment and frequency of lubrication.
- f) Legend for colour coding of all services.
- g) Wiring diagrams.
- h) True-to-scale linen prints, A4 size, of the record drawings.
- i) Itemised list of essential & secondary spares for all plant and equipment.

NOTE: Manufacturer's standard 'hand-out' cards and leaflets will NOT be accepted in the manual. The Contractor shall fix such cards to the plant room walls adjacent each item of equipment.

1.15

ELECTRICAL WORK ASSOCIATED WITH MECHANICAL SERVICES

All electrical work, except the provision of motors, starters and other equipment required to be provided by this specification, shall form a separate contract. It will, however, be necessary to co-ordinate works which require the attention of both disciplines and the Mechanical Contractor shall hand over to the Electrical Contractor all free issue equipment in good time to allow normal progress of the installation.

All wiring diagrams delivered with equipment shall also be handed to the Electrical Contractor and these shall supplement the information prepared by the Project Manager.

1.16

WORKMANSHIP & MATERIALS

The 'Services' shall be executed, manufactured, erected and completed in the best and most workmanlike manner, and with the best materials of their respective kinds, and everything is to be done to the full spirit and intent of the Contract, which is intended to comprise everything necessary for the perfect completion of the works.

1.16 WORKMANSHIP & MATERIALS (Contd.)

Where particular materials are called for, the Project Manager shall have authority to reject materials which do not conform to the specification.

Where the words "equal" and "approved" appear in the specification, they shall mean an article or articles approved in writing by the Project Manager, being equal in every respect to that or those specified.

In cases where permission is given for a lower priced article to be provided, the contract price shall be adjusted to suit the difference in cost.

Unless otherwise specified and approved, all designs, materials and installations shall comply with the latest issue of the relevant British Standards, British Codes of Practice, Statutory Regulations and By-Laws, etc., and all materials shall be new and unused.

1.17 REQUESTS FOR PAYMENT

Copies of interim claims to the Main Contractor shall be forwarded in triplicate to the Consulting Engineer in accordance with the format as indicated in Appendix One of this specification.

1.18 REGULATIONS

The installation shall comply with all relevant statutory instruments and regulations and, in particular, with the following:

- a) The I.E.E. Regulations for Electrical Installations, 16th Edition.
- b) Regulations under the Factories Acts.
- c) Regulations under the Electricity Acts.
- d) The Gas Safety Regulations.
- e) The Health & Safety at Work Act.
- f) The Clean Air Acts.
- g) Any special regulations issued by the local Electricity, Gas or Water Undertakings.
- h) The Control of Pollution Act.
- i) Any relevant Codes of Practice.
- j) Any relevant British Standards.

1.19 ASBESTOS REMOVAL

The Mechanical Contractor shall strictly adhere to the following regulations and procedures:

- a) The Asbestos Regulations 1969.

ASBESTOS REMOVAL (Contd.)

- b) The Health & Safety at Work Act 1974.
- c) The Control of Pollution Act 1974.
- d) The Control of Pollution (Special Waste) Regulations 1980.
- e) Work with Asbestos Insulation & Asbestos Coating (Approved Code of Practice & Guidance Notes).
- f) Asbestos Control Limits & Measurements of Airborne Dust Concentrations - EH/10 1983.
- g) A.R.C.A. Guidelines:
 - i) Recommended Guidelines for the Monitoring of Airborne Asbestos.
 - ii) Guidelines on the Control of Pollution Act 1974 and the Control of Pollution (Special Waste) Regulations 1980.
 - iii) Recommended Guidelines in the use of Protective Clothing when Working with Asbestos - Excluding Respiratory Protection.
 - iv) Recommended Guidelines for the Selection & Use of Respiratory Protective Equipment (R.P.E.) when Working with Asbestos.

It is essential that all the Regulations are specifically adhered to during the period of asbestos removal.

It is essential that the entry to the working area shall be enclosed in the approved manner. In this respect, there may be more than one enclosure. The Mechanical Contractor must therefore carry out the inspection requirements of the enclosure(s) and air sampling must also be undertaken outside the working area between one and two hours after asbestos stripping work has started.

These details must be recorded and submitted to the Consulting Engineer as and when they have been taken.

The Mechanical Contractor shall provide proper changing and washing facilities for his workmen and shall make them available for any other trade staff and Project Manager as required.

After asbestos removal, the contract area shall be thoroughly cleaned and vacuumed to ensure an acceptable level of airborne asbestos fibres. This level shall not exceed 0.2 f/ml.

Unless otherwise particularly stipulated, no work involving the use, removal or disturbance of asbestos, or of materials containing asbestos, shall be carried out under this Contract without the prior written authority of the Consulting Engineer.

If, during the course of executing the work under the Contract, the Mechanical Contractor discovers any material which there is reason to believe may be, or may contain, asbestos, the Mechanical Contractor shall immediately cease work, take all reasonable steps to contain any fibres which may have escaped into the atmosphere (e.g. by closing all doors and windows), remove all staff from site and shall immediately inform the Consulting Engineer at the office from which the relevant order to commence was issued and await further instructions.

The Mechanical Contractor shall be held responsible for ensuring that all members of the workforce having any connection with the Contract are made fully aware of the foregoing requirements of this Clause and that they comply with the same.

SAFETY, HEALTH & WELFARE OF WORK PEOPLE

In executing the contract works, the Mechanical Contractor shall be responsible for and shall strictly comply with all safety, health and welfare measures required under or by virtue of the provisions of any enactment or regulations or working rules or codes of practice of any industry associated with the contract works including, but not limited to, the following:

- a) Health & Safety at Work Act 1974 (see supplement).
- b) The Factories Act 1961.
- c) Offices, Shops & Railway Premises Act 1963.
- d) I.E.E. Wiring Regulations, 16th Edition.
- e) Electricity at Work Regulations 1989.
- f) The Electricity Supply Regulations 1988 (Amendment 1990).
- g) Fire Precautions Act 1971.
- h) Trade Union & Labour Relation Act 1974.
- i) Control of Pollution Act 1974.
- j) The Construction Regulations 1961 & 1966.
- k) Asbestos Regulations 1969.
- l) Codes of Practice & Guidance Notes published by the Asbestos Research Council.
- m) The Occupiers' Liability Act 1957.
- n) The Defective Premises Act 1972.

The Mechanical Contractor must include for providing industrial safety helmets to B.S. 5240 for use by all personnel on the premises, including staff as necessary.

1.20 SAFETY, HEALTH & WELFARE OF WORK PEOPLE (Contd.)

The Consulting Engineer shall be empowered to issue instructions requiring the exclusion from the contract works of any person employed thereon who gives cause or causes the breach of safety, health and welfare requirements.

1.21 INFORMING MANUFACTURERS

Whilst preliminary discussions between the designers and the specified manufacturers have taken place at various stages, it cannot be assumed that any of the firms specified are fully aware of the final design requirements.

It is therefore essential that the Mechanical Contractor fully informs the manufacturers and equipment suppliers of the exact requirements, as shown in the specification and drawings, as claims for extra costs due to lack of knowledge will not be entertained.

1.22 PROGRAMME & PHASING OF WORKS

Commencement, completion and sequence of the works on site shall be agreed to suit the proposed programme of works and, where applicable, phased works, as noted in the main contract tender documentation and associated drawings.

The Mechanical Contractor shall allow in his tender for all the work and facilities required to meet the programming and phasing of the works, including non-productive overtime.

Claims for lack of knowledge in respect of any of the above aspects of the works shall not be entertained.

1.23 REFRIGERANT RECOVERY

The handling of refrigerant or the decommissioning of air conditioning or refrigeration equipment which requires the safe handling of refrigerant shall be carried out by an approved specialist.

A certificate of compliance, witnessed by the Main Contractor, shall be handed to the Consulting Engineers confirming that the appropriate procedures and equipment have been used for the reclamation/removal or re-use of the refrigerant without its loss to the atmosphere.

Where refrigerant has been removed for disposal, a certificate of compliance shall be issued to the Consulting Engineer confirming that its disposal conforms to Section 33 of the Environmental Protection Act 1990.

Failure to comply with this section of specification will entail the Mechanical Contractor being removed from the tender list without notification.

APPENDIX ONE

PROGRESS ANALYSIS FORM

CONTRACT

SUBCONTRACTOR

1. CONTRACT VALUATION

Interim Claim No. Date

Subcontractor Tender Sum

Delete Provisional Sums, Contingencies
& Provisional Dayworks

Nett Contract Sum

Value of Variations Instructed

Total Contract Value to Date

	Subcontractor's Consultant's Valuation	Valuation
Value of Unfixed Materials on Site (refer to attached Sheet 2)		
Value of Contract Work Executed (refer to attached Sheet 3)		
Value of Variation Work to Date (refer to attached Sheet 4)		
TOTAL		

Notwithstanding any previous payments, we certify payment is due up to a gross value of
£.....

Signed Date

On Behalf Of

2. SCHEDULE OF UNFIXED MATERIALS ON SITE

<u>MATERIAL</u>	<u>QUANTITY</u>	<u>VALUATION</u>
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We confirm that we have good title to all the materials listed above and that there is no retention of title on any item in the list.

Signed for Contractor

Designation

3. PROGRESS OF CONTRACT WORK

<u>SECTION</u>	<u>CONTRACT VALUE</u>	<u>PERCENTAGE COMPLETE</u>	<u>CLAIM</u>
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TOTAL

£

4. PROGRESS ANALYSIS OF VARIATION WORK

INSTRUCTION NO.	INSTRUCTION VALUE (including M.C.D.) ADD DELETE	PERCENTAGE COMPLETE	CLAIM
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TOTAL

£

SECTION 2 PARTICULAR TECHNICAL SPECIFICATION

- 2.1 GENERAL DESCRIPTION OF WORKS
- 2.2 AIR CONDITIONING
- 2.3 AUTOMATIC CONTROLS
- 2.4 TESTING & COMMISSIONING

PSA WHOLESALE LIMITED
VERNON HOUSE, SICILIAN AVENUE, LONDON, WC1
REFURBISHMENT OF THIRD AND FOURTH FLOORS

MECHANICAL ENGINEERING SERVICES

SECTION 2 PARTICULAR TECHNICAL SPECIFICATION

2.1 GENERAL DESCRIPTION OF WORKS

The mechanical services work shall include the following, as detailed in this specification and on the drawings.

2.1.1 Stripping Out and Modification to Existing Services

The Mechanical Contractor shall make redundant, strip out and dispose of some existing comfort cooling/heating units and the associated refrigerant pipework and condensing units. This shall include refrigerant recovery in accordance with the relevant Clause in section 1 of this specification.

The Mechanical Contractor shall also divert the existing cold water service tank overflow pipes above Vernon and Sicilian House from their existing positions.

2.1.2 Air Conditioning

- a) With the exception of the server room located on the fourth floor, the third and fourth floors of Sicilian House shall be provided with comfort cooling utilising a two-pipe, variable refrigerant volume system comprising recessed indoor units and an external condensing unit located at roof level, adjacent to the tank room above Sicilian House.
- b) The server room located in Sicilian House on the fourth floor shall be provided with comfort cooling utilising a two-pipe, split system comprising a recessed indoor unit and an external condensing unit at roof level, adjacent to the tank room above Sicilian House.
- c) With the exception of offices 4.1, 4.2 and 4.3, the fourth floor of Vernon House shall be provided with comfort cooling utilising a two-pipe refrigerant volume system comprising recessed indoor units and an external condensing unit located at roof level, adjacent to the tank room above Vernon House.
- d) Offices 4.1, 4.2 and 4.2 in Vernon House on the fourth floor shall be provided with comfort cooling and heating utilising a two-pipe variable refrigerant volume system comprising recessed indoor units and an external condensing unit located at roof level adjacent to the tank room above Vernon House.

2.1 GENERAL DESCRIPTION OF WORKS (Contd.)

2.1.3 Automatic Controls

A time clock shall be installed in reception on the fourth floor. The fan coil units shall be controlled by local wall mounted, remote controllers.

2.2 AIR CONDITIONING

2.2.1 Positioning and Removal of Plant

The Mechanical Contractor shall utilise suitable scaffolding for removal of the existing condensing units located at fourth floor level in Lightwell 1.

2.2.2 Air Conditioning Systems

The Mechanical Contractor shall supply and install the following air conditioning equipment as manufactured by Daikin and as described on the drawings:

Indoor Units:

Third Floor - Sicilian House

FCU 1.1	Model: FXYK 25 K, 1-Way blow cassette & grille (3.1 - Marketing Director)
FCU 1.2	Model: FXYK 25 K, 1-Way blow cassette & grille (3.2 - Financial Controller)
FCU 1.3	Model: FXYK 40 K, 1-Way blow cassette & grille (3.3 - Conference Room)
FCU 1.4	Model: FXYK 32 K, 1-Way blow cassette & grille (3.4 - General Office)
FCU 1.5	Model: FXYK 32 K, 1-Way blow cassette & grille (3.4 - General Office)
FCU 1.6	Model: FXYK 25 K, 1-Way blow cassette & grille (3.5 - Administration Manager)
FCU 1.7	Model: FXYK 63 K, 1-Way blow cassette & grille (3.6 - Post Room)
FCU 1.8	Model: FXYK 32 K, 1-Way blow cassette & grille (3.7 - Managing Director)

NB: FCU 1.1 to FCU 1.8 are associated with condensing unit C1.

Fourth Floor - Sicilian House

FCU 2.1	Model: FHYK 71 F, 1-Way blow cassette & grille (4.12 - Server Room)
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NB: FCU 2.1 is associated with condensing unit C2.

2.2 AIR CONDITIONING (Contd.)

2.2.2 Air Conditioning Systems (Contd.)

Fourth Floor - Sicilian House

FCU 3.1	Model: FXYK 32 K, 1-Way blow cassette & grille (4.7 - Accounts 1)
FCU 3.2	Model: FXYK 32 K, 1-Way blow cassette & grille (4.8 - Accounts 2)
FCU 3.3	Model: FXYK 25 K, 1-Way blow cassette & grille (4.9 - Systems Manager)
FCU 3.4	Model: FXYK 25 K, 1-Way blow cassette & grille (4.10 - Personnel)
FCU 3.5	Model: FXYK 40 K, 1-Way blow cassette & grille (4.11 - IT Office)
FCU 3.6	Model: FXYK 32 K, 1-Way blow cassette & grille (4.11 - IT Office)
FCU 3.7	Model: FXYK 63 K, 1-Way blow cassette & grille (4.13 - B. Smith)
FCU 3.8	Model: FXYK 40 K, 1-Way blow cassette & grille (4.14 - EDP Overflow)

NB: FCU 3.1 to FCU 3.8 are associated with condensing unit C3.

Fourth Floor - Vernon House

FCU 4.1	Model: FXYK 25 K, 1-Way blow cassette & grille (4.4 - Reception)
FCU 4.2	Model: FXYK 40 K, 1-Way blow cassette & grille (4.5 - General Office)
FCU 4.3	Model: FXYK 40 K, 1-Way blow cassette & grille (4.5 - General Office)
FCU 4.4	Model: FXYK 25 K, 1-Way blow cassette & grille (4.6 - Credit Manager)
FCU 4.5	Model: FXYK 63 K, 1-Way blow cassette & grille (4.15 - Dealer Services)
FCU 4.6	Model: FXYK 63 K, 1-Way blow cassette & grille (4.15 - Dealer Services)
FCU 4.7	Model: FXYK 25 K, 1-Way blow cassette & grille (4.16 - Credit Analyst)
FCU 4.8	Model: FXYK 40 K, 1-Way blow cassette & grille (4.17 - Photocopy Room)

NB: FCU 4.1 to FCU 4.8 are associated with condensing unit C4.

Fourth Floor - Vernon House

FCU 5.1	Model: FXYK 25 K, 1-Way blow cassette & grille (4.1 - Managing Director)
FCU 5.2	Model: FXYK 25 K, 1-Way blow cassette & grille (4.1 - Managing Director)
FCU 5.3	Model: FXYK 25 K, 1-Way blow cassette & grille (4.2 - Secretary)
FCU 5.4	Model: FXYK 32 K, 1-Way blow cassette & grille (4.3 - B. Collison)

NB: FCU 5.1 to FCU 5.4 are associated with condensing unit C5.

2.2 AIR CONDITIONING (Contd.)

2.2.2 Air Conditioning Systems (Contd.)

Outdoor Units:

- C1 Model: RSX 10 K, 2-Pipe, 415 volt, 3-phase, 50Hz, cooling only condensing unit (Roof Level above Sicilian House)
- C2 Model: R 71 FW, 415 volt, 3-phase, 50Hz, cooling only condensing unit (Roof Level above Sicilian House)
- C3 Model: RSX 10 K, 2-Pipe, 415 volt, 3-phase, 50Hz, cooling only condensing unit (Roof Level above Sicilian House)
- C4 Model: RSX 10 K, 2-Pipe, 415 volt, 3-phase, 50Hz, cooling only condensing unit (Roof Level above Vernon House)
- C5 Model: RSXY 5 K, 2-Pipe, 415 volt, 3-phase, 50Hz, heating & cooling condensing unit (Roof Level above Vernon House)

Accessories

3 No. KRP2A51 PCB adaptors (for remote on/off control).

1 No. KEK31-41P Universal mounting box.

23 No. BRC1A51 Wall mounted controllers approximately as shown on the drawings, final positions to be agreed on site.

1 No. BRC1B51 Wall mounted controller approximately as shown on the drawings, final position to be agreed on site.

24 No. 2-pipe 8/10 Refnet joint kits.

NB: Some of the above wall mounted remote controllers shall be wired to control two indoor units. See electrical schematic drawing for details.

The air conditioning equipment shall be supplied, tested and commissioned by Pillinger Air Distribution Ltd, The Old Stables, Station Road, Arlesey, Beds, SG15 6RG (Tel: 01462 834999, Fax: 01462 731208).

2.2.3 Refrigerant Pipework

All refrigerant pipework shall be distributed as shown on the drawings.

All pipework sizes and layouts shall be confirmed with the manufacturer prior to installation.

All refrigerant pipework shall be supported on heavy grade cable tray to BS 6946 and/or a proprietary pipe support system such as Insulclamp, zinc plated pipe supports with vibration isolating inserts as manufactured by B.B.J. Engineering.

Where the pipe support system is used, it shall be fixed to 40 x 20 channels at intervals not exceeding 1.2m.

All refrigeration pipework shall be installed to national and local standards and extreme care shall be taken to keep refrigeration tubing clean and dry prior to installation. Only refrigeration grade copper tubing correctly sealed against contamination shall be used.

2.2 AIR CONDITIONING (Contd.)

2.2.3 Refrigerant Pipework (Contd.)

Installation outside shall not be carried out whilst it is raining and at all times the free end of tubing shall be capped whilst carrying out the installation. Dehydrated compressors or filter driers shall not be left open to atmosphere (one or two minutes maximum shall be the limit).

Copper eutectic or specialist soft solders shall be used containing at least 3.5% silver on suction and liquid lines, and high temperature copper eutectic rods or silver solder on discharge lines. These solders are listed as follows:

- a) Copper to copper : Eutectic 1805 (2% silver, no flux).
- b) Copper to brass : Eutectic 1805 (flux 1802).
- c) Copper to steel : Eutectic 1810 (25% silver, flux 1820).

N.B. STANDARD SOFT SOLDER MUST NOT BE USED.

With any high temperature rod, where oxidation is liable to take place, an inert gas shall be used as dry nitrogen or carbon dioxide to avoid scale formation inside the tubing. Dry nitrogen shall preferably be used.

When using soldering paste or flux, the minimum required shall be used to prevent contamination of the filter and joint. The male part of the joint only shall be fluxed. Surplus flux shall be removed with a damp cloth.

Where vibration eliminators are used, the ends shall be wrapped with a damp cloth, and rods with a melting temperature of no greater than 650°C (1200°F) shall be used to avoid damage to the internal joints.

Gas Lines

- i) Horizontal runs shall have a slope of 1 in 200 minimum towards the compressor (direction of flow).
- ii) Vertical risers shall be trapped at the foot of each riser and every 5/6 metres of riser. The suction risers shall have a high enough velocity to carry the oil with the refrigerant.

Liquid Lines

- i) If the condenser/condensing unit is below the evaporator, the liquid lines shall be insulated where they pass hot environments, such as a boiler house.
- ii) If the system is a heat pump type, all liquid lines shall be insulated.

Pressure Testing

After installation, refrigerant shall be introduced to both sides of the system and boosted with dry nitrogen to a pressure recommended by the machine manufacturer. After a minimum period of two hours, the pipework shall be electronically leak tested. The system shall then be left overnight and re-tested for leaks if a significant pressure drop has occurred. Evacuation can take place only after the pipework has been proved leak-free.

2.2 AIR CONDITIONING (Contd.)

2.2.3 Refrigerant Pipework (Contd.)

Evacuation

This shall be carried out with a high quality vacuum pump. The pump shall be fitted with a compound gauge and high vacuum gauge and be connected to both the high and low sides of the system.

Triple evacuation shall be used to ensure that all contaminants are removed, or at least reduced to significantly low proportions.

The refrigeration system shall then be ready for commissioning once the rest of the services are available.

Adding Oil

- i) The refrigeration machine manufacturer shall be consulted as to the type and quantity of oil to be used.
- ii) Oil shall be added between pressure testing and evacuation and shall be introduced into the compressor.
- iii) To prevent moisture contamination, oil shall be introduced from sealed and full cans.

2.2.4 Refrigerant Pipework Insulation

All pipework insulation shall be carried out in accordance with Part 'R' of the Building Regulations (Thermal Insulation of Pipes, Ducts & Storage Vessels).

All liquid and gas pipework shall be insulated with 19mm thick, Class 'O', Armaflex insulation as manufactured by Armstrong Insulation Products to the specification below:

Thermal Conductivity	:	0.035 W/m.K (mean)
Fire Properties	:	Class 'O' to Building Regulations, Section E15
BS 476, Part 7 (1987)	:	Class 1
BS 476, Part 6 (1989)	:	Class O, L<12, i<6.

The insulation shall be installed in accordance with the manufacturers recommendations and all external insulation shall be painted with Armafinish paint to the recommended thickness.

2.2.5 Pipework Identification Bands

All pipework shall be identified according to BS 1710, using coloured PVC tapes with colours to BS 4800.

Identification shall be placed at all junctions, at both sides of valves, services appliances, bulkheads, wall penetrations and any other place where identification is necessary. Identification shall include the nature of service, direction of flow and operating temperature.

2.2 AIR CONDITIONING (Contd.)

2.2.5 Pipework Identification Bands (Contd.)

Bands of tape shall be applied to oil and dirt free surfaces only. The length of the band shall be trimmed to suit the diameter of the pipe, allowing for a 13 mm minimum overlap, and the band applied by wrapping smoothly around the pipe, overlapping on the 'blind' side.

Identification bands shall be manufactured by Hodgson & Hodgson Ltd., Alpine Street, Old Basford, Nottingham, or Focal Displays Ltd., 23 Wates Way, Mitcham, Surrey, CR4 4HR.

2.2.6 Condensate Drain Pipework

The Mechanical Contractor shall supply and install a range of condensate pipework as indicated on the drawing.

All pipework between indoor units and their associated condensate pumps shall be light gauge copper tube to BS 2871, Table X and all joints shall be made using compression type fittings. All pipework shall be supported at intervals not exceeding 2.5m and at all changes to direction and all horizontal pipework shall be laid to a fall not more than 1:120.

Rodding eyes shall be installed at all changes in direction and at tee joints.

All pipework between the condensate pumps and their associated tundishes shall be reinforced, transparent, polyurethane tubing. All tubing shall be supported on heavy grade cable tray to BS 6946 and the Mechanical Contractor shall ensure that it does not have any kinks or flat sections of tube.

The tundishes shall be manufactured from light gauge copper sheet at least 1mm thick.

Pipework and fittings between the tundish and the connection into existing basin waste pipe shall be uPVC and shall comply with BS 4514 and 4576 using 'Key Terrain' or equal and approved. Any horizontal runs of this pipework shall be laid to a fall not greater than 1:120.

All joints shall be made using solvent welded fittings. 'O' ring joints shall only be used where necessary to allow expansion to the pipework.

Thermal movement shall be alleviated by allowing 15 mm in the depth of the socket between the spigot of the pipe and the shoulder of the 'O' ring socket.

'O' ring sockets shall be provided for the purpose of expansion in accordance with the manufacturer's fixing instructions, generally between fixed points, boss connections to stacks and every 1.8 m on waste and anti-siphon pipework.

All expansion joints must be provided with a fitting support to give resistance against thermal movement.

All uPVC pipes passing through fire rated floors and walls, where required by the fire authority or the Building Regulations, shall be fitted with an approved intumescent fire sleeve which shall be installed in accordance with the manufacturer's instructions (Terrain Firebreak 2).

2.2 AIR CONDITIONING (Contd.)

2.2.6 Condensate Drain Pipework (Contd.)

The installation of the uPVC pipework shall be complete with all brackets and supports as necessary to carry the piping, all being constructed of such material and in such a manner to ensure sufficient strength and rigidity, to prevent deflection and to allow for free movement of pipework as necessary.

All hangers for the uPVC pipework are to be installed so as to give free movement of the pipework where necessary to allow thermal movement.

Spacing of supports for uPVC pipework shall not exceed the centres indicated in the following table:

Horizontal Runs	Vertical Runs	Maximum Distance Between Expansion
0.5m	1.8m	1.8m

The above table gives maximum spacing for supports and, due to the system of pipework installed, it may be necessary for bracket to be positioned closer.

Brackets for uPVC pipework shall generally be of the same material as the pipe where exposed to view. The following table sets the standard for all brackets:

Bracket Material	Bracket Type
PVC or brass or single ring	Pipe clip

2.2.7 Condensate Pumps

The Mechanical Contractor shall install in the positions indicated upon the drawings the following condensate pumps:

Pump No. P1 to P14 (inclusive)

Type - Aspen Hi-Flow tank pump with 1l tank capacity. Duty - 288 l/hr at 4m head.

The pumps shall be suitable for a 240 Volt, single phase, 50Hz electricity supply and shall be manufactured by Aspen Pumps, Tel: 01323 848 842.

2.2.8 Pipework - General

Joints shall not be made in the thickness of any wall, floor or ceiling and pipework shall not be embedded in the structure of floors unless approved by the Engineer.

Sleeves shall be provided where pipework passes through walls, floors or ceilings. Pipework passing through floors shall be provided with approved floor and ceiling plates fastened securely to the pipe.

Unless stated otherwise in this specification, where a piped service perforates a structure which is a fire barrier with a designated fire delay characteristic to BS 476 Part 8, the sleeve shall act as a fire stop complying with the Building Regulations.

2.2 AIR CONDITIONING (Contd.)

2.2.9 Painting and Finishing of the Works

As the installation progresses, all ferrous components shall be thoroughly were brushed and cleaned of all dirt, rust, paper labels and grease etc. All welded joints shall be cleaned and be free from surplus slag.

All items of plant which are finish painted at manufacturer's works shall be protected as required by the relevant Clause in Section 1 of this specification and prior to final completion of the works, the items shall be thoroughly cleaned in such a manner which does not damage the paint finish and polished to remove all building debris, insulation and paint splashes.

After cleaning, if any damage is apparent, the plant shall be touched up or completely repainted to the satisfaction of the Consulting Engineer.

IMPORTANT NOTE:

It is the responsibility of the Mechanical Contractor to ensure that all items of plant and equipment become operational in a condition equal to that when they left the manufacturer's finished assembly line. Damage by other trades will not be accepted as a reason for a substandard finish of plant and equipment.

2.3 AUTOMATIC CONTROLS

The Mechanical Contractor shall provide as free-issue to the Electrical Contractor, a 240 Volt, 50 Hz, 4-Channel time clock, 3-Channels of which shall be wired up by the Electrical Contractor to the 3 No. PCB adaptors. The fourth channel shall remain spare. All indoor units shall be connected to the time clock except for indoor unit no. FCLI 2.1 located in the server room which shall be connected with a permanent live feed.

The Mechanical Contractor shall supply and fix beneath the time clock, a label with the following inscription:

AIR CONDITIONING UNITS CONTROL THE FOLLOWING AREAS:

CHANNEL 1 - 4TH FLOOR, VERNON HOUSE

CHANNEL 2 - 4TH FLOOR, SICILIAN HOUSE

CHANNEL 3 - 4TH FLOOR, SICILIAN HOUSE

The label shall be manufactured from brushed aluminium with black lettering and shall have radiused corners and 3mm countersunk fixing holes. The label shall be free of burrs and sharp edges.

The indoor units shall be controlled by the wall mounted remote controllers which the Mechanical Contractor shall provide as free-issue for the Electrical Contractor to wire up.

Failure of any of the condensate pumps will cause the associated indoor units to stop operating and a red warning light adjacent to the wall mounted controller to light up. The red warning light, label and associated wiring, relays and fuses will be supplied and installed by the Electrical Contractor but the Mechanical Contractor shall ensure that it operates correctly prior to commissioning.

The Mechanical Contractor shall liaise with the Electrical Contractor during the works to ensure the system operates correctly.

2.4 TESTING & COMMISSIONING

2.4.1 General

During the installation of the mechanical services system, the Mechanical Contractor shall be responsible for all testing, commissioning and regulation, as specified. When the installation is at a stage of static completion, the Mechanical Contractor shall then advance the system to the full working order.

A detailed commissioning report shall be forwarded to the Consulting Engineer within 14 days of completion of this work.

All testing and commissioning methods shall be strictly in accordance with the C.I.B.S.E. Commissioning Code, as detailed below:

A	:	Air Distribution
C	:	Automatic Control
R	:	Refrigeration Systems
W	:	Water Distribution Systems

The Mechanical Contractor shall include for the cost of all energy consumed for all tests and shall provide all the necessary instruments, plant and equipment, supervision, skilled and unskilled labour required for the site tests, and the accuracy of the Mechanical Contractor's instruments shall be illustrated if deemed necessary.

Seven days notice shall be given to the Consulting Engineer of all works tests, and the Consulting Engineer shall confirm whether the test will be witnessed. The Mechanical Contractor shall include for the cost of all energy consumed for all tests and shall provide all the necessary instruments, plant and equipment, supervision, skilled and unskilled labour required for the site tests, and the accuracy of the Mechanical Contractor's instruments shall be illustrated if deemed necessary.

The Mechanical Contractor shall include for all fees charged by the nominated insurance companies for supervision and examination at works during construction of all pressure vessels and similar equipment.

Three copies of all test certificates shall be handed to the Consulting Engineer.

The Mechanical Contractor shall note that control valves etc. shall not be subject to hydraulic tests greater than the manufacturer's test pressure and, if necessary, such special items shall be disconnected from the pipework system when this is being tested. The Mechanical Contractor shall be responsible for co-ordinating the various specialist commissioning engineers.

Where the operation of different items of plant and equipment is interdependent, e.g. time clock and all units which operate via the time clock, the Mechanical Contractor shall ensure that all parties are fully satisfied with fuse sizes, overload settings, etc. and such recordings of fuse sizes, overload settings, starting currents, running currents, etc. shall be countersigned by both parties on the commissioning report.

During the final stages of commissioning, the Mechanical Contractor shall demonstrate and prove all control functions to the Consulting Engineer and, if necessary, simulation equipment shall be used. The Consulting Engineer shall be given five working days' notice of this final demonstration.

2.4 TESTING & COMMISSIONING (Contd.)

2.4.1 General (Contd.)

The Mechanical Contractor shall include in the tender for instruction of personnel appointed to run and maintain the plant. The instructions shall be carried out over a period of TWO WEEKS and, during this time, the Mechanical Contractor shall advise the personnel appointed of the location and function of all items of equipment throughout the building.

2.4.2 Air Conditioning Installation

Upon completion of the installation, the specialist commissioning engineer shall, under the supervision of the Consulting Engineer, carry out sound tests to determine the sound pressure level in each octave band in selected rooms with the entire plant operations.

Similar tests shall also be carried out at roof level to determine sound and pressure levels created externally by the plant.

The tests shall be carried out using a sound analyser with a capability of measurement over the eight octave band ranges and, when carrying out the tests, particular regard shall be given to the following:

- a) All plant shall be in a normal operational condition.
- b) Areas adjacent those being tested shall be unoccupied.
- c) There shall be no interference from other machinery which may be in the building.
- d) The microphone shall not be held in airstreams of velocity greater than 1 m/s, or nearer than 1200 mm from a diffuser. All readings shall be taken at a height of 1600 mm from floor level.
- e) All readings shall be taken three times and an average taken.

2.4.3 Automatic Controls Installation

The whole of the control installation shall be supervised during the installation by the control manufacturer.

Upon completion, the manufacturers shall test and commission the whole of the control installation to the entire satisfaction of the Consulting Engineer.

During commissioning, all motors be tested on site to check running and starting currents with subsequent adjustments to overloads and fuses, where necessary.