BUILDING
RELATIONSHIPS.

Performance Specification for the Mechanical and Electrical Services

Leybourne Village Hall

Little Market Row,

Leybourne,

Kent ME19 5QL

Version

A - TENDER

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Watts.

Client:	Leybourne Parish Council	**Job Reference:**	128316
Property:	Leybourne Village Hall, Kent ME19 5QL		

Project Preface

Client Name and Address

Leybourne Parish Council
Little Market Row, Leybourne, Kent ME19 5QL

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PART 1 GENERAL SPECIFICATION

PREAMBLE Performance and design

The appointed Contractor will be required to carry out the design and install all the engineering services necessary to provide a completely serviced development.

This specification is for the provision of a combined M&E services installation and where items are specified in either part of the specification (mechanical or electrical) provide all components as required to form a complete installation. E.g. if a mechanical component requires a power supply this is to be provided regardless of whether the supply is shown on the electrical drawings.

The contractor is responsible for the design of the services installations. In some places this specification and the associated drawings describe the PERFORMANCE required of the installations and provide such design details and parameters as considered necessary and/or available. In other respects the design and installation is to be in accordance with British Standard and/or codes, Professional Institution(s) specifications and/or codes of practice and/or any applicable Regulations or in the absence of any of these, to best quality established practice.

The drawings indicate locations of some equipment and such locations may not be varied unless approved. Any connecting runs and/or sizes shown are indicative only and are to be varied as needed to produce the specified performance.

The Contractor is to be responsible for the design to produce the performance specified incorporating the specified parameters except as these may need modification to enable the Contractor (or specialist supplier) to accept full design responsibility. Should tenderers require to alter the specified design parameters in any way full details are to be included with the tender.

Submit with the tender, where necessary to supplement the tender documents, any system design and component details including final capacities, dimensions and details of all principal components, equipment schedules and supporting calculations ; to provide further design information and details as needed to effect the installation.

Provide in time to suit the programme of works, details compatible with and dimensioned to the available structural and/or architectural information and any adjacent component of any other system, sufficient to assess the implications on any item not within the performance design responsibility. Allow sufficient time for the issue of any necessary supplementary information.

Tenderers may wish to sub-contract certain sections of the work. If this is proposed, sub-contractors must be fully competent and should be members of an appropriate specialist association. Sub-contractors must produce details of their sections of the works as required of the contractor overall and the contractor is to produce such supplementary co-ordination information, including drawings where appropriate, to ensure the works are installed in a logical and co-ordinated manner.

Sections of this specification have been prepared to assist tenderers to obtain specialist sub-tenders. Such sectionalisation and any sub-contract does not reduce the responsibility of the Contractor. During design development liaise with other members of the clients design team and main contractor and ensure that space allocated to all plant and equipment is adequate but not oversized.

Where equipment is mentioned by name or manufacturer, this is the preferred supplier, the tenderer is at liberty to propose alternatives, but they MUST be of an equal standard and performance to the named equipment or supplier.

Where alternatives are offered after acceptance of tender price, a saving at least equal to the difference in list price between the named components or supplier and the alternative will be expected.

SECTION 1 CONDITION

1. DEFINITIONS

Main contract - Main building contract between the employer and the several works or main contractor.

Main contractor - Company, firm or person appointed to execute the main contract.

Sub contract - Sub contract between the main contractor and the sub-contractor

Sub-contractor - Company, firm or person appointed to execute the sub contract works.

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

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

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

Supervising officer - 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 - design, obtain, deliver, fix into position, make all connections, test and commission, - unless any part of this is specifically excluded.

Equal/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 unless proof of performance and quality is given. Where alternatives are offered after acceptance of tender price, a saving at least equal to the difference in list price between the named components or supplier and the alternative will be expected.

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 supervising officer on site and, where requested, submit for approval

Directed/authorised - a written instruction.

The name of the contractual parties and their advisors are given in Part 2, Section 1B.

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.

Any sub contract will be placed subject to compliance with the main contract programme and with a 2.5% discount to the main contractor.

3. SUB-CONTRACT CONDITIONS

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

The terms of the sub contract will be in terms equivalent to those of the main contract together with those in this specification. If there is any conflict in this obtain direction but base tender price on this specification.

The sub-contractor may be required to enter into formal agreement with the main contractor indemnifying the main contractor in the same obligations in respect of the sub contract as the main contractor has indemnified the employee in respect of the main contract.

4. SUB-CONTRACT PRICE BASIS

The price basis will be as that for the main contract and, where price is not fixed, submit, copy to the quantity surveyor, monthly statement giving the total sum to be added to the tender price both in the month and in total from commencement, a detailed make-up of the calculation for the month and, where appropriate to the basis, supported by, for: -

Labour - Time records signed by the clerk of works as correct for the time.

Materials - Copies of the invoice and evidence of the price at tender stage for those materials declared with the tender.

5. VARIATIONS

Accept modifications as directed and the value will be determined as directed, by either: -

Quotation - In which submit formal quotation in the form of a priced bill of quantities with rates as original tender. Proceed when an instruction is issued.

Schedule Rates - In which an instruction will be issued. Immediately proceed and submit within 7 days formal statement of cost in the form of a priced bill of quantities with rates as original tender.

Day works - In which an instruction will be issued. Immediately proceed and submit day work sheets to clerk of works each week for signature as correct for time and materials only, price and submit for approval.

Overtime - For authorised overtime submit time sheets as for day works for authorisation of payment for the nett difference between overtime and standard rates.

6. PRICED SCHEDULE OF RATES

Upon being advised that tender is receiving consideration, prepare and, within 7 days, submit, in triplicate, 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.

7. PROVISIONAL AND PRIME COST SUMS

Provisional or prime cost sums will be expended wholly or in part only as directed. Provisional sums represent the nett invoices costs of the materials and labour plus profit and the gross amount will be computed as if the items were a variation.

Prime cost sums represent the nett invoice cost and the gross amount plus the percentage additions stated at time of tender subject to approval of invoices and/or other substantive documents.

8. PAYMENT

Payment on account will be made against a formal certificate of payment. Submit, copy to other interested parties, a statement, of valuation of works executed and materials delivered by tenth (or as arranged) day of month. If it is accepted the valuation is reasonable and that materials have not prematurely been brought to site and are adequately protected, a certificate will be issued for payment of the amount claimed less the retention.

9. FINAL VARIATIONS AND ACCOUNTS

On completion of works submit, copies to other interested parties, a final statement of account in duplicate detailing the: -

Tender amount less the prime cost and provisional sums included together with handling charges.

Nett amounts of all prime costs sums expended together with the handling charges.

Variations executed by quotation.

Variations executed at day work rates.

Approved non-productive hours of overtime.

Note that items are sufficiently detailed by reference to the variation order numbers. Items not related to variations agreed during the contract will not be accepted.

10. DEFECTS LIABILITY PERIOD

For the defects liability period stated in the tender documents, 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 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.

11. 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.

12. 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.

13. SUPERVISION

Keep in charge of the works a competent foreman continuously on site and a supervisor, either of whom shall be empowered to accept instructions concerning all matters in connection with the works.

SECTION 2 ADMINISTRATION

1. TENDER DRAWINGS

The Architects tender drawings to be read with this specification also gives the basic services layout and design intent.

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

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.

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 supervising officer and/or any other contractor or sub-contractor of such installation parameters as they 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 listed in Part 2, Section 1B.

Within 2 weeks 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 up to 4 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. Issue as directed up to 5 copies off each accepted working drawing.

3. BUILDER'S WORK AND ATTENDANCE

Check the shown dimensions of plant rooms, trenches, ducts, manholes and pits, etc., and notify of any case where the dimensions appear unsuitable. Provide detailed information by drawings, submitted for acceptance in principle and issued as clause 2, for all other structural and similar work necessary for the proper execution of the works such as minor pits, trenches, gullies, equipment bases, plinths, supports, special structural steelwork, holes through walls, floors or ceiling, chases in walls or floors and the building in, to main structure, of brackets, supports, pipe sleeves, etc., except that for minor holes, chases, etc., it may be sufficient to 'mark off' or 'set out' to the clerk of works requirements.

Provide fixings for materials and equipment to structure by means of screws and rawlplugs, by rawlbolts, by bolts and nuts, etc., to steelwork by welding and similar to the approval.

4. RECORD DRAWINGS

Maintain at site a set of the working drawings and mark in coloured pencil to show site changes and on completion of installation develop these to provide 'as fitted' record drawings in the form of plastic negatives executed in black ink

and based to form a complete and true record of the installation including the sizes and runs of all pipework, the precise locations of all buried work, both internally and externally and indicating all special protective measures taken.

Submit two preliminary paper prints off each record drawing for acceptance in principle and electronic copy (CD), two paper prints of each accepted record drawing for onward transmission to the employer. The prints are to be folded and mounted into an A4 folder to match the operating instructions. Provide 1 set of prints of each accepted record drawing reduced to A3 size.

Final record drawings are to be provided in paper and digital form as both .dwg files and .pdf format.

5. TEMPORARY ELECTRICITY SUPPLIES AND CHARGES

Provide and/or make use of a temporary site electricity supply by suitable arrangement, to operate temporary lighting, power tools etc., to the maximum load stated in the tender, and pay for all electricity consumed. Provide charges and subsequently remove any temporary wiring necessary to install the works.

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.

6. STORAGE WORKSHOP AND STORAGE

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 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 clerk of works.

7. SITE MEETINGS AND REPORTS

Be represented at any properly called site meeting and prepare written report on the first day of each month, outlining the progress of the work and the work completed to date and issue copies as directed.

8. 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 engineer 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.

9. CASES, CONTAINERS ETC.

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

10. 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., 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.

11. 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.

12. HANDING OVER

Immediately prior to handover of the works provide 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 the IEE Regulations in the case of electrical installations.

Handover will not be accepted unless O&M manuals, record drawings and other operation data are provided and handed over.

Final drafts of manuals are to be provided not less than 3 weeks before handover so comments can be given.

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 and fix all materials except as Main Contractor will afford facilities customary to the trade such as standing scaffolding and hoists.

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

2. STANDARD

Install to all relevant current British Standard Specifications and Codes of Practice.

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 arrangements, room layouts, architectural features, etc., as shown on the current architects and/or structural engineer's drawings and/or as otherwise advised by the Main Contractor. Notify any difficulties.

5. REGULATIONS

Comply with all applicable Regulations, Orders, Bye-laws, Acts of Parliament and other Rules of Central and Local Government Supply. Public Utility and any other accredited Authority including the Institution of Electrical Engineers Regulations.

Work arising due to compliance where details were not available at tender stage will be a variation. Inform appropriate Authorities of works, complete and deliver any necessary application form, pay any fee and give all notices to test and connect.

Include all necessary testing and stamping fees for such as all valves, pipework and fittings, including ball valves, to comply with regulations laid down by the appropriate Authority.

In respect of Bye-laws general approval in principle has been negotiated.

Within 28 days of appointment confirm that all valves, cocks and other equipment are satisfactory to the appropriate Authority or advise changes needed and the cost change. Replace with correct pattern without charge other than the cost difference as if correct had been fitted initially if any valve, cock or other equipment fails to pass any Authority's Inspectors after installation.

6. ALTERNATIVES

Use materials, components and equipment that conform in every detail to the specified requirements which may be at variance with the 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 tender, in the Alternative 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 recommendations of the Chartered Institution of Building Services Engineers permanent detailed information 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 for linear dimensions of plans, pipe bores, duct sizes 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.

Provide diagram for each area indicating circuits and location of all items by number, principle pipe and duct sizes and giving all code details and colours, one copy printed onto plastic film wall mounted under clear perspex in the area with further copies in the instruction manual.

Modify these methods to those already in use by the Employer where so specified or later directed and amend or replace any effected existing identification.

Submit for approval all proposed identification details.

9. PAINTING AND CORROSION

Apply paint only to the items listed below and/or as later specified to all pipework plant and equipment in plant rooms, concealed pipework etc., in trenches, crawl ways, vertical shafts, false ceilings etc., to all ferrous metal, pipework and surfaces, to be thermally insulated and to all supporting steelwork.

That is paint for corrosion protection except in visible user areas, where only clean down and leave ready for painting by the Main Contractor.

For the following descale and clean by wire brushing and apply paint etc.:-

- Plant, equipment, steelwork etc. where NOT insulated - one coat of red or grey oxide primer before erection followed by a second coat after erection. Where internal follow with undercoat and two top coats of paint to provide a hard gloss finish, where external similar but three top coats and matt finish.
- Pipework where NOT insulated - ferrous pipework one coat of red or grey oxide primer immediately after erection. Pipes of all materials an undercoat and top coats as in 1.
- Pipework etc. where insulated (ferrous pipes only) - one coat of bituminous paint immediately after erection followed by a second coat and immediately prior to the application of the insulation.
- Thermal insulation - the necessary coats of size followed by undercoat and top coats as 1.
- 'Bright' metal - all 'bright' metal parts such as chromium plating, small bore copper connections to gauges etc., to be burnished and polished.

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 by the 'Schori' process. 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 AND 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.

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 or 7.00 bar for water, 3.50 bar for oil and 1.75 bar for gas.

13. TEST NOTICE AND 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 AND INSTRUCTION

When installation is in satisfactory working order and so notified in writing put into normal service for seven days from the date of building or building section completion under skilled supervision and attention during the hours of 9.00a.m. to 6.00p.m. 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

Provide two proof copies for acceptance during commissioning followed by 4 bound A4 size 4 ring clip or equal binders printed with names of project, system, designer and installer of the accepted instructions all in accordance with BSRIA Application Guide 1/87.1 each containing:-

System description giving design parameters, capacities and methods of regulation and control.

Schedule of all fixed plant and equipment.

Indexed list of and followed by maintenance, operating, oiling, control and regulation instructions for each unit installed for which such instructions are reasonably required.

Schedule of oils and greases needed indicating frequency of application.

List of tools and spares supplied and/or needed indicating sources of replacement.

List of all test records followed by copies.

Copy of identification codes.

List of all record as fitted, detail and manufacturer's drawings, wiring diagrams, charts etc. produced followed by a copy of each unless given under separate cover.

Page numbers within each section to be numbered.

Operating instructions must be supplied before handover. Failure to provide manuals in sufficient time will delay handover (see section 12).

Provide a complete copy of the manual on a CD in .pdf format.

17. WELDING

Site welding is permissible provided each welder has approved Insurance Company current certificate of competency for the standard tests of BS 4872; pipe welding is to the 'Rules for Inspection and Tests of Welds in Pressure Pipe lines' issued by the Associated (Insurance) Offices Technical Committee; and a certificate issued by an approved Insurance Company of satisfactory visual inspection of all welds is submitted for approval.

Provide for welding all equipment needed including, where required but not available, an adequate electricity supply, comply with all regulations and safety precautions and pay all associated charges.

Electric metal-arc welds to BS 2633 to be used for pipe flanges, vessel seams, etc.

Oxy-acetylene welds to the 'Recommended Practice for oxy-acetylene welds in Mild Steel Pipe Lines' published by the Association of Heating, Ventilating and Domestic Engineering Employers and to BS 1821 may be used for pipe fittings, brackets and supports.

Paint all welds one coat bituminous paint within 60 minutes of completion.

18. FOUNDATION BOLTS AND 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 equipment 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.

20. GUARDS

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

21. PUMPS AND 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 MOUNTINGS AND 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^{O}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 AND SAFETY 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 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 5.6 kW (7.5 HP) - direct on line

5.6 to 11.2 kW (7.5 to 15 HP) - automatic star delta

Over 11.2 kW (15 HP) - rotor resistance

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 AND WIRING

Provide, supply only or supply and erect only, electrical equipment and wiring as specified and provide details and 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, push buttons, instruments, etc. to be suitably coloured, matched one with another, labelled as to function and connected with internal equipment by 1.0mm^2 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.

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

Support pipes of 75mm bore and under operating at 90^{O}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 spacing's 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 Dia**
35 or less	35 x 25 x 4	50 x 35 x 4	45 x 6	10
36 to 65	50 x 25 x 4	75 x 50 x 8	50 x 8	12
66 to 80	65 x 50 x 6	100 x 75 x 8	65 x 12	16
81 to 110	75 x 50 x 8	125 x 75 x 10	65 x 12	18
111 to 160	75 x 50 x 12	125 x 75 x 12	75 x 12	20
161 to 210	100 x 75 x 16	150 x 75 x 12	100 x 12	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^{O}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

Provide sleeves at a time to suit construction programme to pass pipes through walls, partitions, floors, ceilings and other structure and supervise any building in to ensure correct location for free pipe axial movement.

Where internal on both sides sleeve to be flexible pipe insulation of length wall etc. thickness plus 75mm cut back flush when final surface complete except for decoration. Except where a fire barrier and if so required by Fire Officer, a floor of a 'wet' area, i.e. liable to spillage such as kitchens, plant rooms, etc. or as later specified, sleeve to be of pipe or other approved inert material of not more than 10mm or less than 4mm internal diameter greater than final pipe overall diameter, including any thermal insulation, and of length to protrude 2/3mm, or, for ''wet' areas floors, 50mm proud of surface finish. Caulk annual space with vermiculite 'bonding fluid'.

Where external on either side and/or passing through a waterproof membrane provide continuity of the water penetration prevention system as specified or if not so specified provide sleeve as for 'wet' area floors with flange with clamped or welded 200mm diameter zinc shield and arrange build-in with mastic waterproof material.

Sleeves of flexible pipe insulation to be 12mm thick Armaflex by Armstrong Cork Company or equal and approved fixed by pushing onto the pipe or where essential split and bonded to the pipe by adhesive and taped overall to give tight joint reducing sound transmission but allowing thermal movement. Suitable Armaflex sizes to give satisfactory sleeves are: -

Pipe Bore	Copper	Steel	PVC	*Pipe *bore	Copper	Steel	PVC
15mm	3	7 3		*32mm	10	11	10
20mm	7	8	7	*40mm	11	13	11
25mm	8	10	9	*50mm	14	15	14

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

32. PIPE AIR RELEASE AND 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 AND ANCHORING

Provide means for thermal expansion in pipework of any service likely to operate at 4O^{O}C or over, as specified, or where not so specified by change of direction or installation of 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:-

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.

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 Pipeline Components Ltd. 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.

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

Pipe size	Width	Depth
Up to 50 mm	l.20 m	l.80 m
65 mm	l.35 m	2.l0 m
75 mm	l.60m	2.40 m
100 mm	l.95 m	3.00 m
125 mm	2.25 m	3.45 m
150 mm	2.65 m	4.35 m
175 mm	3.60 m	5.50 m

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.

Anchors - to be similar to pipe brackets specified with, in addition, a small piece of RS channel shorter in and 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 graphite non-asbestos 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 BS2871 is specified the tube to be of de-oxidised non-arsenic copper to BS1174.

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 l50mm 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 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, 90o bend = 12, 45o 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.

Provide all pipes and metal work, otherwise provide details and supervise Main Contractor.

38. ASBESTOS

No asbestos is to be used.

For work in existing buildings check within seven days of appointment if an existing asbestos hazard may lead to refusal of staff to work and submit written notification of all such hazards. If likely to be made part of the works submit also a quotation for replacing the hazard with a suitable alternative.

If delays occur due to staff refusal in respect of a notified hazard, other than due to failure to act in reasonable time upon instructions given to remove the hazard, then any substantiated costs incurred due to the delay will be reimbursed, but no delay or delay costs will be considered in respect of any non-notified hazard.

39. POLYCHLORINATED BIPHENALS

No substance containing ANY Polychlorinated Biphenyl may be used it has been used as cooling and/or insulating fluid in electrical equipment such as transformers, capacitors, fluorescent lighting ballast, etc. and in hydraulic and heat transfer equipment. Common 'trade' names are Askarel, Aroclar, Clophen, Chlorextol, Dyukanol, Fenclor, Inerteen, Kanechlor, Moutar, Noflamol, Phenochlor, Pyralene, Pyranol, Sanotherm FR, Sovol and Therminol.

40. CFC's (ChloroFluoroCarbons)

No materials which contain CFC gases or use CFC gases in their manufacture are to be used. CFC gases as defined in the Montreal Protocol.

41. F-GAS REGULATIONS

Provide a register and include it the O&M manual records and recommended testing procedures to comply with the F-Gas regulations.

All works to be undertaken by a REFCOM Elite registered company adhering to all relevant FGas Regulations.

42. LEGIONNAIRES DISEASE

Arrange systems to minimise presence of Legionella pneumophila bacteria. That is, based on the Health & Safety Executive's "Legionnaires' disease – The control of legionella bacteria in water systems (approved code of practice and guidance 2000) and in accordance with HS(G)70 line notes produce as far as feasible conditions avoiding temperatures between 20 and 50°C, pH values in the range 6.6 to 7.2 and the presence of iron nitrogen and cystine and/or provide equipment suitable to reduce risks from Legionella pneumophila bacteria.

Fit all cold water storage tanks with tight covers, air vent protected by wire balloons, drain point at the lowest level and thermal insulation as needed to prevent the water temperature exceeding 20°C. Provide submersible components of a type approved by the Water Authority as not supporting bacterial growth.

Fit all hot water storage vessels similarly as appropriate. Display a notice adjacent to each system giving instructions as to what tests, type and frequency, need to be made to ensure Legionella pneumophila bacteria is not present to an unacceptable degree, what action to take to produce acceptable conditions.

There is no humidification system anywhere in this project.

43. SAFETY HEALTH AND WELFARE

In carrying out the Works or Services under this Contract, the Contractor shall adopt safe methods of work in order to protect the Health of employees of the Contractor. Sub-Contractors, employer and all other persons, including members of the public.

The Contractor shall review their Health and Safety Policy and Safe Working Procedures as often as necessary and in the light of changing legislation. In particular the Contractor shall comply with the requirements of the Health and Safety at Work Act 1974, the Factories Act 1961, the Offices, Shops and Railways Premises Act 1963 and any subordinate legislation.

The Contractor shall allow for all costs incurred in complying with the Health and Safety legislation, and provide a copy of their Health and Safety Plan and Policy prior to commencement of works and develop and implement the Health and Safety Plan to completion of the works.

SECTION 4 STANDARDS - ELECTRICAL

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 and 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

Install to all relevant current British Standard specifications and Codes of Practice

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

Comply with all applicable Regulations, Orders, By-laws, Acts of Parliament and other Rules of Central and Local Government, Supply, Public Utility and any other accredited Authority including the Regulations for Electrical Installations, 17th Edition issued by the Institution of Electrical Engineers (The "IEE Wiring Regulations").

Produce calculations to confirm that cable and protective device sizes and capacities comply with IEE regulations and submit for approval.

Inform appropriate Authorities of works being undertaken, complete and deliver any application form, and pay any fee and give all notices to test and connect.

Bye-Law provisional approval has been negotiated.

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

Provide to the recommendation of the Chartered Institution of Building Services Engineers on plant labels, instrument notation graduations, test certificates, as fitted drawings, etc., with both SI Meter, 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, circuits, cable cores, busbars, trunking etc., except where use and connection is reasonably obvious for operation and maintenance, to BS 1710 and IEE Regulations with circuit lists and/or 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.

Provide typed circuit lists on plastic film under clear perspex in interior of each item giving distributor name, number and location and each circuit number, point numbers, type and wattage connected, cable size and protection device and rating.

Labels to be 4mm thick clear plastic with 6mm high black filled letters on reverse side two screw fixed to a logical external surface of switch and distribution equipment, etc.; for terminals adjacent to or on the block and for busbars, etc., coloured to indicate phase fixed to the bars. Provide additional label with 10mm high red letters reading 'CAUTION V VOLTS' where V exceeds 250 volts.

Main switchboard label letters to be 12mm high, one label with black letters giving name and main function and second label with red letters giving IEE Regulation instructions as to periodic inspection and testing with adjacent removable chart on plastic film under clear perspex cover for inspection and test records.

Provide on outer face of all substation, main switchroom and rising duct doors labels with 75mm high red letters "DANGER 415 VOLTS" or "Treatment for Electric Shock" instruction on substantial card as produced by the "Electric Review" or equal.

Provide diagram for each main and sub switchboard giving circuits and location of all items by number, principle cable sizes and giving all code details and colours, one copy printed onto plastic film wall mounted under clear perspex adjacent to the board concerned with further copies in the instruction manual.

Modify these methods to those already in use by the Purchaser where so specified or later directed and amend or replace any effected existing identification.

Submit for approval all proposed identification details with specimen circuit lists.

9. PAINTING AND CORROSION PROTECTION

Paint all electrical equipment supplied which requires painting and to include repainting all items supplied which have become marked or damaged and so that the finish of any run or group has a consistent finish and to all ferrous supports and parts installed externally, in plant rooms or in tunnels, ducts, shafts, etc. and/or otherwise specified.

For items to be painted, thoroughly descale, wire brush and paint one coat of red or grey oxide before erection followed by a second coat after erection followed by an undercoat and two top coats of paint to provide a hard gloss finish where internal with third coat to provide a hard matt finish where external.

All paints to be suitable for their purpose, be heat resisting where necessary and paint colours to be approved prior to commencement of final 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 by the 'Schori' process. Equipment to be so treated to be completely dismantled 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 when 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 deficiency and will then be considered as supplied under the Contract.

Where equipment to be connected is not complete with integral overall controlling switch, fuse and indicator lamp make the final connection through a suitable control unit comprising switch, fuse and indicator lamp.

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 AND COMMISSION

Test and commission each section of the works as appropriated and/or specified and demonstrate that each section will operate as specified having controls correctly set and free in operation all instruments correctly calibrated.

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 all tests required by the IEE Regulations and as specified including: -

Visual Inspection as IEE Regulations Chapter 61, results to be issued to the Engineer.

Continuity of ring final conductors.

Continuity of protective conductors, main and supplementary equipotential bonding.

Earth electrode resistance when provided.

Insulation resistance and insulation of site built assemblies.

Polarity.

Earth fault loop impedance.

Operation of residual current devices.

Check prospective fault levels and disconnection times and submit written report to the Engineers.

13. TEST NOTICE AND RECORD

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

14. OPERATION AND INSTRUCTION

When installation is in satisfactory working order and so notified in writing put into normal service for seven days from the date of building or building section completion, under skilled supervision and attention, during the hours of 9.00 a.m. to 6.00 p.m. During this period lubricate and maintain all moving parts and instruct the Purchasers 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 design by the Engineer.

The Purchaser 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

Provide 4 A4 size 4 ring clip or equal binders printed with names of project, system, Engineer and installer in accordance with BSRIA Application Guide 1/87.1 each containing:-

System description giving main design parameters, capacities and methods of regulation and control - of which submit draft for approval.

Schedule of all fixed plant and equipment

Indexed list of and followed by maintenance, operating oiling, control and regulation instructions for each unit installed for which instructions can reasonably be required.

Schedule of oils and greases needed indicating frequency of application.

List of tools and spares supplied and/or needed indicating sources of replacement.

List of all test records followed by copies.

Copy of identification code adopted.

List of all as fitted, detail and manufacturer's drawings, wiring diagrams, charts etc., produced and of value to the operation, maintenance and/or modification of system, followed by a copy of each unless given under separate cover.

Method statements for any operational or maintenance/repair activities requiring special methods of working or containing residual risks as required by the CDM regulations

Issue one copy directly to Purchaser's engineers during commissioning and other as directed.

A copy of the entire manual is to be supplied on CD in .pdf format.

16. TOOLS AND KEYS

Provide two sets of all special tools and keys necessary for the operation and maintenance of provided items of equipment and hand to the Purchaser with a detailed list. Obtain two receipted copies and forward one to the Engineer.

17. ELECTRICITY CHARACTERISTICS

Provide electrical installation suitable for the available supply assuming a maximum voltage fluctuation of plus or minus 10 per cent.

18. LUMINAIRES LAMPS AND TUBES

Provide luminaires complete with accessories, supports, lamps and/or tubes of the make, type and size specified designed to operate with temperature not exceeding 150°C at lamp or tube connector and 55°C in wiring spaces with an ambient temperature of 21°C having cooling and 'cool-wire' devices as needed and in any event where temperatures may be exceeded.

Obtain written confirmation of all luminaires and, when confirmed, obtain written guarantee that operating temperatures will be as specified before placing any order for luminaires.

Provide luminaire support as appropriate to its weight, direct from conduit box where appropriate with no weight greater than 5 kg applied to any cord. Rigid suspensions to be from 'hook-plate' or 'ball and socket' to permit lateral movement. For luminaires in or on suspended ceilings provide separate independent support.

Provide lamps and tubes as specified, or, where not specified ' pearl' tungsten lamps, 'white' hot cathode and 'natural' cold cathode tubes.

Where luminaires and/or lamps and tubes are specified to be supplied free issue fix and commission as if supplied.

Clean all luminaires and lamps in the 7 day period prior to building handover.

19. ACCESSORIES

Provide accessories with accessible terminals of the pinch screw or clamp type screw fixed into boxes of adequate size to give 10mm rear space for wiring as follows:-

Local Switches to be quiet action a.c. type with ceramic or moulded bases mounted on to the switch plate or separate grid. Install so that the switch dolly is 'down' when the switch is 'on' or as appropriate.

Multiphase switches must comply with IEE Wiring Regulations.

Ceiling switches are to be robust, and where for recessed or semi-recessed with white plastic break joint ring. Adjust pull cords to a suitable length after installation and fit an acorn or knob.

Ceiling Roses to be white moulded plastic mounted to a circular conduit box.

Lamp Holders to be of white moulded insulating material with telescopic plungers, shade carrier ring and cord suspension grip except in luminaires or attached to conduits to be brass with earth terminal.

Batten holders to be of white all insulated type for circular conduit box, with Home Office pattern skirts or shade carrier ring if luminaire specified. Provide BC lamp holders for lamps up to 150 Watts otherwise GES type except as later specified.

Socket Outlets To be of the 13 amp shuttered square pin pattern for flush or surface mounting to BS 1363 or BS 2814 with one matching plug suitably fused and connected where appliances are installed. Supply remaining plugs with 13 amp fuses and an equal quantity each of 3 and 13 amp fuses, box and hand to the Purchaser against receipt.

Special Purpose Socket Outlets Fit clock connector boxes flush unless otherwise specified using white MK 995 with 2 amp fuse to BS 1362 and earthing facilities.

Where unable to make a permanent connection provide 2 amp 3 pin socket outlet and plug or as later specified.

Fused Connection Units Connect permanent fixed appliances through a 13 amp fused connection unit incorporating switch and indicator lamp or as otherwise specified.

External Accessories provide for external use all accessories of the industrial water-tight pattern with gaskets.

20. SWITCH AND DISTRIBUTION EQUIPMENT

Provide, to BS 5486, switch and distribution equipment specified in totally enclosed solidly constructed mild steel cases of clean external appearance with securely hinged and gasketted access doors having provision for padlocking. Pad locks are not required unless specified.

Provide detachable neutral bars of same cross section as phase bars, whether or not initially required, and connections as specified - holes for conduits, flanges for trunking, sealing chambers for paper insulated cables etc. - with earth bonding connection.

Switch Fuses 500 Volt 'on-load' pattern with switch blades on a solid insulating bar for quick make and break action, HBC cartridge type mounted independently of the switch mechanism and operation of the 'free handle type' interlocked with the access door and marked 'on or 'off'.

Fused Switches As switch fuses but with double break movement and quick make and break action with fuses across switch blades.

Isolating Switches As switch fuses except without fuses.

Fuse Boards 500 Volt pattern with removable and reversible chassis mounted interior with facilities for sweating sockets or crimped terminals for incoming phase and neutral cables, all live metal parts enclosed with insulating material, including when the fuse carriers are withdrawn, barrier of incombustible, rigid insulating material of adequate depth to segregate different phases and with wiring arranged so fuse banks may be withdrawn without disconnecting cables. Provide residual current operated devices to any circuit taken outside the protected zone. Where SP&N fuse boards not available multiphase boards may be adapted to SP&N by linking the phase bars.

Main and Sub-Main Switchboards Multiple boards specified to be rated at 31 MVA at 500 Volts and comprise components of a single manufacturer fully assembled in sections where needed, wired and tested at works, with all conduit and/or trunking to enclose cables, etc., including meter tails, needing only fixing into position and connection to external circuits to complete installation.

Busbars to be of hard drawn high conductivity copper to BS 159, or aluminium PVC sleeved connected to each switch etc., with solid drawn rods or bars clamped or bolted to the main bars.

Provide floor support for all multiple boards comprising mild steel angle frame of not less than 50 x 50 12mm for boards built up from individual components and 40 x 40 x 5mm for enclosed sheet steel cubicles.

For cubicles provide bolted on cover panels and arrange in compartments each with gasketted hinged door having spring level lock, having interior clearance of not less than 50mm between 'live' and 'earthed' parts.

Submit for approval manufacturers general arrangement drawings, and, when this approved, also detailed shop construction drawings for each board.

Spare Fuses Provide spare fuses of each capacity adopted - one within the casing of each item of local switch and distribution equipment and four for each main and sub-main distribution panel in a spare fuse compartment.

21. MOUNTING HEIGHTS

Except as otherwise specified mounting heights from finished floor level of 450mm to underside or 1200mm to the top of the switch to comply with AD part M for all switches, socket outlets, alarm contacts and similar 'reachable' units.

Emergency exit signs, bells, buzzers, intruder alarm PIRs shall be installed at between 2100-2300mm above finished floor level.

22. CIRCUITS PHASING AND PROTECTION

Connect as specified points in circuits and phases from the distribution equipment indicated numbering from the left hand side. Provide protection to each circuit by circuit breaker, miniature circuit breaker, HBC or cartridge fuse or as specified, of the rating and characteristics required to give full circuit and protective conductor protection. Fit as the work proceed the ratings specified and prior to commissioning review all circuit protection and make necessary additions, adjustments and replacements giving written notification to the Consulting Engineer of any specified rating that does not provide full protection and proper discrimination.

HBC cartridge fuses to be of the ASTA tested indicating pattern in 'Red Spot' holders. Do not use rewireable fuses unless specified.

Do not fit spare fuse ways with a fuse.

Provide and hand to Employer in addition to those in switchgear giving 20% of the total number of each size of cartridge fuse.

23. EARTHING AND BONDING

Provide mechanical and electrical continuity throughout and bond to a main earth point provided by the Electricity Supply Authority or as specified or, where not specified, comprising two 3.7m long 16mm diameter earthing rods driven into the ground at no less than 6.0m from any building, each top terminated in purpose made concrete earthing manhole and connected to other rods and to main switchboard by a 25mm x 4mm earth lead run underground at 450mm minimum depth connected to 25mm x 4mm earth tape run continuously along the length of all members of the main switchboard frame and bonded to all items of switchgear by 22mm x 1.5mm earth tapes.

Provide 25mm x 4mm earth tapes similarly to all other multiple boards and bond together all conduit and trunking system, metal frames, enclosures, lighting fittings, cable sheaths, etc., with 12mm x 4mm strips.

Provide main and supplementary equipotential bonding and protective conductors to IEE Regulations Table 54F.

Provide earth test links adjacent to all multiple boards and at all junctions comprising 12mm x 4mm strips secured across a 50mm break in the earth lead or tape by high tensile steel bolts and nuts tightened by torsion spanner.

Earth conductors to be of high conductivity bare copper with minimum number of bolted and soldered joints supported at 1 metre minimum intervals by copper or brass saddles. Where underground, external or in damp location earth conductors to saddles to be tinned and joints to be given two coats anti corrosive paint and covered with self-adhesive PVC tape.

Excavate and after, backfill, to any trenching and erect and cement into place manholes etc.

If the resistance of the main earth exceeds the permitted value extend the earth contract area as directed as variation work.

24. SUPPORTS

Provide as specified and/or needed any rolled steel section frame, mounting pedestal, etc., and, where fixing to walls of less than the strength of 225mm brick, provide steel bolts through wall to connect to steel plate on reverse side.

25. WIRING FOR MECHANICAL SERVICES

Provide all *power* and such *control* wiring as specifically detailed for the Mechanical Engineering Services. *Control* wiring not specifically detailed will be installed as later specified. The extent of the work to be:

Electric *power* wiring, conduits, trunking, etc., from local boards to each item of electrically driven appliance such as boilers, fans, fan heaters, motorised valves, etc., all as later specified. Electric motor starters, starter control panels and similar equipment will normally be supplied under the Mechanical section of the contract but may be supply only, or supply and erect (but not connect) or may be for supply and erect under this specification, all as later specified. In any event accept any loose equipment so provided and install and connect this as appropriate terminating with a final connection to each appliance, and supply and incorporate any necessary additional equipment which will include an isolator adjacent to the appliance when this is required.

Electric *control* wiring, conduits, trunking etc., from the point at which an electric power connection is made is to be carried out under this Specification where later so specified. Where the control wiring is not so specified, the cost will be met from a provisional sum included in another section of the Contract and that Installer will be instructed to appoint the Electrical Installer to install such control wiring to details he will provide and the Electrical Installer is to act as Sub-Contractor to the Mechanical Installer for this purpose. Within 12 weeks of the appointment obtain full details of all the control wiring required and provide, with a copy to the Engineer, a fully detailed quotation for installing the control wiring. The quotation is to be in the form of a priced bill of wiring for quantities based on the same rates applicable to the Tender Price and for all work to be in accordance with the general requirements of this specification.

The wiring for Mechanical Services is to be complete as specified with all cables, conduits, trunking, switches, accessories, fixings, fuses, labels, circuits, lists, etc., except as later specified.

26. CABLES

Provide specified type cables with fully identified cores all to appropriate British Standard made in single complete lengths delivered to and handled on site on complete sealed drums arranged, where needed, with top guide, supporting ramp and overrun brake. Run rectilinear to adjacent surfaces in cable trunking or on cable tray or cleats as appropriate and/or specified.

Provide extendible cleats and hangers at intervals to give adequate support to smallest cable.

Install cable lengths to site measurement and not to any scheduled length. If any equivalent aggregated scheduled length is not as installed that will be a variation.

Provide rodent and water repellent half hour fire resistance seal with bituminous compound at all cable entry points to ducts, etc.

27. FLEXIBLE CORDS

Flexible cords to be white LSF sheathed to BS 6500 of size complying with IEE Regulation with a minimum size of 1.0mm^2 Polythene insulated and/or sheathed cables are not accepted. Fix by clamp or equal to ensure that the weight of fittings, etc., is not taken by terminals.

28. HEAT RESISTING CABLE

Make connections to apparatus, electric or otherwise, luminaires, etc., where the terminal temperature is above 60°C, with MIMS, asbestos covered cable or flexible cord to BS 1327.

High voltage discharge lamp circuit cables to be metal sheathed armoured to BS 559.

29. CONDUIT CABLES

Provide conduit cables of 600/1000 volt grade of sizes given in the IEE Regulations or as specified with minimum size 1.5mm^2 of 6491B Single Core Cables Stranded LSF manufactured to BS:7211 and approved by BASEC except in Boiler Rooms and areas with temperatures above 40^{o}C where they are to be elastomerbutyl rubber insulated cables to BS 6899.

Install only in conduit, trunking or the enclosed spaces of switchgear, equipment or apparatus unless otherwise specified and with switch and distribution equipment neatly bunch and support.

Install cables looping from one point to another with connections made only at distribution boards, ceiling roses, luminaires, switches, socket outlets, etc.

At terminals strip back insulation without damage to conductor strands. Tightly twist together before inserting into terminal two or more conductors and arrange sufficient length for future reconnection should the first break away.

Bare conductors are not to project beyond any insulated shrouding or mounting of a live terminal.

Make connections between cables and flexible cords or internal fittings wiring with porcelain shielded connectors having two pinching screws for each cable core.

30. CONDUITS

Provide cable conduits fixed to the surface or buried in the structure as later specified.

Steel Conduits In dry internal areas heavy gauge (black enamel) steel with welded seams and screwed joints to BS 4568 Part 1, Class 2.

In external and damp internal areas, cavities of external walls, etc., solid drawn, galvanised inside and out, with watertight joints to BS 4568, Part 1, Class 4.

Sizes to be as later specified or as IEE Regulations except none to be less than 20mm external diameter. The maximum conduit diameter to be appropriate to available space, particularly in relation to screed depths. If a larger size than specified will ease drawing in cables with access specified, it is permissible to use additional and/or larger conduits and/or additional access - provided that there is no increase in price and in implications to the building.

Accessories to be malleable grey cast iron to BS 4568, of small pattern with long threaded spouts, or loop-in pattern having the correct number of entries, side, tangent or rear, for all as appropriate purpose.

Covers to have 3mm overlap for buried work, flush for surface work plain, ball, socket, dome or hook-dome to be screw fixed with gasket in galvanised runs and where specified or bakelite break-joint ring for buried work.

Bushes, plugs, glands, etc., to be of brass and all male bushes to be of long thread pattern.

Adaptable boxes of mild steel for flush dry situations, cast iron for surface, wet or exterior positions may be used at multiple intersection joints for cables from the same distribution board.

Boxes for power accessories to be to BSS dimensions, for flush to BS 1299 and to be mild steel with conduit knockouts, for surface socket outlets to be mild steel, moulded or cast iron as later specified, with adjustable lugs where possible.

Switch boxes to be mild steel deep pattern or as later specified.

Use through boxes on multiple runs where appropriate. No manufactured elbows, bends or tees, solid or inspection typed are permitted.

All connections to be to threaded spout of conduit box or in clearance hole of loop-in, adaptable, switch, etc., box, or trunking or in the enclosure of an electrical fitting. Connections to loop-in boxes to be by standard conduit coupling and smooth bore long thread male bush to sheet steel or cast cases or equipment having tapped conduit entries of little depth by threaded conduit screwed into the entry with external locknut and internal female brass bush, except where without bush but with end reamered smooth where unavoidable.

On other connections will be accepted unless approved. Provide secure fixings at not less than the intervals as IEE Regulations and at 20mm on each side of any bend or set. To surface conduits mild steel spacer bar saddles, 3mm bars, for smooth surfaces such as plaster or fair faced brickwork, cast iron spacing saddles for rough surfaces. To conduits galvanised steel crampets at minimum centres with at least one in a run of less than 2500mm horizontally, 1200mm vertically. Fix boxes separately.

Install to be electrically and mechanically continuous, of clear smooth internal bore, particularly where cut and/or screwed, with sets free from distortion, run individually from distribution boards complete before wiring drawn in to prove it may later renewed.

Lay flat without low points or drainage holes and pull through swab where needed to dry out before cables drawn in. Provide draw-in boxes on straight runs at 9m horizontally, 4.5m Vertically, on runs with bends at 7.5m minimum centres with not more than two bends between any box and where on run between two areas in which difference exceeds $10^{O}C$ of temperature and/or 20% of relative humidity - filled with compound after wiring to form vapour barrier between the two areas. Provide clamps to wiring in box on a vertical run exceeding 4.5m to relieve stress on cables caused by their own weight.

Surface runs to follow rectilinear building lines, not the shortest line, with several run in closely spaced group. Buried runs may run between points where feasible.

For direction changes within wall etc., provide back outlet box and avoid set buried in structure.

Provide at least 150mm clearance to any water or gas pipe.

Set out conduits in any tiled or similar surface so that any exposed cover is in the centre of a tile or as directed.

Flexible Conduits Provide for final connections to machines etc., to BS 731 Part 1, Type B flexible metallic tubing sheathed with PVC, with brass adapters fixed at both ends with external PVC insulated copper earth wire, connected to terminals at both ends.

All Insulated Conduit to be as specified for steel conduit except as manufacturers detailed instructions with compatible accessories, boxes, etc., and with semi-permanent mastic joints in corrosive or damp situations.

31. CABLE TRUNKING

Provide cable trunking as later specified or instead of multiple conduit runs, interconnect switchgear, etc. (Note clause does not refer to skirting, multi-section, floor or trunking of a special nature for which see Part 2:-

Cable trunking shall be manufactured to comply with BS 4678 and be simple rectangular constructed from rust proofed mild steel sheet finished stove enamel, or galvanised as specified, 18 gauge for longest side up to 100mm 16 gauge up to 150mm and 14 gauge up to 230mm, made in continuous lengths up to 3600mm, of section of the lipped type with flange or lip along whole of the open side with continuous lid or cover made to same quality and length arranged to overlap trunking flange or lip and be securely fixed thereto. Self-tapping screws will not be acceptable.

Adjoining sections to be butt joined with internal fishplate connector or sleeve attached by not less than four 5mm bolts and nuts on either side, two of which to be connected by 12mm x 4mm copper bonding strap for electrical continuity.

Trunking sizes to be to the IEE Regulations Appendix 12 plus 25% spare capacity or as later specified.

Accessories to be of some material as trunking, but, other than bends, tees, etc., one gauge heavier thickness, purpose designed and made by same manufacturer connected as adjoining sections. Where two different sizes of trunking are to be used in a continuous run a connection is to be made by a purpose designed reducing piece.

Fix directly to walls, etc., or support brackets as appropriate to location or as later specified and secure at centres not less that 1200mm and not more than 1800mm and within 150mm on either side of all bends, tees, etc.

Install generally as appropriate to Clause 30.1 for conduits except on vertical runs provide insulated metal peg supports or hardwood cleats where needed to relieve cable stress and, where trunking passes through a building fire barrier provide on same line an approved internal barrier.

Locate lids and covers on top or front side arranged for easy removal.

Provide factory made expansion couplings where the trunking crosses the building expansion joints.

32. CABLE TRAY

Provide cable tray as appropriate or later specified, perforated, or as specified, constructed from mild steel sheet finished galvanised 18 gauge for up to 100mm width and 16 gauge above this, made in continuous lengths up to 1800mm, of size adequate to carry cables laid closely side by side without bunching or multiple layering or as later specified.

Where to support cables exceeding 25mm external diameter strengthen by welded mild steel flat bars on edge or angle sections run on both sides and with lateral members to prevent sagging.

Adjoining sections to be butt joined by two 75mm long 12mm x 4mm bonding straps bolted to each section. Accessories to be of same material as tray but of on gauge heavier, purpose designed and made by same manufacturer connected as adjoining sections. Provide straps at intervals as IEE Regulations to secure cables to tray. Fix as trunking.

Install generally as appropriate to Clause 30.1 except install horizontally or vertically for cables to be laid on the top or front side and not be suspended beneath the tray unless otherwise later specified.

33. MINERAL INSULATED CABLES

Provide heavy duty mineral insulated metal sheathed (MIMS) cables or as specified of copper or aluminium to BS 6207 with core in magnesium oxide or equal in continuous seamless sheath for sub circuits and, for main and sub main feeds and/or where external, damp or underground, an overall PVC sheath. Do not use for connecting any power capacitor.

Joints, termination's and seals to be made by and installed to instructions of cable manufacturer with brass gland connectors of the compression type with PVC shrouds and any PVC sheathing cut back made good with Lassovic tape or equal, and with identification and insulating sleeves over all bare metal cores.

Provide cold seals in ambient temperature up to 80°C, with brass screw on pot, neoprene sleeves with anchoring wedges, resin bonded fabric cap and plastic compound; above 80°C not exceeding 120°C up to 200°C medium temperature seals with Silica bonded glass cap, porcelain anchoring wedges, PTFE sleeving and sealing compound and above 200°C up to 350°C high temperature glazed seals with brass screw on pot type seal fitted with low melting point glazing flux capped with ceramic cap or beads.

Provide for cores of 6.0mm^2 and over cone grip lugs for copper and compression lugs for aluminium and, where less than 6.0mm^2 take direct to terminals using compression lug connections as BICC - Burndy Limited or similar, with non-ferrous gland plate or equal where more than one single core MIMS cable enters a box or casing.

Install to recommendations of cable manufacturer run as specified or where not specified run on the surface (not buried in the building structure in any way) fixed by saddles at not less than 100mm to 200mm on either side of any bend or accessory and at intervals of not more than 50 times the cable diameter for horizontal or 100 times for vertical runs, with saddles on multiple runs provided as required by the smallest cable, except, where in ducts or trenches only accessible at inspection traps cables not to be fixed.

Provide all necessary measures to prevent electrolytic action between dissimilar metals and cold welding - particularly for aluminium. Apply densal grease to prevent cold welding. For cables buried in building structure test each length and joint for continuity and insulation resistance prior to building in.

34. LSF SHEATHED CABLES

Provide as specified to BS 6004, 600/1000 Volt grade to sizes given in the IEE Regulations or as later specified with a minimum size of 1.5mm^2 run concealed in spaces above ceilings and under floors with vertical runs in conduits or trunking except where possible to run within a cellular construction, and supported by saddles directly on the structure with bearers of wood or cable tray provided for unsupported lengths over 150mm. Ensure protective conductor size complies with IEE Regulations.

35. LSF INSULATED CABLES

Install LSF main cables later specified to BS 6346 with stranded copper, aluminium wires or solid aluminium conductors as specified, 25mm^2 or aluminium wires or solid aluminium conductors as specified, 25mm^2 or greater conductors shaped and compacted, 10mm^2 or lesser conductors of copper, filled and sheathed with LSF and for external, damp or underground use single wire armoured LSF sheathed overall, except, where specified or approved or dry internal use, the LSF insulation may be laid with jute filler bedded with bituminous hessian tapes, compounded overall.

Joints, terminations and seals to be as specified for Paper Insulated Cables except the compound may be cold pouring to BS 1858 (max. 11 kV) or, where LSF to be joined to paper, hot pouring Class II to BS 1858 with a maximum pour temperature of 125^{o}C. Make terminations and joints in a single 8 hour period in gland of the 'Hawke improved' pattern or equal to grip the LSF sheaths and the armour and connect the core conductors by compression terminals, or, if approved, provide compression or solid ferrule joints to maker's instructions. Seal immediately and cut ends by self-adhesive non-hygroscopic tape over wax.

Install as for paper insulated cables except with minimum bending radii not less than 8 times cable diameter.

36. UNDERGROUND CABLES

Except as later specified or directed lay underground cables for cover of 450mm for LV cables and 900mm for HV cables following ground contours having continuous support and, where passing through structural foundations, below hard surfaces or would be subjected to superimposed load, run through earthenware cable ducts with covered access pit of suitable dimensions over any cable joint.

Cable trench excavations to be of width to permit multiple runs to be laid side by side, level bottomed lined with 50mm sand or soft soil, with lower concrete blinding where in hardcore, fill or soft ground.

Test underground cables in sections and arrange cover as soon as practicable with fill of further sand of soft soil to give 50mm cover followed by, where specified, not less than 150mm wide, 37mm minimum, 60mm maximum thick concrete interlocking cable tiles to BS 2484 top indented 'DANGER ELECTRICITY' laid to overlap cable(s) by not less than 50mm on each side, and then excavated material in 225mm layers separately tamped down.

Provide surface markers to BS 2484 at 30m minimum intervals on straight runs and at all joints and direction changes, having 3mm indented 25mm high letters, stating cable LV or HV, if joint present, depth and indicating route by arrows.

All underground cables to have additional sheath or serving which is to be removed from the length run internally. Provide all cables, cable markers, tiles, etc.

37. ASBESTOS

No asbestos is to be used.

For work in existing buildings check within seven days of appointment if an existing asbestos hazard may lead to refusal of staff to work and submit written notification of all such hazards. If likely to be made part of the works submit also a quotation for replacing the hazard with a suitable alternative.

If delays occur due to staff refusal in respect of a notified hazard, other than due to failure to act in reasonable time upon instructions given to remove the hazard, then any substantiated costs incurred due to the delay will be reimbursed, but no delay or delay costs will be considered in respect of any non-notified hazard.

38. POLYCHLORINATED BIPHENYLS

No substance containing ANY Polychlorinated Biphenyl may be used - it has been used as cooling and/or insulating fluid in electrical equipment such as transformers, capacitors, fluorescent lighting ballast, etc., and in hydraulic and heat transfer equipment. Common "trade" names are Askarel, Aroclor, Clophen, Chlorextol, Dykanol, Fenclor, Inerteen, Kanechlor, Moutar, Noflamol, Phenoclor, Pyralene, Pyranol, Sanothern FR, Sovol, and Therminol.

PART 2 PARTICULAR SPECIFICATIONS - GENERAL

SECTION 1 OUTLINE OF WORKS

1. LOCATION

The development is located at Leybourne Village Hall, Little Market Row, Leybourne, Kent ME19 5QL.

2. DESCRIPTION OF THE DEVELOPMENT

The project on site shall comprise the refurbishment and extension of existing multi-function village hall as indicated on the drawings.

The existing building comprise of single storey building with a double height main hall. The proposed refurbishment includes a side extension to the north-west of the building. The existing boiler plant is to be replaced and relocated to a new boiler plantroom.

The incoming utility supplies shall be maintained and/or modified as indicated below,

Electricity Supply – The building is served by 100A TP&N service head. Currently only one phase is in use, with the feed to the building via a 100A SP&N whole current meter. Contractor to survey the service head and confirm that all three phases are live. Contractor to submit an application to UKPN and the utility provider to upgrade the existing meter to provide 100A TP&N whole current meter, increasing the supply from 23kVA to 70kVA.

Gas Supply – The existing gas supply and meter shall be maintained, gas services to be installed as required to serve the new boiler plant.

Water Supply – The existing water supply shall be maintained, water services to be installed as required to serve the domestic water plant. The existing provision comprises a cold water storage tank and gravity fed systems. The tank is located within the loft space, this provides minimal working head pressure, also the roof void is shallow limiting access to service/clean the tank. The proposal is to isolate and remove the existing tank and feed all outlets via mains water pressure. Contractor to validate the size and pressure of the existing supply, if required, the provision shall be increased to serve the number of outlets and anticipated demand.

Full working details must be obtained from the appropriate Architect's and Structural Engineers drawings.

Particular care should be taken when installing the services to ensure that damage to the fabric and decoration, etc. within the existing building is kept to a minimum. All parts of the existing building are to be suitably protected where works are being carried out.

3. ISOLATION AND STRIP OUT OF EXISTING SERVICES

The project on site shall comprise the refurbishment of the building as indicated on the drawings.

These works shall include the strip out of all redundant services to enable the building to be remodelled and fit out.

The Contractor shall verify these details during their pre-tender site inspection and shall make due allowance for any items not shown and additionally identify to the Contract Administrator where there are discrepancies.

Prior to the strip-out works being undertaken the respective services shall be spray painted and identified to the Contract Administrator/Engineer to confirm the elements for removal.

4. NOISE

Take all reasonable precautions during the progress of the works to prevent or reduce nuisance and inconvenience caused by noise to the occupants of adjacent areas and buildings.

Comply with the noise restrictions or BS 5228 "Code of Practice for Noise Control on Construction and Demolition Sites" and any restrictions likely to be imposed by the Local Authority.

Allow for keeping the noise on the site to an absolute minimum by adopting those precautions recommended in the DOE advisory leaflet No. 72 "Noise Control on Building Sites." Mufflers and acoustic enclosures shall be provided if

necessary. Use of electric tools, mixers and plant shall be limited where possible. Radio receivers and similar devices will not be permitted.

Allow for preventing any other form of nuisance or interference (eg. smoke, dust, fumes, spillage and any other form of pollution with particular reference to waterways) arising from the works activities.

5. PROGRAMME REQUIREMENTS

The programme for the general erection of the works will be given in the Main Contractors Conditions and the Engineering Installation must be phased to suit the building programme.

Note that there are particular requirements for the alteration and diversion of services that must be undertaken in a controlled sequence to enable the school to remain operational throughout the contract.

6. BUILDERS WORK

Precisely locate all holes, chases and building work in connection with the Engineering Systems onto builders work drawings and submit for comment as specified in Part 1 Section 2, making the allowance for the contract programme.

All holes in structural slabs and walls will need to be precisely located on builders work drawings at an early stage in the contract.

All builders work drawings are to be submitted at an early stage to the Architect for agreement before the work commences. Any holes or chase cut without prior approval will be reinstated at the contractors cost, if so instructed by the Architect.

7. SURVEY OF EXISTING SERVICES

Record drawings of the existing services will be provided where available. Prior to starting works a full verification survey is to be undertaken to ensure that the services to be altered are understood and condition appraised.

8. EXISTING SERVICES

Contractor shall survey the existing site area and immediate adjacent areas to confirm the extent of the existing services. Where existing services are to be retained and reused the contractor shall provide sufficient protection and marking to prevent damage on site.

Identify all existing services with appropriate authority and advise main contractor of locations.

Take into account existing services in preparation of builders work information.

Contractor shall allow to isolate and remove from site all services made redundant by these works including all brackets and fixings.

On completion issue record drawings indicating the “as installed” services.

9. FIRE STOPPING OF SERVICES

Identify fire separation lines, where services pass through fire barriers, party walls and roof spaces ensure that the fire integrity is maintained. Seal using fire resistant caulking or intumescent mastic and/or proprietary gland plates correctly rated. All separation is to be to a rating required by the fire officer, a minimum of 1 hour. All builders work holes are to be filled and stopped on completion.

In order to provide protection all risers and service entry points all ducts and services passing into and out of the occupied areas are to be fire stopped regardless of whether the separating structure is fire rated or not.

Where voids or service spaces are compartmentalised to prevent the spread of smoke or fire, comply with the compartmentalisation and seal services to match. Where service routes are provided for the later installation of services, e.g. for data, telecom or similar services provide appropriately sized builders work holes with intumescent knockouts for the later sealing of services.

10. ACOUSTIC SEPARATION BETWEEN WALLS, FLOOR AND THROUGH SERVICE VOIDS

Careful co-ordination and arrangement of services is to be undertaken so that there is no transmission of noise from between rooms or from plant rooms, risers and service voids into the occupied areas.

SECTION 2 DRAWINGS AND INFORMATION

1. TENDER DRAWINGS

The tender drawings comprise the Architects layout drawings (which are generally of the standard size, either A1 or B1) and the A3 and/or A4 size sketch details and schedules, together with, where appropriate, particular architectural drawings giving such as sectional information etc.

See architects tender package for,

List of full set of tender drawings

The symbols and abbreviations used to compile the drawings

The A3/A4 sketch details

For the engineering drawings the drawing numbers have particular significance and the four parts are:-

PROJECT NO. : SYSTEM : NUMBER : ISSUE

The **SYSTEM** letter denotes E for Electrical, M for Mechanical etc. and A is used where the drawing shows more than one or even, perhaps, ALL the systems.

The **NUMBER** is a straight sequence number for the particular system and usually has no location significance. Numbers prefixed $ (avoid the confusion of S and 5) show the drawing is an A3/A4 sketch detail or schedule, and numbers without the prefix are the large layout drawings.

The issued reference for a finalised drawing will depend on the circumstances and will be ONE of:-

T where issued for lump sum TENDER use B where issued to form basis for a Bill of Quantities C where issued during the currency of a contract to enable the contractor to CONSTRUCT or otherwise proceed.

REVISIONS are then denoted R1, R2 etc. with details of the revisions given in the revisions column, although, exceptionally there may be T2 or B2 et seq. issues where there is such as a second tender issue - and for each details are given in the revisions column.

2. WORKING DRAWINGS

The tender drawings listed in Part 4 are to some extent diagrammatic and do NOT give full installation details, as noted in Part 1 Section 2.

The Installer is required to produce supplementary installation and builders work drawings in accordance with Part 1 Section 2 and the following schedule is considered as the minimum number of drawings necessary to meet the specification in this respect.

Mechanical

		SCALE
2.1	Pipework mechanical drawings, including support details	1:50
2.2	Plant space plans and sections, including support details. Plant cupboard details. Plumbing arrangements and SVP details.	1:20
2.3	Boiler room and flue details	1:20
2.4	Manufacturers detailed dimensional drawings for all items of plant	1:10, 1:20

2.5	Plans of all installations at each level.	1:50
2.6	Pipework and equipment fixing details	1:10
2.7	Wiring diagrams and control panel details for all systems, control and power wiring	NTS
2.8	Details of all site, incoming services and utilities risers.	1:10/1:100 (external)
2.9	Builders work requirements	1:50

Electrical

		SCALE
2.10	Detailed electrical floor plans.	1:50
2.11	Plant rooms and main switch panel general layout.	1:50
2.12	Riser details.	1:20
2.13	External services and roof plans.	1:100
2.14	Details of all site, incoming services and utilities risers.	1:10/1:100 (external)
2.15	Builders work requirements	1:50

Any additional information the Installer considers necessary to provide to indicate the installation details of the works must be submitted to the Consulting Engineer for comment, in accordance with Part 1 Section 2.

3. POSITIONS OF EQUIPMENT SHOWN ON ARCHITECTS DRAWINGS

The architects drawing package indicates positions of socket outlets, radiators, distribution boards, mechanical plant etc. All positions are nominal and may be varied during the tender period or during inspection/comment of working drawings. No cost change will be permitted for changes in locations provided the total number of items of equipment in an area does not change. If locations change after working drawings have been inspected and deemed acceptable and work has commenced on that element of the installation, additional costs will be accepted charged on a per item or per metre basis taken from schedule of rates.

The architect's drawings indicate outlets, accessories, and other components of visual and functional interest to the users. They do not identify or show all the engineering services necessary to create a complete installation in accordance with this specification. In the absence of clear locations for particular items of plant seek clarification.

4. SAMPLES

Provide samples of each luminaire, accessory, smoke detector and other electrical component visible in the development. Samples to be reviewed by design team and confirmed before ordering.

5. DESIGN PROCESS - PROVISION OF INFORMATION

5.1 GENERAL

The contractor will be required to manage his design process so that it harmonises with that of the project generally. Information shall be provided in adequate time to enable other parties to complete their own work. The general design process for M&E and design calculations required are as follows: -

- General statement of proposals

  Immediately, upon confirmation of appointment, provide a detailed general statement of proposals for the works. This statement shall identify each engineering service and confirm that the contractor's proposal for the system is in accordance with the specification, or giving detailed proposals of alternatives. Confirm that space allowances shown on the architect's drawings are adequate for the installation. Where minor

adjustments to plant spaces are required, identify them. Note - wholesale changes to the internal space planning and general distribution proposals will not be permitted.

- External works and statutory supplies

  As soon as possible arrange meetings with statutory suppliers to progress provision of mains services for the development. Confirm by drawings, the current suppliers requirements. Carefully co-ordinate the services installation to minimise trenching and builders work.

- Schedules of equipment manufactures and more detailed proposals

  On receiving comments on the general proposals and services suppliers, confirm final equipment selections, routes and spatial requirements. Provide sketch information regarding each service to enable comments by the engineer and to enable the architect to fully understand the services systems, their distribution and incorporation into the development.

- Submission of calculations and design information

  Provide information to enable the Engineer to verify the design or calculations verifying selection and performance. The calculations shall be, unless otherwise stated, in accordance with a standard procedure by a recognised authority. They shall be complete with drawings identifying the equipment being sized and on completion all calculation shall be supplied as a record set in an indexed file.

Calculations and or performance information will be required, as a minimum, for the following systems:-

5.2 ELECTRICAL

- Volt drop and discrimination calculations for each main cable and sub circuit
- Illumination calculations and flux plots for general, emergency and external lighting
- Confirmation of sounders etc. for fire alarm system
- Smoke detection layouts for the individual domestic systems and common parts system
- Wiring schematics for comms, data, AV, access control, assistance call system, AFILS, CCTV, etc.

5.3 MECHANICAL

- Part L calculations for Building Regulations.
- Heat loss/gain calculations for each area and system.
- Selection of heating/cooling emitters
- Calculation and selection of ventilation plant
- Calculations for ventilation
- Pipeline sizing for heating mains and plant room circuits
- Flow calculations for LTHW, Mains, HWS and BCWS systems
- Water flow calculations
- Outflow calculations for each sanitary appliance
- Drainage calculations for all above ground drainage - suitable for submission for approval to building control.

5.4 GENERAL SERVICES INSTALLATION

- Service riser ducts and service routes

  Provide details of service riser ducts and services distribution in plan and section; elevation and plan so that all services connections can be co-ordinated.

- General distribution arrangements

  Provide general layout at 1:50 indicating of the general distribution. The distribution is to be shown on the latest set of architect's drawings.

- Builders work information

Provide general layout at 1:50 indicating all builders work as specified elsewhere. The distribution is to be shown on the latest set of architect's drawings.

5.5 CO-ORDINATION WITH ARCHITECT AND ENGINEER

The whole design process is to be paramount in close liaison with the architect and engineer. Attend design review meetings to develop engineering schemes and to incorporate them into the overall scheme design. Provide information in accordance with the programme. Where requested provide supplementary design calculations and drawings to verify existing proposals or alternatives.

The design process described above may be varied in sequence to tie in with the programme and progress of the works.

Provide all calculations and drawings necessary to enable building control approval for the development.

6. DESIGN CRITERIA

It is proposed to utilise the following design environmental criteria to develop the design:

The building services shall be designed and installed to comply with latest Building Regulations, British Standards, CIBSE guidelines and other relevant regulations.

External Design Conditions

Summer	30°C db 20°C wb for estimation of gains
Winter	-4°C, @ 100 % saturation

Internal Design Conditions

Summer	General areas - No temperature control
	Main Hall and Small Hall – 24°C ± 2°C at point of monitoring (room air temperature),
	no specific RH control, except
	for resultant.
Winter	21°C ± 2°C at point of monitoring (room air temperature), no RH control

Occupancy Density

As CIBSE recommendation

Ventilation

Main Hall/corridor/	Natural ventilation by openable windows
Store	
WCs	Mechanical extract ventilation, minimum 10 air changes per hour. Make up air drawn from adjacent areas via undercut doors.
Plant areas	to British Standards

Air Infiltration Rate

Main Hall	0.5 air changes per hour
Corridor	0.5 air changes per hour

Operation of Building

All plant	24 hour (adjustable)

Internal Power and Heat Allowances

Lighting	10 W/m^2 Energy efficient LED lighting
Small Power	10 W/m^2
Mechanical Plant as installed	
Fabric gain	as CIBSE Guide

Solar gain	as CIBSE Guide
People	90W sensible, 70W latent

Internal Noise Levels

Main habitable areas	NR 35
Bar areas (hatch open to hall)	NR 35
Toilets / Back of House	NR 40
Kitchen	NR 45

Lighting

As recommendations of SLL Code for Lighting 2012

Main/Small Hall	200 lux for general seating, 350 lux for sports/multi-function
Stage	300 lux (specialist theatre lighting by others)
Office areas	300-500 lux
Toilet	200 lux, IP rated as required
Corridor	150 lux
Kitchen	500 lux
Plant rooms	200 lux
Store room	100 lux
External entrance/ramps	75 lux

Emergency Lighting

To comply with the requirements of BS5266

7. DESIGN CODES AND COMPLIANCE

Contractors design to comply with the following unless otherwise stated:-

The Building Regulations

Requirements of Building Control

Requirements of the Local Authority

Requirements of the Disability Discrimination Act

Requirements of the Fire Officer

Gas Safety Regulations

Water Supply Regulations 1999

CIBSE Design Guides, Technical Memoranda, Applications Guides

BSRIA Technical Memoranda and Manuals

CIBSE and/or IOP for design of drainage

BS 7671:2018 - IET Wiring Regulations

Requirements of British Telecom

The Health And Safety Executive

The CDM Regulations

The Regional Electricity at work Regulations

The Control of Pollution Act.

British standards appropriate to the systems concerned

NACOSS standards for security, access control and CCTV systems

COSHH (Control of Substances Hazardous to Health) Regulations

8. CDM REGULATIONS

Comply with the CDM regulations and carry out the duties required under the regulations for the roles of designer of mechanical services and systems installer. Within 7 days of appointment identify the named designers and provide evidence of their experience and training.

9. PI INSURANCE

Provide evidence of PI (professional indemnity) insurance of not less than £500,000 for the type of work being undertaken.

10. SUB-CONTRACT DESIGN

The contractor may, at his discretion sub-contract the preparation of installation drawings or elements of performance design to a specialist designer/installer or Consulting Engineer. In the event of such sub-contract demonstrate that the chosen specialist has adequate capacity, design skills and experience to carry out the work and make the necessary input into the Safety Plan.

11. ENGINEERING SYSTEMS - GENERAL ARRANGEMENT

Engineering systems are to be concealed within wall linings, joinery and ceilings (where provided), office floors shall comprise of exposed services at high level and are to be carefully coordinated with the architecture.

All systems made redundant by these works shall be isolated and removed from site. Existing systems shall be modified, extended and/or renewed to services the new building.

12. DISTRIBUTION - ROUTES AND SERVICE ZONES

EXTERNALLY

External distribution to be by buried mains and cables below soft surfaces where practical. Ensure adequate protection and identification. Mains buried beneath roadways or pavements are to be arranged to suit the common services trench arrangement acceptable to the statutory authorities and so that services can be replaced without disturbing the finish.

In conjunction with the main contractor identify the routes and locations of existing external services and plan the work to maintain existing supplies.

INTERNAL

General distribution in the new works are to be concealed within the building fabric and service voids. Low level electrical services shall be concealed within the raised floor and chased into the walls. Services shall be wired in conduits to allow future rewire without the need for extensive opening up works.

All penetrations through fire compartment walls/floors are to be fire stopped to a rating of 1 hour.

Architects drawings for details sections. Take particular care to ensure that crossovers can be accommodated within the void depth. Where services run behind equipment/sanitary ware ensure that appliances can be fitted into space allowed without projection.

Acoustic separation between walls, floors and through service voids

Careful co-ordination and arrangement of services is to be undertaken so that the there is no transmission of noise from between rooms or from plant rooms, risers and service voids into the occupied areas.

Fire stopping and fire separation

Identify fire separation lines, where services pass through fire barriers, party walls and roof spaces ensure that the fire integrity is maintained. Seal using intumescent mastic and/or proprietary gland plates correctly rated. All separation is to be a minimum of 1 hour. All builders work holes are to be filled and stopped on completion.

In order to provide protection to the collection all risers and service entry points all ducts and services passing into and out of the occupied areas are to be fire stopped regardless of whether the separating structure is fire rated or not.

13. OPERATION & MAINTENANCE MANUALS

Provide two proof copies for acceptance during commissioning followed by 1 electronic copy and 2 bound A4 size 4 ring clip or equal binders printed with names of project, system, designer and installer of the accepted instructions all in accordance with BSRIA Application Guide BG1/2007 each containing:

The operating and maintenance manuals must include:

- A full description of each of the systems installed, written to ensure that the operator's staff fully understand the scope and facilities provided.
- A description of the mode of operation of all systems including services capacity and restrictions.
- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- Details of how to re-commission so that complex plant services within the building can be re-commissioned by an engineer without any historic knowledge of the systems.
- A photo-reduction of all record drawings together with an index. Reduced size to A3.
- Legend of all colour-coded services.
- Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.
- The name, address and telephone number of the manufacturer of every item of plant and equipment together with catalogue list numbers.
- Manufacturer's technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.
- A copy of all Test Certificates, Inspection and Test Records, Commissioning and Performance Test Records (including, but not limited to, electrical circuit tests, corrosion tests, type tests, start and commissioning tests) for the installations and plant, equipment, valves, etc., used in the installations.
- A copy of all manufacturers' guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturers.
- Copies of Insurance & Inspecting Authority Certificates and Reports.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.
- Procedures for seasonal change-overs and/or precautions necessary for the care of apparatus subject to seasonal disuse.
- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- Details of lubrication systems and lubrication schedules for all lubricated items.
- Details of regular tests to be carried out
- Details of procedures to maintain plant in safe working conditions.
- Details of the disposal requirements for all items in the works.
- A list of normal consumable items.
- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- A list of any special tools needed for maintenance cross referenced to the particular item for which required.

- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.
- Back-up copies of any system software.
- Documentation of the procedures for updating and/or modifying software operating systems and control programmes.
- Instructions for the creation of control procedure routines and graphic diagrams.
- Details of the software revision for all programmes provided.
- Two back-up copies of all software items, as commissioned.
- Copies of relevant HSE/CIBSE/IET Guidance notes etc.
- Contractual and legal information including but not limited to details of local and public authority consents; details of design team, consultants, installation contractors and associated subcontractors; start date for installation, date of practical completion and expiry date for the defects liability period; details of warranties for plant and systems including expiry dates, addresses and telephone numbers.

14. RECORD DRAWINGS

Prepare Record Drawings and Schedules to a scale not less than 1:50 from the "As Installed Drawings" maintained on site as the Works progress. Endorse all such documents 'RECORD DRAWINGS'. Where agreed with the CA certain detailed information may be provided in schedule form. Prepare electrical drawings in accordance with BS EN 61082.

Provide reduced scale copies for inclusion in the operating and maintenance manuals as referred above.

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

- Location, including level if buried, of Utility Service connections, including those provided by the appropriate Authority, indicating points of origin and termination, size and material of service, pressure and/or other relevant information.
- Disposition and depth of all underground systems.
- Schematic drawings of each system indicating principal items of plant, equipment, zoning, means of isolation, etc. in sufficient detail to make it possible to comprehend the system operation and the inter-connections between various systems.
- Details of the principles of application of automatic controls and instrumentation.
- Diagrammatic dimensioned plans and sections of each system or service showing sizes and locations of all ancillaries, plant, equipment controls, test points, and means of isolation etc. including any items forming an integral part of the engineering systems provided by others (such as plenum ceilings, builders' work shafts, chimneys etc.).
- Identification of all terminals/cables etc. by size/type and duty/rating as recorded from the approved commissioning results.
- Detailed wiring drawings/diagrams/schedules for all systems, including controls, showing origin, route, cable/conduit size, type, number of conductors, length, termination size and identification, and measured conductor and earth continuity resistance of each circuit.
- Ensure routes indicate if cable/conduit is surface mounted, concealed in wall chase, in floor screed, cast in-situ, above false ceiling etc.
- Details of co-ordination of wiring and connections with cable core identification, notation of fire alarm, security, control and instrumentation and similar systems provided as part of the Works.
- Details to show inter-connections between the Works and equipment or systems provided by others to which wiring and connections are carried out as part of the Works.
- Location and identity of each room or space housing plant, machinery or apparatus.

- Dimensioned plans and sections at a scale of 1:20 of plantrooms, service subways, trenches, ducts and other congested areas where in the opinion of the CA smaller scale drawings cannot provide an adequate record. Indicate the location, identity, size and details of each piece of apparatus.
- Manufacturers' drawings of equipment indicating general arrangement and assembly of component parts which may require servicing.
- Internal wiring diagrams together with sufficient physical arrangement details to locate and identify component parts.
- Schedules as required to locate, reference and provide details of ratings and duty of all items incorporated into the Works together with all fixed and variable equipment settings established during commissioning.

PART 3 PARTICULAR SPECIFICATIONS – MECHANICAL SERVICES

SECTION 1 EXTENT OF WORKS

1. EXTENT

All the Mechanical Works covered by this specification and the relevant drawings shall be carried out to leave fully operational systems.

The services required to the development include the following listed below:-

The descriptions are not intended as a comprehensive itinerary of the work contained but to give an overview of same which when read in conjunction with the other sections of the specification to give a comprehensive description of the services to be provided.

1. Completion calculations and the following works as required to satisfy Building Regulations requirements, this shall comprise but not be limited to the following,
    - Part L Calculations. Contractor shall complete an EPA to show the design will meet the requirements of the approved document. Upon completion of the project the contractor shall provide a separate EPC for the refurbished building.
    - Provide details of all mechanical and electrical plant to building control, including system efficiency and methods of control. This should include heating, hot water, internal and external lighting.
    - Water efficiency calculations and documentary evidence of appliances/fittings.
    - Design & Installation of utility connections – Gas and water supplies (refer to structural engineers drawings for details of the belowground drainage). Both systems will require site survey to establish the full scope of works.
    - Isolation and removal of redundant services – contractor to survey site to establish the full extent of the works for pricing.
2. Mechanical toilet extract ventilation system.
3. Mechanical kitchen ventilation system.
4. Comfort cooling system.
5. Gas fired condensing boiler.
6. LTHW heating.
7. Gas services.
8. MWS and HWS services.
9. Soil, waste and condensate drainage systems above ground - modification and new
10. Surface water drainage, down pipes and guttering serving the roof areas
11. Thermal insulation of the engineering services.

12. Automatic control systems of the engineering services.
13. Working drawings of installation and manufacturers data.
14. Testing and commissioning of the engineering systems.
15. Operation and maintenance manuals and as installed drawings.

This list of items is provided for the convenience of tenders only and is not to be considered to replace in any way the requirements and intent of this specification all as later described.

All plant, equipment, accessories, etc., shall be complete with all necessary fittings and fixtures to complete the works in every respect.

All builders' work associated with the Services will be carried out by the Main Contractor, to be based on drawings showing the extent of the works to be provided by the Services Contractor. During the tender process advise the main contractor of the builders work requirements.

The contractor shall at all times remain fully responsible for the correctness of the installation. The capacity of any equipment identified for the purposes of specification shall be verified during the design process – advise any discrepancies and take appropriate action to ensure that the systems are complete and operate correctly on completion. Where necessary seek clarification or recalculation from the Services Engineer.

The contractor shall prepare full submission of their drawings and specifications to the Approved Building Control consultant. This submission shall include all technical data of the proposed equipment and material to be used and all necessary calculations as required, i.e drainage, ventilation provisions etc.

Building constructional details are shown on the Architect's drawings. The contractor will have deemed to have reviewed the drawings during the tender process.

The mechanical and electrical installation shall be read in conjunction with and coordinated with all other building services and the architectural and structural layout.

All materials shall be installed in accordance with Section 2 of the Specification.

All equipment, accessories, etc., shall be complete with all necessary fittings and fixtures to complete the works in every respect.

The Contractor shall be deemed to have visited the site to ascertain the nature and extent of works. No claim for additional works shall be considered due to failure to visit the site or interpret the scheme design. Any questions relating to the site or the works must be raised before the return of tenders.

The Contractor shall ensure that they are fully familiar with the extent of the other services to be installed and shall arrange their services accordingly. Agreement shall be reached concerning the physical location of equipment before any work is put in hand.

The Contractor shall allow in his Tender for minor variations of up to 2.0 metres in positions of all such equipment and any such minor variations which are made before installation of the equipment commences shall incur no "extra to contract" charges. This list of items is provided for the convenience of tenders only and is not to be considered to replace in any way the requirements and intent of this specification all as later described.

SECTION 2A PLUMBING - WATER SERVICES - STANDARD DETAILS

1. STANDARDS

Standards of materials and installation to be as part 1, section 3 except as specifically mentioned in this section.

Unless more stringent requirements are stated in this Specification, all site works shall be in accordance with BS6700: 1997 and the Water Supply Byelaws.

2. PIPEWORK & FITTINGS

All distributive pipework shall be copper tube to EN1057 R250 formerly BS 2871 Table 'X' Non-dezincifiable capillary type to BS EN 1254-1 with integral lead free solder rings, where available, up to 75mm bore.

Short connections of 28mm bore and below to be made with light gauge copper tube to BSEN 1057 Table 'X' with gunmetal capillary fittings to BS 864 with anti-electrolytic coupling between the two materials.

3. INTERNAL VALVES

Provide valves for isolation and/or regulation as indicated on the drawings. Valves to have lever operation generally and screwdriver operational where exposed to view in user areas. Screwed valves to BSPT, flanged valves to be BST 'D'.

Valves to be isolating ball valves or equal manufactured by Crane, Hattersley or equal.

Valves exposed to view in user areas to be nickel chrome finish.

4. NON RETURN VALVES

Provide and fix where specified and/or shown on the drawings swing check valves with lightweight flap as made by Hattersley Limited, or other equal and approved.

5. ISOLATING BALL VALVES

Provide and fix ball valves to all hot and cold water branches, to each individual sanitary fitting, or range of fittings, to each ball valve, and all other appliances to which water is connected and wherever else specified and/or indicated on the drawings.

Ball valves to be as Crane D171A ball valves or equivalent with lever operation where not exposed to view and screwdriver operation nickel chrome finish ballofix valves where exposed to view in other areas.

6. FLOAT OPERATED BALL VALVES

Ball valves are to be of appropriate bore and design suitable for flow required at pressure available with silencers on discharge ports to BS 1212.

7. CONNECTIONS TO FITTINGS

Provide all necessary float pipes to connect two or more draw-offs where arranged adjacently "in line". These floats to be constant bore terminated in a plugged end and provided with an outlet for each connection, with isolating valves as indicated.

Final connection to lavatory basins, sinks and other similar fittings is to be made with a suitable connector at approximately 450mm from the sanitary fitting. The final connection is to be made with a separate pipe section with swan neck or equal device to avoid damaging pressure being imposed upon the sanitary fitting.

8. BIB TABS

Provide bib tabs as specified and/or indicated on the drawings of polished brass, easy clean pattern, clearly marked as "stopcocks".

9. STRAINERS

Where required provide strainers in pipelines. Strainer are to be provided in every case to mixing valves/diverting valves.

10. TESTING & COMMISSIONING

Provide all assistance and appliances for testing during the progress of the contract and for the final tests. Provide, fix and adequately support all necessary blanked ends and plugs for testing purposes.

Ensure that all pipelines are completely clear of any obstruction, debris and superfluous matter before any tests are applied to such sections, and upon completion of the contract.

Give notice of testing to the Engineer prior to any tests being carried out on site.

All services shall be inspected and tested as specified and shall be to the satisfaction of the Engineer.

When all draw-off taps are closed, the system shall be absolutely watertight. Distributing pipes shall be tested to maximum working pressure plus 50% or to 14m head, whichever is the greater. The pressure, without measurable loss, shall be maintained for 30 minutes.

All overflow pipes shall be tested for soundness under working conditions.

Locate all defects revealed by the tests, remedy them and repeat the tests until a satisfactory result is obtained

11. CHEMICAL CLEANING

After commissioning all water tanks and pipework are to be thoroughly cleaned and flushed with solvent solution followed by chlorination in accordance with BS 6700 and the requirements of the Water Company.

On completion of chlorination the system is to be thoroughly flushed with clean water.

Provide certificates of purity. Tests are to be taken at random from ten points and sent for independent analysis and test certificates submitted. Should any test provide unsatisfactory chlorination of the entire process is to be repeated and the water retested until satisfactory conditions are achieved.

SECTION 2B PLUMBING – HWS SYSTEM – SPECIFIC REQUIREMENTS.

1. EXTENT

The work to be carried out under this section is the installation and commissioning of hot water services from new point of use unvented electric hot water heaters and combination boilers to all final outlets.

The system is to be complete with flow and secondary return pipework, valves, insulation etc. as specified and/or indicated on the drawings, including final connections to each draw off point.

The system is to be fed with pressure boosted cold water feed as specified in Section 2C.

2. SYSTEMS

The type of water heaters shall be as follows to serve each area.

- Kitchen areas - as the demand is difficult to assess, the proposal is for the installation of a local combination boiler to serve each kitchen area, this will provide hot water on demand when required and offer a continual supply for the duration required
- Toilet areas – minimal usage for hand washing only, local electric water heaters to each toilet block/group of toilets.

3. PIPEWORK

All pipework and general matters are to be as specified in section 2A, unless specifically mentioned in this section.

All pipework to be concealed within building fabric or within joinery.

4. ELECTRIC WATER HEATERS

Provide HWS generation from an unvented electric hot water heater as indicated within the schedules and on the drawings local to each area served.

The water heater shall be fed from an individual 7-day time clock controller and be complete with local temperature controls and be of the capacity and duty indicated in the schedules.

Each water heater shall have facility for the following connections and fittings:-

- Cold inlet feed
- Hot water flow
- Safety valves (pressure and temperature)
- Drain cock
- Thermometer
- Altitude gauge

- Temperature sensor (for control of temperature)
- Pressure reducing valve, if required to serve both hot and cold water outlets to maintain equal pressure differential between the two at each outlet (for TMV's or monobloc taps).
- Expansion Vessel.

5. Combination Boilers

Refer to LTHW heating.

Each combination boiler shall have facility for the following connections and fittings:-

- Safety valves (pressure and temperature)
- Thermometer
- Altitude gauge
- Temperature sensor (for control of temperature)
- Pressure reducing valve if required (to serve both hot and cold water outlets to maintain equal pressure differential between the two at each outlet (for TMV's or monobloc taps).
- Expansion Vessel.

6. EXPANSION VESSEL

Provide expansion vessels for the hot water system of the type and size recommended by the electric hot water heater manufacturers or as indicated on the drawings/schedule.

7. VALVES

Provide valves as specified in Section 2A and as indicated on the drawings. Provide lever operated, quarter turn isolating ball valves as Crane or equivalent on connections to each draw off. Valves as indicated or manufactured by Danfoss, Sampson or equal, set to limit discharge pressure to 1.5 to 3.0 bar adjustable.

8. FINAL CONNECTIONS

Make all final connections as Section 2A clause 8, including connections to basins, WC's, sinks, kitchen appliances etc.

9. THERMOSTATIC MIXING VALVES

Provide thermostatic hot water service mixing valves on final connections to hot water service points of each of the wash hand basins and sinks to limit the maximum hot water draw off temperature to 41°C.

Devices shall have automatic shut off in the event of mains failure. The valves are to be manufactured by Horne Engineering (Tel. 01505 321455) type Horne 15 for the basins, type Horne 20 for bath connections or equal and approved. The valves shall be of TMV3 classification.

10. CHEMICAL CLEANING

Upon completion and BEFORE chlorination of the system, fill the system with water and thoroughly flush with a soluble solvent. Drain and refill the system after flushing and prior to commissioning.

Commission and chlorinate as Section 2A, including connections to shower mixers, basins, WC's, sinks, appliances etc.

11. PIPE SIZES

To be selected so that the design velocity does not exceed 1.3 m/s.

SECTION 2C PLUMBING – MAINS COLD WATER SERVICE – SPECIFIC REQUIREMENTS

1. EXTENT

The work to be carried out under this section is the installation and commissioning of mains cold water system to serve all final outlets.

The existing cold-water storage tank located within the loft space is to be made redundant. Contractor to isolated and removed tank from site and all associated redundant pipework.

The existing mains supply is to be extended to serve the existing gravity down pipe and to all new final outlets.

The above works shall include the provision of thermal insulation to all mains and CWS pipework as specified in section 4 A and B.

The system is to be complete with all pipework, valves, supports, air vents, brackets and insulation, co-ordinate with the Water Company installation and conform to their bye law requirements.

For the purposes of design assume that mains water pressure is 1.0 bar and that there is adequate flow.

Pipework and general matters to be as Section 2A.

2. EXTERNAL PIPEWORK

The water supply pipework in external trenches shall be run in blue polyvinylchloride to BS 6572:1986 with all necessary approved fittings. All external excavations for trenching will be carried out by the Main Contractor to the Installers and Water Company advised requirements.

Service pipe shall be run a minimum 900mm below ground level to prevent freezing. Supervise the backfilling and trench bedding by the Main Contractor to ensure correct installation and protection of the service pipe.

Pipework installed on the external balconies shall be provided with thermal insulation suitable for environmental conditions and trace heated. Trace heating tape shall be self-regulating power limiting cable system as manufactured by Pentair or equal and approved. System to operate during cold weather conditions to maintain the system temperature at 5-10°C (adjustable). Mechanical contractor to design, provide and install the trace heating system.

3. PIPEWORK – Acceptable alternatives

All pipework and general matters are to be as specified in section 2A, unless specifically mentioned in this section.

Pipework specified is for copper tube. Alternatives for press-fit and or proprietary multi-layer systems are acceptable but the manufacturer and type of jointing are to be agreed prior to commencement. Pipework to be approved – contractor to state system in tender return.

All pipework to be concealed within building fabric or within joinery.

4. FINAL CONNECTIONS

Make all final connections as Section 2A clause 9, including connections to temperature limiting mixers, basins, WC's, sinks, appliances etc.

5. VALVES

Provide valves as specified in Section 2A and as indicated on the drawings. Provide lever operated, quarter turn isolating ball valves as Crane or equivalent on connections to each draw off.

6. PIPELINE SIZES

To be selected so that the design velocity does not exceed 1.3 m/s.

7. CHEMICAL CLEANING

Upon completion and BEFORE Chlorination of the system, fill the system with water and thoroughly flush with a soluble solvent. Drain and refill the system after flushing and before chemical cleaning. Commission and chlorinate as Section 2A.

8. EXISTING

All existing pipework made redundant by these works is to be removed.

SECTION 2D PLUMBING - SANITARY STANDARD DETAILS

1. STANDARD

To be in accordance with the appropriate clauses of Part 1, Section 3 except as specifically mentioned otherwise in this or subsequent sections.

2. DESIGN

Systems are to be designed using single stack principle in accordance with the requirements of BS EN12056-2, BS 5955, BS 8000 part 13, IOP and subsequent revisions and replacements.

Drainage systems are to be fully self-venting and where self-venting cannot be achieved an independent ventilating pipe or air admittance valve is to be provided.

Capacity flows determined by the discharge unit method.

3. MATERIALS & REGULATIONS

The whole of the sanitary services, pipework, fittings, etc., are to be installed to comply with the appropriate British Standards and codes of practice and is to be fully in accordance with the local authority regulations.

Obtain from engineer or architect any approval in principle already negotiated to obtain approval from the local authority by delivering any necessary applications and giving all necessary notices to enable the authority to test the installation at the appropriate times.

All pipes and pipe fittings shall be carefully examined before fixing. Defective items shall be replaced.

Particular care shall be taken that all pipework is erected and secured truly parallel and plumb with vertical surfaces. All horizontal pipework shall be arranged with falls to BS 12056-2:2000.

All branch connections to horizontal pipework shall be swept in the direction of flow.

Long runs of pipework shall be erected so that stresses of expansion and contraction, due to temperature variation, are taken up by expansion joints. Where small bore branches are made to pipework remote from anchor points, the branches shall be arranged to form a radius arm so that the axial movement of the main does not stress the connecting fittings.

Where expansion devices are used they shall be of similar material to the pipe, installed in line with the axis of the pipe, and shall be free from compression, tension or torsion. The female member of the expansion devices shall be firmly anchored to allow the male member to take all movement.

Where the pipes pass through fire compartmentation, walls, floors and in-fill slabs, sleeves shall be fitted to allow free axial movement of the pipes. Sleeves shall be of a material compatible with the pipes they protect, non-combustible and of a minimum bore to allow such movement. The length of sleeve shall be sufficient to finish flush with the finished wall or, where passing through floors, to protrude 6mm above and below the finished floor thickness. The annular space between pipe and sleeve shall be tightly packed with alumina silicate string or rope and sealed with fire-retardant mastic to prevent the passage of fire.

Split slip-on wall and floor cover-plates shall be provided as a finish to pipework, up to and including 50mm diameter, in occupied areas other than plantrooms and service voids. Samples shall be first submitted.

Union type fittings shall be provided to make up to outlets of basins and sink wastes, on pipework up to and including 50mm diameter.

Joints in pipework shall not be made within the thickness of walls, floor or roof, or where they would later be built in wherever this can be avoided.

Jointing material shall not project into the bore of pipes, fittings of appliances.

Access plates shall be fitted at the foot of each vertical gravity stack and also at junctions to horizontal branches of 50mm diameter and over to enable the complete piping system to be internally cleaned and rodded.

Access caps/plates shall be fitted at ends of all gravity horizontal pipework, at junctions, and at changes of direction on branch pipework.

4. TESTING

Test each stack pipe and all runs by maintaining an air pressure within the pipe of 100mm wg as measured by a "U" tube so that pressure drop does not exceed 6mm in 15 min. and make such further tests as any be required by the local authority.

Submit triplicate copies of a certificate of each test, signed by the clerk of works or other approved test witness.

5. WORKING DRAWINGS

Prepare all necessary 1:10 and/or 1:20 scale drawings of the sanitary pipework installation together with the associated builders work drawings required as previously specified in Part 1.

6. SANITARY FITTINGS

All sanitary fittings are to be provided by the Main Contractor.

Make all necessary connections to the sanitary fittings and appliances, including water supply, soil, waste and anti-syphon connections as appropriate.

Where there are to be both hot and cold water taps the hot tap is to be on the left hand side.

7. SEALING TRAPS

Provide to the waste outlet from each sanitary fitting and appliance a suitable "P", "S", "Gully" or other type trap as specified or appropriate of the self-cleansing pattern having a minimum seal of 75mm. To be made of the same material as the waste pipes.

8. OVERFLOWS

Provide to each flushing cistern and all other tanks and equipment with an overflow pipe of copper as Section 2A, to discharge externally clear of the wall unless otherwise indicated on the drawings.

Bath and similar overflows, where not integrally made, are to be connected into the side of the sealing trap.

9. STACK ROOF TERMINALS

Extend all stack pipes to roof level and convert to terminals suitable for use with a single membrane roof. Holes by main contractor, provide connection boot, fixings and seal in place.

10. PIPEWORK

Pipework and fittings to be installed in the materials specified in Section 2F to the requirements of Part 1, Section 3 but suitable for sanitary services as described in the following clauses of this section.

All sanitary services pipework is to be installed in straight lines between fittings and all "horizontal" runs are to be laid to falls in accordance with the local bylaws but in any event to falls of not less than 1 in 48 unless otherwise specified.

- Vertical SVP - Cast Iron/HDPE
- Stub Stacks - Cast Iron
- Soil and waste connections - UPVC
- Final connection to roof terminals - flexible UPVC (where appropriate)

All bends and changes of direction are to be easy sweep made in the direction of the flow.

External rain water goods to be cast iron.

Plastic Pipework

All plastic pipework is to be installed with components and to the recommendations of Gerberit Terrain Limited, or other equal and approved, to comply with all relevant British Standards, codes of practice and local bye-laws.

Generally, except as required to be modified to suit the material, plastic pipes are to be installed as specified for cast iron, the particular differences to be :-

Where plastic pipework is specified the waste and soil drainage pipework and fittings is generally to be run in non chlorinated UPVC conforming to Grade 2 and BS 3506 modified to have a high temperature softening point and be suitable for effluents at temperatures up to 84°C - Key Terrain 100 Series for soil pipes and 200 Series for waste pipes.

Joints are to be solvent welded.

Joints are to be made of flexible seal rings.

Where pipework of one grade connects to another grade or another material a purpose made connector is to be used.

The system is to be installed with full provision for thermal expansion including special couplings as required.

Cast iron pipework - Soil and waste

Where cast iron pipework is specified, pipework and fittings are to be as Saint Gobain Ensign system to BS 416, BS 2494 and BS 6087 with manufacturers standard fittings earth continuity clips and supports.

Oval access doors to be provided at each branch, on all bends and at the end of all long horizontal runs and wherever else required to adequately clean the whole of the system all as recommended in BSEN 12056.

Any changes of pipe bore in a run are to be effected with purpose made reducing pieces.

Pipes are to be supported at each joint beneath the socket at minimum centres of 2000mm for horizontal runs and 3000mm for vertical runs.

Where pipes are to be hung from soffit of slab use manufacturers support brackets.

The size of the members is to be :-

64 and 75mm bore pipe :- 12mm rod, 38 x 6mm flat iron

100mm bore pipe and over :- 19mm rod, 50 x 6mm flat iron

Where cast iron pipes are to be run together with other pipes to be installed common support may be provided.

SECTION 2E PLUMBING – SOIL, WASTE & rainwater - SPECIFIC REQUIREMENTS

1. EXTENT

The work to be carried out under this section is the design, supply, installation and testing & commissioning of the above ground soil and waste drainage systems to all the sanitary fittings and sanitary appliances and to provide condensate drainage from mechanical plant as indicated on the drawings within the building.

All works to be concealed within the building fabric and/or joinery.

Vertical stacks to be cast iron or HDPE, and all run outs and connections to be UPVC.

All connections shall be coordinated with the joinery manufacturer to ensure all services are concealed within service voids and/or joinery.

All pipework belowground and main stub stacks/soil vent pipes shall be cast iron, as Saint Gobain, Timesaver range.

All sanitary pipework is to be as specified in section 2D. The pipework is to be complete with all necessary fittings, supports, access points, rodding eyes, traps, etc., to form complete systems.

Provide drawings at an early stage related to the structural grid to enable accurate positioning of ground sockets and ground floor gully points. All riser and SVP layouts are to be agreed with the architect and engineer prior to issue.

Condensate Drainage

Condensate drainage is not indicated on the drawings, contractor shall complete the design. Condensate drainage shall be taken back to local SVP's and/or RWP and connected to the existing stacks via a trap. Condensate drain traps shall be self-sealing dry traps.

2. PIPEWORK MATERIALS

Soil and waste vertical stacks and all soil and waste pipework run within ceiling voids are to be cast iron as manufactured by Geberit Ltd their Timesaver range as Section 2D.

Soil and waste above ground run from vertical stacks is to be Acoustic UPVC pipework as Section 2D. UPVC pipes shall be as manufactured by Gerberit Terrain, Acoustic dB12, as Section 2D.

3. TRAPS

Provide traps to each sanitary fitting identified on the architect's drawings, as Section 2E, clause 7. Traps to be uPVC and concealed. Any visible traps are to be specified by the Architect and supplied with the sanitary ware.

In any shower room provide a shallow inset floor gully with integral trap sized to match the floor tiling with shallow body. Connect into drainage system close to floor level. Alternatively, where location permits, provide shallow trap with running trap in pocket within service duct.

Traps for plant condensate drains to be provided with dry traps as manufactured by HepvO or equal.

4. FINAL CONNECTIONS TO SANITARY FITTINGS

All final connections are to be made to sanitary fittings as Section 2E. Sanitary fitting are to be provided by the Main Contractor. Final connection to WC to be by Multiquick connector.

5. SVP ROOF TERMINALS

Fit bird guards to all roof terminals.

6. OVERFLOWS

Provide overflows from WC and urinal systems in copper pipework as Section 2D.

Provide in each WC an overflow indicator - stainless steel with glass/mesh view port.

7. TRAPS

Provide traps to each sanitary fitting as Section 2D and as needed.

8. FIRE COMPARTMENTATION

Where pipe services pass through floors, walls, columns and beams take adequate measures to maintain the enclosure integrity to the requirements of the Fire Officer, Local Authority, Clients Insurers etc.

Where pipes pass through fire zones provide sleeves with annulus between the sleeve and the pipe to be tightly packed with high density mineral wool.

9. SVP LOCATIONS

All SVP, RWP locations are nominal to be final positioned with Architect.

SECTION 3A LTHW Heating standard details

1. GENERAL MATTERS

All general matters to be Part 1, Section 2, except as specifically mentioned otherwise in this section.

2. PIPEWORK AND FITTINGS

All pipework and final connections to be copper tube to EN1057R250 formerly BS 2871: Part 1: Table X, with capillary type fittings to BS 864: Part 2, swept in the direction of flow.

Air pipes, vents, cold feed pipes and tank overflows to be similar.

3. VALVES

Provide valves for isolation and/or regulation at all main branches and wherever else specified and hand wheels for isolating valves and lockshield with dust caps for regulating valves.

4. TESTING AND COMMISSIONING

During the period specified for plant to be operated test, operate, fully balance and regulate, calibrate, set and adjust all control equipment to commission and demonstrate that:-

4.1 The flow and return temperature to each section accords with the design value and that all regulating valves are correctly adjusted for balanced flow.

4.2 The temperature in each heated space is at the design value.

4.3 All automatic controls are in correct adjustment.

5. CORROSION INHIBITOR AND STERILISATION

During the final filling of the heating system introduce chemicals point to:-

5.1 Bring the pH value to 9.5 using approved chemical treatment.

5.2 Introduce an approved bactericide to neutralise all sulphate reducing bacteria.

5.3 Carry out flushing and cleaning of the system prior to the system commissioning and in accordance with BSRIA Application Guide 1/89.

5.4 Use a water treatment suitable for the materials in the system.

6. DESIGN

The heating system is to operate in the fully condensing mode with a water flow temperature of :-

Flow 60°C Return 40°C MWT 50°C

SECTION 3B PLUMBING – LTHW HEATING SYSTEM – SPECIFIC REQUIREMENTS.

1. EXTENT

The work to be carried out under this section is the provision, testing and commissioning of a LTHW heat generation system with room sealed gas fired condensing boilers to provide LTHW to serve the space heating and generate domestic hot water to serve local outlets (within each kitchen).

The system is to operate complete with circulating pumps, pipework, valves, fittings, supports, brackets, insulation, etc., all as specified and/or indicated on the drawings.

All pipework and general matters are to be installed to the requirements of Part 2 and Section 3A except as specifically mentioned otherwise in this Section.

2. PIPEWORK

All pipework and general matters are to be installed to the requirements of Part 1 and Part 2 Section 3A except as specifically mentioned otherwise in this Section.

All expansion and vibration isolation equipment is to be provided by Pipeline Components Limited or equivalent. Provide anchors and stainless steel axial compensators as necessary to compensate for pipework expansion.

Pipelines to be sized on a maximum velocity of 1.5 m/s or 250 Pa/m whichever is less.

3. BOILERS

Provide new room sealed gas fired combination condensing boilers as scheduled to provide primary LTHW to the space heating and generate domestic hot water to serve local outlets.

The boilers are to be suitable for natural gas firing utilising the maker's standard integral burners. They are to be suitable for maximum design temperatures of 80°C flow and 60°C return.

Each boiler is to be supplied with the following fittings and accessories and also those stated in Part 1 and recommended by the manufacturer.

- Burner/door safety interlock switch
- Safety valves (pressure and temperature)

- Altitude/pressure gauge
- Dial thermometer
- LTHW flow and return connections
- Main water/cold inlet feed
- Hot water flow
- Pressure reducing valve, if required to serve both hot and cold water outlets to maintain equal pressure differential between the two at each outlet (monobloc taps).
- Drain socket from module casing
- Gas Supply/connections
- Condensate drain
- Concentric flue
- Local circulating pump
- Expansion Vessel
- Manufacturer's integral controls suitable for external control system enabling.

The thermometers are to be fitted with phosphor bronze separable pockets and a dial range of 20% more than the maximum working range. Fit altitude gauges with siphons and gauge cocks and a dial range of 50% more than the working point. A suitable gas cock is to be fitted on the supply side of each gas governor. Boiler flueways are to be shut down for maintenance or cleaning.

The boilers are to be suitable for a working pressure of 4.0 bar and tested in accordance with BS 7799/196 to 6.9 bar. Each boiler is to be suitable for connection to a 240V, single phase 50Hz A.C. mains supply, and complete with the following:-

Boiler mountings and equipment

Gas firing equipment as described in this section

Boiler automatic control equipment as specified in Section 5

The boiler units are to be complete in all respects and are to form when coupled to the gas burners a fully integrated unit assembled and tested on site and are to be in accordance with all relevant British Standard Specifications and SAFed requirements.

The boilers are to be capable of intermittent firing without sustaining thermal shock to the detriment of the boiler construction and flow and return connections are to withstand thermal expansion without experiencing mechanical stress, water leakage, etc.

4. BOILER FLUE

The contractor shall supply and install a proprietary concentric stainless steel room sealed flue system.

Allow a condensate drainpipe from the flue/boiler to appropriately discharge into the aboveground drainage with a suitable self-sealing dry trap.

This system is to be manufactured to BSEN 1856-1 and constructed from a 316 grade stainless steel inner pipe and a 316 grade stainless steel outer casing. Drawings of the flue detail proposed are to be submitted for approval. Boiler flues configuration is to be vertical and discharge external at roof level.

Flueways must be installed so that they do not provide a potential source of ignition.

Detailed drawings of the proposed arrangements showing connection details, method of support, etc are to be submitted for approval before manufacture is commenced.

On completion the installer shall provide certification that the installation complies with the requirements of the Building Regulations and the relevant British Standards associated with flue installations.

5. LTHW CIRCULATING PUMPS

The boilers should be supply complete with integral circulation pump.

The pumps shall be controlled as referred in Part 3, section 5.

6. PRESSURISATION UNIT & EXPANSION VESSEL

The Contractor shall supply and install an expansion vessel and pressurisation make up set as manufactured by Mikrofill Ltd, or equivalent and accepted.

The pressurisation make up set shall be a twin pump packaged unit as to a Mikrofill "Maxi Plus" or equal and approved. The mains water is to be 20mm cold water extended c/w check valve connection to the unit. The system connection to the LTHW system is 25mm valved outlet.

The unit microprocessor control has pre-set pressure settings based on the design system parameters. The system pressure is maintained by an integral solenoid valve.

The unit monitors inlet water pressure and shuts down when the pressure falls below minimum cold fill pressure. When the water pressure is reinstated the unit will automatically reset. The unit will show an alarm message to its own display when the system pressure reaches a high or low condition. The alarm signal will relay back to the control panel and boiler.

The contractor shall supply and install a vertical standing expansion vessel together with all necessary interconnecting pipework. Refer to equipment schedule for the vessel size.

The unit shall be capable of an inlet cold fill pressure of 2.0 bar and a final working pressure of 3.0 bar.

7. VALVES

Provide valves as specified in Part 2, Part 3 Section 3A, as below and as indicated/required. All valves shall be as manufactured by Crane, Hattersley, or equivalent.

Commissioning sets

For 50mm and below - Hattersley CV 2432 or equivalent

For 65mm and above - Hattersley CVM 2733 or equivalent

Double regulating valves

For 50mm and below - Hattersley 1432 or equivalent

For 65mm and above - Hattersley M733 or equivalent

Isolating valves

For 50mm and below - Hattersley Globe Valve 113 or equivalent, lever or screwdriver operation

For 65mm and above - Hattersley 731 or equivalent

Drain cocks

Draw off ball valve - Hattersley 370 or equivalent

8. STRAINERS

On the inlet side of all pumps provide pipe strainers.

The strainers are to be of "Y" type construction with screwed brass bodies and perforated brass screen in all sizes up to and including 50mm (2 inch). Larger sizes are to have flanged cast iron bodies. All strainers are to be as manufactured by Hattersley types 807-907 or equal and approved.

9. FIRE COMPARTMENTATION

Where pipe services pass through floors, walls, columns and beams take adequate measures to maintain the enclosure integrity to the requirements of the Fire Officer, Local Authority, Clients Insurers etc.

Where pipes pass through the above provide sleeves - the annulus between the sleeve and pipe to be tightly packed with high density mineral wool.

10. AUTOMATIC CONTROLS

The system is to be automatically controlled as specified in Part 3, Section 5.

11. THERMAL INSULATION

The system is to be thermally insulated as specified in Part 3, Sections 4.

12. SYSTEM FLUSHING AND CLEANING

Carry out flushing, chemical cleaning and rinsing of the whole adapted heating system prior to the system re-commissioning in accordance with BSRIA Application Guide BG 29 2012.

After chemical cleaning, the system shall be drained and rinsed to remove any debris. The water treatment/cleaning specialist shall monitor the condition of the rinse water as the system is progressively rinsed. The rinsing shall continue until the desired iron and chemical residue values are obtained.

Include for finally filling the system with water plus suitable inhibiting agent as recommended by a water treatment specialist.

The system will not stand unused after commissioning. The passivation technique shall therefore allow for the system to be in full use after completion of the commissioning.

13. HEAT EMITTERS

Supply and install radiators in circulation areas, bar, kitchen and storage areas. The contractor shall complete heat loss calculation, provide selection and prepare a schedule of the proposed heat emitters. We would anticipate radiators be installed with a mixture of electric panel heaters, the performance shall be as described below:

Radiators

Radiators shall be suitable for operation at temperatures of 60°C flow, 40°C return and a test pressure of 5 Bar.

All new radiators are to be of steel flat panel type. Check that specified sizes co-ordinate with intended locations; do not protrude above window sills etc and report any difficulties prior to ordering.

Provide supports arranged to give maximum clearance of 40mm from walls and 75mm (min) above floor finish.

Provide for each radiator valves for isolation, regulation and control, including thermostatic head and valve body. Connections to be generally bottom opposite ends (BOE).

Radiators are to be completed with vent plug. Thermostatic radiator and lock-shield valves shall be as supplied by Herz (Tel. 01784 435302) or equivalent and approved. Thermostatic valves shall be of the vandal proof type of model “Hercules” 91050-0.

Finish to be a RAL colour confirmed by the Architect; allow for RAL 9010 white. Radiators are to be delivered paint finished polyester powder coated. Protect paint finish until handover.

SECTION 3C VRF HEAT RECOVERY SYSTEM

1. EXTENT

The work to be carried out under this section is the supply, installation, testing and commissioning of a R410A DX heating or cooling system.

The DX heating/cooling system is to include all external condensing units, interconnecting refrigerant pipework, thermal and acoustic insulation, internal room heating/cooling units (FCUs), AHU direct expansion coils and associated controls to form a complete system. Controls shall be provided to enable independent temperature control of each system and area. The VRF system shall be provided with inverter driven fans and compressor within the external condensing units.

The fan coil units are to be either ceiling mounted cased type or recessed. Refrigeration pipework shall be concealed within the services voids and fixed with proprietary fixings or run on galvanised steel service tray at high level across the floors, as indicated on the drawings.

VRF external condensing unit shall be located in designated plant areas at the rear of the building.

Condenser units shall have enough capacity to serve the designated areas of the building.

All works shall comply with the relevant FGas Regulations and local bylaws for refrigerant systems. Works shall be conducted by a REFCOM "Elite" registered company under licence.

2. SYSTEM

Each heating and cooling VRF system is to be capable of providing heating and cooling through each fan coil and/or AHU DX coil connected to a condensing unit. The refrigerant used by the systems is to be R410A.

3. INDOOR UNITS

The indoor units shall be installed exposed and shall generally be ceiling or floor standing ducted type as detailed in the equipment schedules.

Each indoor unit will have a heat exchanger which shall be constructed from copper tubing with aluminium fins. The flow of refrigerant through the heat exchanger will be controlled by a linear expansion valve. This valve will be controlled by two pipe thermistors and a return air thermistor and shall be capable of controlling the variable capacity of the indoor unit between 25% and 100%.

The indoor unit will require a 240V single phase supply. Control will be via the 30V dc fuzzy logic signal from the outdoor unit.

Ceiling Concealed Ducted Type

Air will be discharge by a forward curved centrifugal fan horizontally out of the unit and to the linear diffuser plenum. The plenum is to be internally insulated (thermal and acoustic insulation), leaving an exposed galvanised steel finish.

The return air will be filtered through a washable filter mounted in the return air inlet.

The unit are to be concealed at high level and supported by suitable anti-vibration mounts.

Floor Standing Concealed Ducted Type

Air will be discharge by a forward curved centrifugal fan horizontally out of the unit and to the linear diffuser plenum. The plenum is to be internally insulated (thermal and acoustic insulation), leaving an exposed galvanised steel finish.

The return air will be filtered through a washable filter mounted in the return air inlet.

The units shall be installed concealed at high level above the shop front and supported from the walls by suitable anti-vibration mounts. Supply air shall be ducted from the top of the unit, dropping behind the unit to a supply air grille mounted horizontally in the bulkhead above the shop front.

4. PIPEWORK

Refrigerant pipework

Interconnecting refrigerant pipework between the indoor and outdoor units to be refrigerant quality soft/medium drawn copper tubing to BSEN 1057 complete with appropriate headers and joints. Installation of the pipework is to be carried out by an approved refrigerant engineer, in accordance with BS EN378 2000 specification and manufacturer's recommendations. Joints shall be kept to a minimum and brazed in accordance with the HVCA Code of Practice:- Brazing and Bronze Welding of Copper Pipe and Sheet. Pipework to be run on galvanised steel trays and fixed and supported at a maximum centres of 1.5 metres.

Condensate Pipework

Condensate pipework is to be run in UPVC Durapipe minimum diameter 20mm where condensate drainage by gravity to a suitable trapped waste connection is practical. Where drainage by gravity with a fall of at least 1 in 120 is not practical, a peristaltic condensate pump with braided vinyl tubing for the pumped discharge is to be used.

Condensate drainage shall be provided with armaflex insulation to match the visual appearance of the refrigerant pipework.

5. DUCTWORK AND GRILLES

The supply air from the exposed ceiling hung fan coil units shall discharge through galvanised steel ductwork and terminate at the diffuser plenum box. The ductwork shall be manufactured and installed in accordance to DW144 to HVCA standards and must be complied in all respects.

The supply air plenum box of the diffuser/grille shall be insulated internally to maintain the external galvanised steel visual appearance.

Grilles & diffusers are to be manufactured by Air Diffusion/AMP (Tel: 01474 338708) or equal and approved.

6. CONTROL SYSTEMS

Remote Controller

All the indoor units shall be controlled by a local remote controller with LCD touch panel and Icon display optional with Power Proportional Distribution Function (PPD). The controller shall be capable of controlling and displaying the following functions for fifty indoor fan coil units:

- On/Off
- Operating Mode
- Set-Point
- Fan Speed
- Louvre Position
- Timer Settings
- Test Run
- Fault diagnosis

Provide the required adapter to enable interface with the fire alarm system so that the mechanical plant will shut down in the event of an activated alarm. The systems shall automatically reset following the clearance/reset of the fire alarm.

7. TESTING AND COMMISSIONING

Carry out flushing and cleaning of the system prior to the system commissioning and in accordance with BSRIA Refrigerant pipework to be pressure tested with oxygen free nitrogen to 40 bar for a 24 hour period and checked for leaks and vacuumed and dehydrated to –752mm Hg for a 12 hour period. Refrigerant charge required for each system to be calculated by manufacturer/supplier in accordance with manufacturer's recommendations and charged via an appropriate charging station.

Each system to be run and tested with all temperatures, pressures and safety device settings recorded. Operation of all controls to be tested and demonstrated.

8. SPECIALIST CONTRACTOR

The complete VRF installation shall be undertaken by a Mitsubishi approved contractor under the Mitsubishi "Business Solutions Partner" scheme which provides a 7-year warranty to the system installation and equipment.

The following sub-contractor listed under the same scheme which the contractor may seek prices for the system.

Coolair Equipment Limited

Address 19 Hollingworth Court, Turkey Mill, Ashford Road, Maidstone, Kent ME14 5PP

Contact John Otterson, Tel: 01622 762222

SECTION 4A THERMAL INSULATION - STANDARD DETAILS

1. EXTENT

The Contractor shall provide and install thermal insulation as detailed below:-

Heating, Mains/cold water, Hot Water, Internal Soil/Waste and Rainwater Pipework.

2. GENERAL

The whole of the thermal insulated work detailed in this Section shall be carried out by a firm of specialists, approved by the Engineer, employing skilled craftsmen used to the class of work and finish required and shall comply with the provisions of BS 1334 and BS 1588.

The various types of insulation material detailed in the subsequent Clauses of this Section shall be applied to the works as set out in Part 3.

All insulating materials, however fixed, shall be in close contact with the surface to which it is applied and all joints shall be sealed after ensuring that the edges of sectional material, where employed, are in close contact with one another over the entire insulated surface.

The integrity of a vapour barrier is of prime importance and all joints/ends must be adequately sealed.

3. INSULATION MATERIALS

The following basic materials shall be used to make up the insulating layers detailed subsequently:

Glass Fibres - Bonded

Bonded glass fibre material shall consist of glass drawn out into fine flexible fibres and bonded with a thermosetting resin into rigid slabs. The density shall be approximately 96 Kg/m^3 and the thermal conductivity not more than 0.039 W/m°C at 80°C and 0°C mean.

Glass Fibre - Mat

Glass fibre mat shall consist of glass drawn into long flexible fibres free from shot. The density shall be approximately 48 Kg/m^3 exclusive of finish and the thermal conductivity not more than 0.045 W/m°C at 75°C and 0°C mean.

Expanded Polystyrene

Expanded Polystyrene shall be of cellular foam plastic, self-extinguishing grade, moulded in slabs or sections. The density shall be approximately 25 Kg/m^3 and thermal conductivity not more than 0.034 W/m °C at 20°C.

Flexible Expanded Polyurethane

Flexible expanded polyurethane shall be cellular foam plastic, self-extinguishing grade, moulded slab of sectional form. The density shall be approximately 30 kg/M3, and the thermal conductivity shall not be more than 0.026 W/m °C at 20°C and 0°C mean.

Phenolic Foam

Rigid phenolic foam shall be of a non-communicating cellular structure foamed from phenol resins, moulded into slabs or sections. The nominal density shall be 35 kg/M3 and have a thermal conductivity not more than 0.029 W/m°C at 20°C and 0°C mean.

4. REINFORCEMENT

Where reinforcement is called for, or required, in connection with insulating materials, it shall be one or other of the following:

Galvanised wire netting manufactured to BS 1486 to 25mm mesh by not less than 0.9mm thick.

Galvanised wire, either 0.9mm spirally wound at approximately 75mm pitch or 1.2mm when used in single strands at right angles to the axis of the pipe.

Aluminium bands 20mm wide by 0.5mm thick, with galvanised wire end loops.

Fine cotton scrim cloth incorporated in a hard set material just below the finished surface.

5. INSULATION FINISHES

Insulation shall, according to the specific requirements of the service and area concerned, be finished as follows:

Bare rot-proof and fire resistant cotton canvas fabric as on sectional insulating materials.

Keenes gypsum based plaster, over slab sectional material, mixed and applied by trowel to an approximate thickness of 13mm, reinforced and finished smooth.

Waterproof Poly-isobutylene sheeting wrapped on to insulation and sealed longitudinally and circumferentially with the appropriate solvent.

Rigid sectional glass fibre bonded to a reinforced aluminium foil coated with white lacquer to give Class 'O' facing (WCO).

Rigid sectional glass fibre bonded to a reinforced aluminium foil bright Class 'O' facing (BCO).

Galvanised sheet steel cladding, the material being not less than 0.5mm. Such shall be applied over pipe sections or slab material secured with cadmium plated self-tapping screws. Cladding shall be applied to pipe beds, etc, in the form of multi-segmented lobster back sheets secured as for straight runs.

Glass reinforced laminate of aluminium foil and paper, sealed with 50mm wide self-adhesive aluminium foil having a minimum thickness of 0.5mm.

Aluminium foil facing with off-white plastic finish, sealed with 50mm wide self-adhesive foil tape finished to the same standard.

Embossed aluminium sheet cladding, the material being not less than 0.6mm, shall be applied over the pipe sections or slab material secured with a suitable number of self-sealing pop-rivets. Cladding shall be applied to the pipe bends etc, in the form of multi-segmented lobster back sheets screwed as for straight runs. All square edges shall be provided with reinforced seams.

6. RIGID SECTIONAL PIPE INSULATION

Rigid sectional pipe insulation shall consist of prefabricated moulded lengths manufactured from the required basic material. Such sections shall, in all cases, be prepared on mandrels having the exact diameter of the pipe to be insulated. Sections shall be formed in half pipe units or segments approximately one metre long, to the thickness required.

The rigid section shall be manufactured with an enclosing cover/finish of a type detailed in Clause 2.08.4. Such covering shall have been attached to the sections with a suitable adhesive so as to provide a segmental hinge on one side and a 25mm lap on the other side and at one end. Site fixing shall include the sealing of the lap by further adhesive and bands fitted 4 per one metre section.

7. FLEXIBLE PREFORMED PIPE INSULATION

Flexible preformed pipe insulation shall consist of moulded lengths of the basic material. Such lengths shall, in all cases, be prepared on mandrels having the exact diameter of the pipe to be insulated. Sections shall be formed in lengths of up to two metres, to the required thickness, split longitudinally down one side.

Site fixing shall include sealing all joints with an approved adhesive prior to the application of a 25mm wide self-adhesive black tape as recommended by the insulation manufacturer.

Pipe Fittings, Etc

Pipe Fittings, bends, elbows, tees etc, on pipe runs shall be insulated with sectional material to the same detail as for the straight runs. The prefabricated lengths being cut or bent as required to form a casing for each fitting. Such casings shall be attached as for straight runs, all joints being sealed as detailed previously in this section.

Where hangers and/or supports occur along the run of insulated hot pipes, the insulating materials shall be cut back to permit the protrusion of the support.

Where hangers and/or supports occur along the run of insulated cold pipes, a segmented section of hardwood or polyurethane approximately 100mm long, shall be insulated pipe and the ends thereof butted tight to the insulation.

Valves, Flanges and Pumps

At valves, flanges, unions, test holes, test pockets, pumps and manholes, etc, insulation shall be cut back, where required, to permit the removal of bolts, etc, and allow for the application of prefabricated insulating pads in the case of test holes or test pockets and insulating boxes made in two or more sections for valves, flanges, union, manholes and pumps.

The pads shall be a section of insulation material as for the adjacent pipe or duct finished to the same standard to suitable means of attachment.

The valve/flange boxes shall be made in two halves from embossed aluminium sheet not less than 0.8mm thick. Such to be provided with reinforced corners, toggle clips, collars for clipping to adjacent insulation and linings of Phenolic foam to the same thickness as used for adjacent pipes, all cavities being completely filled with “Densofil”, In the case of valves, such covers shall enclose the whole body, leaving the minimum spindle protrusion. A separate removable insulated cover shall be provided for the handwheel/operating lever with a sponge rubber gland sealing ring to spindle.

8. RECTANGULAR AIR DUCT INSULATION

Insulation to rectangular air ducts shall consist of pre-formed slabs of basic material cut to site to suit the particular application so that the top and bottom pieces overlap the sides.

The air ducts shall be thoroughly cleaned prior to the application of the recommended contact adhesive in beads at 150mm centres. In addition, the insulation on the underside of the ducting shall be secured using self-adhesive hangers and washers spaced at 300mm centres. As this work proceeds all necessary precautions shall be taken to ensure that all joints are close butted.

All joints shall be sealed by the application of purpose made 50mm wide self-adhesive tape as recommended by the insulation manufacturers. Where the self-adhesive hangers penetrate the finish, the continuity of the vapour barrier shall be maintained by the application of a sealer approved by the insulation manufacturer.

Where supports occur, the insulation shall be applied direct to the ductwork the insulation being protected, by means of sheet metal hoops or straps, against movement of duct and/or hanger.

9. CIRCULAR AIR DUCT INSULATION

Insulation to circular air ducts shall consist of pre-formed rigid sections up to and including 450mm diameter and with slotted laminate for larger sizes.

The air duct shall be thoroughly cleaned prior to the application of the recommended contact adhesive in beads at 150mm centres and secured with bands at 450mm centres.

All joints shall be secured by the application of purpose made 50mm wide self-adhesive tape as recommended by the insulation manufacturers.

Where supports occur, the insulation shall be applied direct to the ductwork, the insulation being protected, by means of sheet metal hoops or straps, against movement of duct and/or hanger.

10. FLOOR DUCT FILL

Where an unventilated floor duct is used to accommodate pipework conveying natural gas, the entire trench shall be filled with a powdery type material such that no air pockets or cavities are left.

Where heating pipework is run within a sheet metal capping, the cavity shall be totally filled with an Urea Formaldahyde type insulating foam.

11. MAKING GOOD EXISTING INSULATION

Repairs to thermal insulation disturbed in making connection to existing pipework and/or plant shall be carried out as part of the work.

Thickness of insulating materials shall be as follows:

Pipe-work or Item Size	Performed Rigid Insulation Thickness
15 mm (½")	25 mm
19 mm (¾")	25 mm
25 mm (1")	25 mm
32 mm (1¼ ")	32 mm
40 mm (1½")	32 mm
50 mm (2")	32 mm
65 mm (2½ ")	32 mm
80 mm (3")	32 mm
100 mm & over	44 mm
Supply Air Ductwork	50 mm

SECTION 4B THERMAL AND ACOUSTIC INSULATION - SPECIFIC REQUIREMENTS

1. EXTENT

The works under this section comprises the provision of thermal insulation to the following services:

LTHW service pipework/fittings

Cold water services pipework/fittings

Hot water services pipework/fittings

Internal soil and rain water pipes to prevent condensation and to add acoustic performance.

The works are to be to BS 5422. All materials used are to be non-flammable to BS 476. Unless specified otherwise, the works are to be in accordance with Section 4A.

2. IDENTIFICATION

All services in risers, boiler and wiring cupboards and for central plant identified in accordance with BS 1710 with lettering as Part 2 of this BS.

3. PIPEWORK - GENERALLY

LTHW and Hot Water Service Pipework

Insulate with performed sections manufactured from CFC free Koolphen K Phenolic foam with factory applied reinforced aluminium foil vapour barrier jacket. Nominal density 50 kg/m^3. Mean thermal conductivity of insulation to be 0.020 w/mk at 20°C and 0.025 w/mk at 80°C.

Insulation thickness to be 20mm where pipework and ductwork run internally and 30mm where run externally exposed to ambient conditions. At crossovers in the floor void and at areas where pipework passes close to electrical ducts etc insulation may be trimmed or reduced in thickness locally.

All joints to be tightly butted and insulation secured with 3 aluminium bands per metre length.

Bends and elbows to be insulated with carefully mitred segments of insulation secured by aluminium bands.

At valves and fittings where concealed (i.e./ in ceiling voids, riser ducts, plant cupboards etc.) insulate with 13mm thick class 'O' Armaflex manufactured by Armstrong World Industrial, oversized sections secured with aluminium bands, arranged for easy dismantling and reinstatement to enable access to valves.

Cold Water Service Pipework

Insulate in accordance with Clause 3.1 above with the addition of vapour sealing of the entire pipework systems. All sections shall be butt jointed tightly and sealed with 50mm wide aluminium foil tape self adhesive, to match the factory applied facing.

At valves, fittings and other terminations of the continuous vapour seal, chamfer the insulation and bond the aluminium foil to the pipe either side of the valve/fitting to prevent moisture entering the insulation.

Insulate valves and fittings with class 'O' Armaflex and self adhesive aluminium tape overlapping to form a vapour seal.

Refrigerant Pipework

Insulate with Class O Armaflex.

Any metals part not insulated are to be painted with anti-condensation paint.

Condensate pipework

Insulate condensate stacks in accordance with clause 3.1 above with the addition of vapour sealing of the entire pipework systems. All sections shall be butt jointed tightly and sealed with 50mm wide aluminium foil tape adhesive, to match the factory applied facing.

At fittings and other terminations of the continuous vapour seal, chamfer the insulation and bond the aluminium foil to the pipe either side of the valve/fitting to prevent moisture entering the insulation.

Insulate fittings with class 'O' armaflex and self adhesive tape overlapping to form a vapour seal.

4. HOT WATER STORAGE CALORIFIERS

Plant to be supplied pre-insulated by manufacturer as specified.

5. AIR HANDLING PLANT

Plant to be supplied pre-insulated by manufacturer.

6. FIRESTOPPING OF SERVICES

Provide at each floor level fire resistant caulking or intumescent sealing to a rating required by the fire officer. Where voids or service spaces are compartmentalised to prevent the spread of smoke or fire comply with the compartmentalisation and seal services to match.

SECTION 5 AUTOMATIC CONTROLS

1. EXTENT

The work under this section comprises design, provision, testing and commissioning of control systems for the following,

Hot and cold-water services

Mechanical kitchen ventilation systems

Gas safety system

Mechanical toilet extract systems

LTHW system

Comfort cooling system

Frost protection

The control systems comprise the provision of all control equipment such as - sensors, controllers, sequencers, actuators, motor starters, load controller, control cubicles, including all interconnecting control wiring. The control components are to be as manufacturers proprietary controls.

Ensure that the controls manufacturer selects the proper control equipment including valves, dampers etc, to ensure a satisfactory operation of the system. Ensure that the necessary information concerning final flow rates etc is provided to the controls manufacturer to enable the correct selections to be made.

The control system is to include all thermostats, sensors, controllers, valves, dampers, damper operators, pressure switches, relays, starters and control equipment including associated control wiring. All starters, unless otherwise specified, are to be provided where necessary to give adequate protection of the plant.

2. CONTROL SYSTEMS

Provide standalone domestic type controllers for each unit to provide time scheduled control of heating and hot water services as required by the occupants. Time switch to gas fired boilers to have 7 day (weekday/weekend) facility. Provide room thermostat/integral temperature sensor in time switch for frost and condensation protection for each area.

3. CONTROL VALVES

Provide automatic control valves with control ranges and pressure characteristics compatible with the services being controlled.

The control valves provided are to be of a plug and seat type arrangement with a minimum a rangeability of 1 in 50.

4. HEAT GENERATION

4.1 General Description

The LTHW system is to be provided with water at a design flow temperature at 60°C and return temperature of 40°C via the individual boiler plant as specified in Section 3. The LTHW system will serve the radiators with local TRV control.

Controls for heating installations shall be robust and shall include a time clock and programmer. Controls shall be located in the kitchen or service cupboard.

The boiler manufacturer controls are integral to the boiler and these shall include the following features:-

- 7 day multiple ON/OFF programmer (with battery reserve) manufactured by Bosch or Honeywell/Danfos.
- Weather Compensator.
- Programmable Room Thermostat, to allow a minimum of 6nr temperature setting per day.
- Provide all wiring for the controls system.

All the controls components are to be from the same manufacturer and are to be installed in accordance with the manufacturer's instructions.

4.2 Flow Temperature Control

The combination boiler controls shall be set to provide LTHW at 60F°C – 40R°C.

The combination boiler shall provide hot water at 55°C

A temperature sensor located in the flow from the boiler shall be arranged to maintain the design flow temperature of 60°C (adjustable).

4.3 Circulation Pumps

The pumps are to be energised via the time channel setting on the domestic controller in each unit. Provide run on facility to pumps to maintain flow through boilers after shutdown to remove residual heat.

4.4 Frost Protection

If the temperature sensed by an internal temperature sensor located in each kitchen controller falls below 10°C (adjustable) the boiler in that area shall be initiated, overriding the time control but maintaining start sequencing and shall continue to run until the internal temperatures rises to 12°C (adjustable).

5. EXTRACT FANS

Toilets.

During occupied hours the extract fans serving the toilets shall be provided with continuous operation via time clock control (adjustable). For out of hours operation the toilets shall be provided with PIR presence detector arranged to operate when occupation is detected with timed override facility to provide fan minimum run time after occupation ends of 10 minutes overrun (adjustable).

Kitchen extract fans

Local on/off controller with integral humidistat override control and run on timer.

6. COMFORT COOLING SYSTEM

The DX Split systems are to be controlled by the manufacturer's proprietary controls system, to include the following operational facilities: -

- Time scheduled control of the internal fan coil units and external condensing units serving each tenancy, with separately programmable time schedules for weekdays and weekends.
- Each fan coil unit shall be capable of having heating and cooling output controlled by a integral or remote mounted room controller to control the temperature, fan speed and on/off of the unit.
- Each group of fan coil units within each respective tenancy shall have a central zone controller to allow control and monitoring of each respective fan coil units.
- Sequenced start-up of fan coil units and condensing units to reduce starting current when systems initially enabled.
- Link to fire alarm system to automatically shut down system on signal from fire alarm. Systems to automatically reset to normal operation when fire alarm condition cleared.

7. PLANT LOCAL ISOLATORS

Local isolators of starter controlled plant will incorporate auxiliary contacts and will be provided by the electrical installer. Provide within the control panels the necessary auxiliary terminals to break the starter coil circuit when the local isolator is operated.

8. WIRING

The work under this section comprise the design, provision, installation, testing and commissioning of control systems for each tenancy.

The mechanical installer is to include for all control wiring and final connections of power wiring to equipment from local isolators provided by the electrical installer. Provide control wiring between each type of control equipment and the panels as necessary, using screened cables or where required by controls manufacturer in conduit or trunking.

The number and size of cables to each control device is to be as required by the controls specialist, segregated as necessary. The wiring is to be carried out to the requirements of the latest IET Regulations and the system is to be fully earthed and bonded and tested in accordance with the requirements of the controls equipment manufacturers.

SECTION 6A AIR SYSTEM - STANDARD DETAILS

1. STANDARDS

To be to Part 1, except as specified.

2. DUCTWORK

Provide true section ranges of airtight sheet steel ductwork as later specified fabricated from galvanised steel sheets with lock formed or riveted seams and stiffening all to the recommendations of the Heating and Ventilating Contractors Association specification DW 144 and addendum DW/TM1 except as specified.

End and offset centreline radii to equal at least one width of duct unless otherwise shown. Changes in section of duct to be tapered. Branches to be taken off with easy sweep bends at normal bend radii. Provide guide vanes at all positions later specified and wherever not possible to install at the radii specified.

Provide 75mm slip joints between all fixed points such as between grilles, bends and branches, except where flanged joints are installed. Make good all cut edges and other abrasions to the galvanising by painting with two coats of a suitable zinc based paint. Mount thermostats, etc. in ducts with screw fixed plate and gasket.

Provide flexible ducts only where specified or approved and of an approved make.

Treat for protection all ductwork subject to external atmosphere and/or high humidity conditions as specified.

Where protection is not so specified submit quotation for such protection as needed.

Prepare and submit for acceptance detail shop ductwork fabrication drawings from measurement taken on site.

Fabricate and erect ductwork using an approved specialist. State name at time of tender. Submit as directed for approval any piece of ductworks at works.

3. SUPPORTS

Support ductwork at centres of not more than 2.5m on purpose made hangers, cantilever brackets etc. constructed of material not lighter than specified for angle joint flanges. Provide "Lindaptors" or equal clips to support ducts from exposed steelwork and in no circumstances drill steelwork without approval. Provide "Rawlbolts" or equal to support ducts from beam casings or roof slabs. Provide any needed steelwork to support ductwork at high level in plant rooms etc. with anti-vibration mountings required for filters, fans, air heater batteries, sound insulation, fire dampers etc.

4. FLEXIBLE CONNECTIONS

Provide flexible connections on the suction and discharge connections to all fans and in any duct crossing a building expansion joints made with best quality air tight sailcloth except for kitchen extract and similar high fire risk fans where connections to be made with approved flexible fireproof material.

5. ACCESS DOORS

Provide access doors in the suction and discharge branches of all fans, filters, heaters, coolers, humidifiers etc. adjacent to all dampers on all duct runs at intervals of not less than 10 metres and wherever else specified to give generous access for inspection, cleaning and maintenance.

Hinge doors to ductwork framing and secure in closed position by approved type of fixing device to give airtight joint.

6. EXTERNAL LOUVRES

Provide, where later specified external louvres constructed from sheet steel not less than 2mm thick or as later specified in angle iron framing with 25mm wire mesh bird guard and blades arranged to prevent entry of driving rain, all galvanised after manufacture. Mount to wood frame provided by the main contractor.

7. PROVISION FOR TESTING

Provide for testing at suitable positions on the upstream and downstream side of each fan, heater, cooler, filter etc. 25mm diameter hole covered by test plug.

8. TEST AND COMMISSION

Test and commission as Code series A issued by the Chartered Institution of Building Services Engineers providing all design information that code requires.

9. BALANCING DAMPERS

Provide balancing dampers where specified and on all branches from main runs of ducting serving two or more grilles or diffusers of the multi-lead type except that butterfly dampers with the spindle parallel to the long side may be used in ducts having a long side not exceeding 450mm and short side not exceeding 300mm provided there is a sufficient length of straight duct for leak in open position. Blades to be aerofoil section in air streams exceeding

10m/s velocity, may be flat at lower velocity.

Provide with each damper quadrant arm and operation lever mechanism with clamping device with oiling nipples to all bearings, and engrave or otherwise permanently mark quadrant with scale showing correct setting for design conditions, full fresh air, where applicable and closed.

10. AUTOMATIC DAMPERS

Provide, unless otherwise specified, automatically operated motorised dampers on the fresh air inlet, exhaust to atmosphere and recirculation branches of each plant with provision for recirculation on the suction or discharge branch of each fan in a plant having duplicate fans and wherever else specified, constructed as specified for multi-leaf dampers except where ball bearings and with damper matched to the resisting torque of the damper and linkage and interlocked with appropriate fan motor starter. Damper motors to incorporate auxiliary switch to close as the damper closes with control arrangement and use of auxiliary switch, if required, as specified and/or needed for satisfactory operation.

11. FIRE DAMPERS/SMOKE DAMPERS

Provide in all ducts where passing through a fire resisting barrier (floor, wall or partition) and where specified, fusible link operated single or multi-leaf fire dampers or foil or other type, or as specified, constructed to BS 476, BRE recommendations and/or local regulations of rating equal to barrier, set to close in the event of air stream reaching in excess of 65^0C with access door adjacent to and upstream for testing and fusible link replacement.

Smoke and fire dampers shall be powered open and closed and shall be complete with battery pack and local controller. Integral smoke detectors shall be provided and linked to the fire alarm system.

Fire dampers and smoke dampers shall be supplied by Actionair Ltd

12. DAMPER APPROVAL

Submit for approval before manufacture detail drawings of all damper types.

13. FANS GENERALLY

Provide fans in the positions and of the types, sizes and capacities specified when handling air at a density of 0.82cub m/kg or as appropriate to temperature made as specified, or, where not so specified by Matthews & Yates Limited, Keith Blackman Limited, Woods of Colchester Limited, Brooks Ventilation Limited or equal.

Fan motors to be to Part 1, Section 3, except "super silent" with motor speeds not exceeding 960 rpm and suitable for the available electricity supply. Generally this will be three phase but check before placing orders.

Finish casing and all metal parts, inside and out with primer and two coats of suitable paint.

Submit for approval prior to manufacture drawings detailing the general arrangement and associated builderswork.

Fan capacities later specified which do not include the 5% margin required by the British Standard specification which is to be added unless inherently available in the fan design, have been calculated by aggregating the specified resistance of filters, air heater batteries etc. with the ductwork resistance calculated to the factors of the CIBSE Guide.

Check resistance of installed system and provide fans with duties as needed to produce specified flow rate.

Submit for approval calculations and provide fans of characteristics as required. Where feasible this may be by provision of alternative pulleys to any belt driven fan.

14. CENTRIFUGAL FANS

Impellers to be of the multi-vaned type with forward curved blades or of the Centrifugal fans to comprise heavy steel plate housing stiffened against drumming having flanged outlet for all sizes and flanged inlet spigot where the inlet diameter exceeds 600mm. Arrange to allow for access to impeller with impeller bearings supported from both sides of the fan casing by bearer bars, unless otherwise specified with access door scroll casing to facilitate inspection and cleaning and drain pad and plug at the lowest point.

Non overloading backward curved type, or as specified, with vee belt drive enclosed in heavy gauge wire mesh guard galvanised after manufacture and with fan motor mounted onto adjustable slides rails.

15. AXIAL FLOW FANS

Axial flow fans to comprise heavy steel plate housing stiffened against drumming and lined with "Silence" or other suitable acoustic treatment with flanged inlet and outlet connections, the impeller direct driven from an electric motor supported resiliently and axially from the fan casing, with casing access door to facilitate cleaning and inspection and drain pad and plug at lowest point in casing and with grease nipples or oil filler caps extended through the casing for external access.

16. FILTER MANOMETERS

Provide on casing connected across each air filter by copper tube dyed blended paraffin filled inclined precision bore glass tube manometer on stove finished mounting with adjustable scale and condition markers.

17. HOT WATER AIR HEATER BATTERIES (where fitted)

Provide in the positions and of the sizes and capacities later specified, or where not specified of suitable capacity for the system, hot water air heater batteries comprising 12mm bore solid drawn copper tubes, with plain copper or aluminium fins expanded onto them, expanded and brazed into purpose made headers having screwed connections, suitable for the hot water primary conditions of temperature and pressure elsewhere specified of hydraulic resistance not exceeding 1200mm water gauge and resistance to air flow not exceeding 2.5mm water gauge made as later specified or where not so specified by F H Biddle Limited or other equal.

18. AIR GRILLES

Provide in the positions and of the type, sizes and capacities detailed on the drawings, air grilles to introduce into or to exhaust air from the ventilated spaces each complete with adjustable directional control and multi-blade opposed blade air volume control damper and all necessary ancillary equipment for easy adjustment and cleaning.

Except where to be fitted directly to ductwork, air grilles to be seated on a sponge rubber or equal gasket and fixed to timber or similar frames and grounds provided by the Main Contractor.

Air grilles to be made from mild steel or aluminium and are to be finished with cellulose enamel of a colour to be approved and applied to both the grille face and to all visible screw heads and made as later specified, or where not so specified by AMP Limited.

19. ACOUSTIC ATTENUATION

Take all necessary measures, including where necessary the provision of acoustic attenuation equipment, so that the total sound pressure levels in both the ventilated spaces and all other areas do not exceed the values of noise criteria curve NR 35 unless otherwise stated in BB documentation, or as otherwise later specified, when measured by a sound spectrometer at a height of 1.5 metres above finished floor level during a still night or other suitable time when the plant is running and all other sounds are at their lowest level.

Where acoustic attenuation equipment is later specified, this will be adequate to meet the specified requirements with the information currently available, but check the actual acoustic characteristics of the fans, heaters, ductwork etc. as installed and provide as necessary to meet the specified sound level requirements. Submit fully certified sound reassure levels over the range of frequencies from 63 Hz to 8kHz to demonstrate attenuation has been provided as specified.

Appreciate that poorly executed ductwork can lead to increased sound pressure levels. Provide any additional acoustic treatment needed arising from this and similar matters.

The acoustic attenuation equipment is to comprise the necessary non-flammable and non-hygroscopic sound absorbing material applied in suitable steel casings with flanged ends for connecting to ductwork or as an acoustic duct linking, all generally as later specified. In all cases the free cross-sectional area of the ductwork is to be maintained to the sizes specified.

SECTION 6B MECHANICAL VENTILATION

1. EXTENT

The works under this section of the specification comprise all works necessary and provision and commissioning of mechanical toilet extract ventilation as described in the specification.

The systems are to be complete with, ductwork, dampers, grilles and attenuators etc., in accordance with this specification and Section 6.

2. DESIGN BASIS

The system is to be designed in accordance with CIBSE Guides, Local Authority requirements and to meet the following criteria:-

Hall and Stage areas	Natural ventilation by manually openable windows
Kitchen areas	Mechanical extract ventilation (to comply with AD Part F) with local manual control. Natural purge ventilation via manually openable windows.
Toilets/Bar/Bar store	Mechanical extract ventilation, minimum 10 air changes per hour or to comply with AD Part F whichever is greatest. Make up air drawn from adjacent areas via undercut doors.
Staff accommodation	Natural ventilation by manually openable windows
Store rooms	Trickle vents to limit the risk of condensation
Plant areas	to British Standards

In each case the static pressure drop per metre shall not exceed 1.5 Pa/m

Noise levels in each room shall not exceed NR 38 and the noise level in any adjacent occupied unventilated space shall not exceed NR 38.

Provide sufficient access doors throughout the entire route of the ductwork to allow access for cleaning. Where possible do not install access doors to the underside of the kitchen extract ductwork.

Ensure good access is provided to the filters for regular replacement. Provide each filter assembly with an easy means of withdrawing and clamping the filter media.

Ensure the filters fit tight into its frame and fix every such frame so that there is no bypass of air around the filter/frame assembly.

Supply and install, after the final testing and commissioning, a new set of filters in every filter unit to ensure that the works are handed over to the employer with clean filters at practical completion.

4. TOILET EXTRACT FANS

The works under this section comprise the installation and commissioning of mechanical extract ventilation. The systems are to be complete with fans, ductwork, dampers, grilles, etc in accordance with the specification and Section 6A, unless otherwise specified in this Section.

The Contractor shall supply and install an extract fan system to serve the each bedroom ensuite and WC. This shall include an inline ducted ceiling fan complete with integral controller. The ducting shall extend and terminate to the ceiling extract valves. The Contractor shall allow all necessary volume and fire dampers and attenuators as required.

5. DUCTWORK

Galvanised sheet metal ductwork is to be manufactured in accordance with Specification DW 144 produced by the Heating and Ventilation Contractors Association and Section 6A of this Specification. The systems are to be medium velocity, medium pressure. Alternative UPVC duct work is acceptable

Flexible Ductwork

All flexible ductwork connections to be as manufactured by Meklok Compoflex or equivalent. Supply ductwork to be pre-insulated with 25mm mineral wool insulation and aluminium polyester sleeve vapour barrier. Extract ductwork need not be insulated. Support at maximum centres of 1.5 meters.

6. VOLUME CONTROL DAMPERS

At all branch ducts provide opposed blade balancing dampers as manufactured by Waterloo Ozonair or equal and approved.

Modulating Dampers

Modulating dampers shall comprise of opposed blade dampers all located within the unit casework, each damper shall be sized to accommodate the internal fitting of a 'Belimo' type damper actuator.

Each damper blade shall be constructed from double skin epoxy coated aluminium aerofail profile blades fitted with rubber edge sealing strips, mounted in an aluminium casework.

Each damper blade shall operate via its own heavy duty ABS plastic gear wheel.

7. FIRE DAMPERS

Where indicated and where ductwork passes through a fire barrier, provide fire dampers with fusible link, or smoke detector operated release complete with manufacturers installation frame as manufactured by Actionair or equal and approved.

Obtain Local Authority and Fire Officer approval and allow for testing the dampers to the Fire Officer's requirements.

8. ACCESS DOORS

Adjacent to volume control dampers, for fire damper access and in accordance with DW 144 provide access doors.

9. GRILLES AND DIFFUSERS

Provide as indicated in the drawings/schedules grilles and diffusers complete with purpose made plenum boxes/neck reducers as required, including fixing clips and sealing strips/joints to form an airtight seal with the ductwork. Provide necessary supports for plenum/diffuser assemblies from structure.

Colour/finish of grilles and diffusers to be as BS or RAL colour to be approved by the Architect. Allow in tender for standard BS or RAL colour to be advised.

10. EXTERNAL LOUVRES

Provide external louvers as indicated on the drawings/schedules. All louvers to be complete with bird screen and finished in RAL or BS colour to be approved by the Architect.

SECTION 7 GAS SERVICES

1. EXTENT

The work to be carried out in this section is the alteration of an existing gas service serving the gas fired LTHW boilers.

The existing incoming supply and meter at ground floor level shall be maintained. The contractor shall complete modifications of the existing gas service pipework from the gas meter to all outlets served comprising two new combination boilers located within the plant area and new kitchen.

Provide gas distribution systems and connection to gas fired boiler. The gas safety system shall have interlocks to a gas solenoid valve which shall switch off the gas supplies on detection of gas leaks within the plant room and when the fire alarm system is activated.

Gas distribution to be capable of providing sufficient gas flow for the simultaneous demand for site at a pressure required meeting the requirement of British Gas and/or the equipment with the highest gas pressure requirement whichever is the greater.

All Gas system works shall be by a Gas Safe Approved supplier and installer.

2. GAS DATA

The gas supply available will be natural gas with a declared calorific value of 10.53 kWh/m³ and the pressure at the meter outlet of 2.09 kPa.

3. GAS PIPEWORK AND FITTINGS

All above ground pipework is to be of black mild steel tube to BS 1387 of medium quality for sizes 3/4" and 1/2" bore, and heavy quality for 1" bore and above. Joints are to be welded, except that final connections of less the 1/2" bore, which are to be made in light gauge copper tube to BS 659 with capillary soldered fittings.

Underground pipework is to be polythene to BGS/PS/PL2 Part 1 and fittings to BGS/PS/PL2 or PL3 except in respect of pipe markings.

The number of joints is to be kept to a minimum.

Where pipework is installed in the riser space provide ventilated u-PVC pipe casings, with intumescent fire sleeves where the casing passes through the plantroom wall/fire barriers.

Where pipework run through ceiling or floor voids they are to be enclosed by a pipe sleeve or trunking which is ventilated to outside and fire rated to the same fire integrity of the area through which the pipe is passing through.

All pipework to be installed to requirements of IM16.

4. CONDENSE POCKETS GAS PIPEWORK

Pipe runs are to be run continuously towards the points of connection wherever possible and otherwise to specified low points.

Provide and fix at all low points scale and drain pockets comprising tubular pocket of the bore of the line, but not exceeding 2" diameter with 1/2' valve drain.

5. GAS CONTROL VALVES

Provide and fix gas control valves on the inlet side of all equipment. Valves are to be accessible and are to be lubricated plug cocks having screwed ends, open/close indicator and operation wrench.

6. GAS GOVERNORS

Constant pressure gas governors are to be fitted on the inlet to all gas equipment adjacent to the gas cock. Include for checking that all equipment is supplied with suitable governors.

Adjust all gas governs to give the pressure required and particularly ensure that all packing discs are removed.

7. GAS APPROVAL

The whole of the gas installation is to comply with the requirements of the Gas Safety Regulations 1998 and any specific requirements of the local gas company.

8. PAINTING

Paint all pipework in accordance with Part 1.

9. METERS

Existing utility gas meter is to be maintained.

SECTION 8 ACOUSTIC ATTENUATION AND ANTI-VIBRATION

1. EXTENT

The works to be carried out in this section comprise the supply and installation of all acoustic and anti-vibration equipment for the building.

Supply and install acoustic plant attenuation and anti-vibration equipment as required.

Note, all acoustic equipment visible externally is subject to approval by the Planners.

All major plant items and main pipe runs in ducts and risers are to be supported to avoid:-

- Excess stress by thermal expansion/contraction
- Transmission of noise/vibration and loading to building structure

2. THERMAL MOVEMENT

The entire pipework system is to be submitted to a specialist for review and their recommendations incorporated into the final scheme for installation. Where possible movement shall be absorbed by physical arrangement of pipelines but where this is not possible guided compensators shall be used. All equipment shall be selected to suit the working pressure of the systems.

Finned tube heating elements below pew tiers is to be provided with appropriate anchoring and expansion bellows to compensate for pipe length.

The specialist shall be Engineering Appliances or equal.

3. VIBRATION AND NOISE

All vibrating equipment like fans, pumps and other equipment with moving parts shall be mounted on anti-vibration mountings and/or inertia bases to minimise the transmission of vibration to the structure.

The acoustic supplier shall be Emtec Products Limited (020 8848 3031) or equivalent, who shall confirm that all noise criteria are met against the final plant selections and working drawings layouts and details.

SECTION 9 MAINTENANCE

1. EXTENT

The tender is to include a full maintenance contract throughout the 12 months defects liability period on all the mechanical and controls equipment. The 12 month defects period is to commence at practical completion of the entire contract works, irrespective of any partial handover.

Maintenance work and maintenance intervals are to be to the manufacturer's recommendations or where this is not stated to CIBSE or BSRIA recommendations.

2. RESPONSE TIMES

Provide the following response items:

- Emergency Call (Fire/Flood/No Power/No heating etc) : Within 4 Hours
- Priority Call: Within 24 hours
- Standard Call: By arrangement

Contact numbers are to be issued prior to commencement of the contract.

All call outs would be deemed as chargeable in accordance with our day work rates.

Submit indicative maintenance proposals with tender.

PART 4 PARTICULAR SPECIFICATION - ELECTRICAL SERVICES

SECTION 1 EXTENT OF WORKS

1. EXTENT

The scope of the works shall include the design, supply, assembly, installation, connecting up, testing and setting to work of the new electrical installation as listed below and as described in the relevant sections of this specification.

The descriptions are not intended as a comprehensive itinerary of the work contained but to give an overview of same which when read in conjunction with the other sections of the specification to give a comprehensive description of the services to be provided.

- Isolation and removal of existing services and/or services made redundant by these works
- New Sub-main distribution
- Lighting and emergency lighting throughout the building
- External lighting
- Lighting Controls
- Small power installation
- Power wiring to mechanical services
- Fire Alarm system
- Access Control
- Data/Telephone wiring and containment
- CCTV System
- Intruder Alarm System
- AFILS
- Earthing and bonding
- Containment for all electrical services
- Testing and commissioning
- Operation and maintenance manuals.

This list of items is provided for the convenience of tenders only and is not to be considered to replace in any way the requirements and intent of this specification all as later described.

All equipment, accessories, etc., shall be complete with all necessary fittings and fixtures to complete the works in every respect.

All builders work associated with the installation will be carried out by the Main Contractor, to be based on drawings showing the extent of the works to be provided by the services Contractor.

Full building constructional details are shown on the Architect's drawings. The Tenderer will be deemed to have reviewed the drawings during the tender process.

The installation shall be read in conjunction with and coordinated with all other building services and the structural layout.

The Contractor shall be deemed to have visited the site to ascertain the nature and extent of works. No claim for additional works shall be considered due to failure to visit the site or interpret the design. Any questions relating to the site or the works must be raised before the return of tenders.

The Contractor shall ensure that they are fully familiar with the extent of the other services to be installed and shall arrange their services accordingly. Agreement shall be reached concerning the physical location of equipment before any work is put in hand.

The Contractor shall allow in his Tender for minor variations of up to 3.0 metres in positions of all such equipment and any such minor variations which are made before installation of the equipment commences shall incur no “extra to

contract" charges. This list of items is provided for the convenience of tenders only and is not to be considered to replace in any way the requirements and intent of this specification all as later described.

SECTION 2 MAINS & SUB-MAINS DISTRIBUTION SYSTEM

1. EXTENT

The work to be carried out under this section of the specification is to include all works necessary for the provision of a complete electrical distribution system.

The site is provided with an individual UKPN incoming service head, 100A TP&N. Currently only one phase is in use providing a 100A SP&N supply via a whole current meter. As part of the proposed extension works with the increase in overall floor area, number of kitchen appliances, comfort cooling and possible specialist stage lighting, the existing provision (23kVA) is not sufficient to meet the increased demand. The proposal is to maintain the existing 100A TP&N service head, replace the existing single phase meter with a new 100A three phase whole current meter.

The contractor shall undertake the following works,

- Test the existing service head to confirm all three phases are live
- Issue and application to UKPN and the utility provider to upgrade the existing meter from 100A SP&N to 100A TP&N whole current meter, served from the existing service head.
- Complete all negotiations and attendance with UKPN/utility provider.
- Provide the required test and commissioning certificates.

Contractor to provide a new three phase MCB distribution board to serve the local distribution boards and mechanical control panels. The board shall be a suitable number of ways as required for ancillary services. Any other circuits necessary to carry out a full installation plus 10% spare ways (minimum of two spare ways).

The new distribution boards shall be split load type suitable for and include sub metering of the lighting / small power / mechanical services within each board as required to comply with the Building Regulations AD Part L.

Provide switchgear, cables, tray, trunking, conduits and accessories etc. as required to provide a complete installation.

Contractor shall complete the design, installation and testing to comply with the requirements of BS7671:2018. The contractor shall be authorised and approved to provide test certificates by NIC EIC.

2. SYSTEM

The Contractor shall design and provide all distribution boards/panels, sub mains cabling/distribution and switchgear to serve all areas of the site.

Provide galvanised trunking for cabling between the services head, meter and distribution board.

New supplies are to be run concealed within the ceiling void.

3. SUBMAINS CABLING

All submain cables shall be via XLPE/SWA/LSZH Cu cables, the contractor shall install a correctly sized separate CPC for each Sub Main. All Sub Main cables shall be fixed to appropriately sized cable tray/ladder in ceiling voids /risers and concealed within building fabric in all other areas.

All steel wire armour cables shall be terminated in accordance with the manufacturer's recommendation using correctly sized and type gland kit complete with earth tag and bolt.

4. DISTRIBUTION BOARDS

Distribution boards shall be Surface mounted within risers as indicated on drawings and offer a degree of protection to IP31. Manufactured to comply with BS EN 60439 pt1 &3.

The distribution boards are to house type B, C & type D MCB's and be complete with appropriately rated integral isolators.

They will be fitted with a hinged door hung by means of internally fixed hinges. When closed, the case is to be dust-proof and entirely free from external lugs or protrusions. Drilling in the case is only to be provided for immediate needs, unused holes will not be permitted.

Metering shall be provided in accordance with the requirements of The Building Regulations Part L.

All busbars shall be in the same position on all poles relative to the bank of MCB's when assembled. Each MCB and neutral connection shall be provided with way numbering identification.

5. MINITURE CIRCUIT BREAKERS

Miniature circuit breakers will be manufactured in accordance with BSEN 60898 Part 1. The current rating of units at 400V (nominal voltage to switch 230 volts).

The category of duty for units 50A and below shall be to 6kA unless indicated otherwise or required.

Where all circuits are controlled by RCD, they shall be divided to a minimum of two groups or RCBO's to protect each individual circuit, refer to the distribution board schedules for specific details.

6. RESIDUAL CURRENT DEVICES

Residual current devices (RCD's and/or RCBO's) shall comply with BS4293, BSEN 61008 and BSEN 61009. The rated voltage, current, breaking capacity and tripping current (sensitivity) shall be as indicated. RCD's shall be capable of detecting pulsating d.c. fault currents.

RCD protection shall be provided to all small power and lighting circuits.

Distribution boards serving kitchen areas shall be provided with RCBO's, to prevent loos of power to all circuits, nuisance tripping of circuits serving refrigerators.

7. LOW VOLTAGE CARTRIDGE FUSES

Cartridge fuses for voltage up to and including 1000V A.C. are to comply with BS 88, Parts 1 and 2.

The rated breaking capacity of the cartridge fuse at the system voltage will be 80KA

General-purpose fuse links are in all cases to have a fusing factor class Q1 unless specifically noted otherwise on the drawings.

8. METERING

The new distribution boards shall be split load type suitable for and include sub metering of the lighting and small power within each board as required to comply with the Building Regulations Approved Document Part L.

Metering solutions shall be enclosed within the distribution board or panelboard. Where not integrated in the base enclosure, the external meterpack shall be a standard catalogue option and shall be designed to easily attach and aesthetically match with the parent enclosure. External meterpacks for MCB Distribution boards must include all necessary cables to connect to the main Distribution board.

Metered type 'A' and 'B' boards shall have meters pre-installed. An option must be available on split-metered boards, which uses a single meter to separately measure the Power and Lighting loads integrated in a single board. The solution shall provide separate connectivity of Power and lighting information (kWh) via two pulsed outputs and options for Modbus RS485 / RTU.

Metering options within type 'B' Distribution boards shall not impact on the capacity of the Distribution board e.g. a twelve way board must provide capacity for twelve outgoing circuits.

MCCB Panelboard Metering should be provided with all necessary wiring looms for connection to the ct's and Meters. Side enclosures for housing the Meters must have hinged doors. Meters must provide a 3 line display of electrical parameters for clarity.

9. POWER FACTOR CORRECTION

Power Factor correction shall be provided to serve the main MCCB panel. Provide a centralised automatic power factor correction, comprising of multi capacitor type, with the phasing of the capacitor being controlled by a microprocessor based relay, to monitor and compensate the reactive power demand on the supply.

The specialist supplier shall size all associated equipment etc.

10. SURGE PROTECTION DEVICE (SPD)

Provide and install a SPD on the incoming supply to provide protection of the electrical services and connected appliances on site.

11. ISOLATING SWITCHES

Each switch is to be provided with facilities for padlocking in the "OFF" position. To prevent accidental contact with live parts, switches of the withdrawal chassis isolating types, are to have either fully shrouded fixed contacts or insulated cover plates.

Switches in individual enclosures are to have an earth terminal, meet the degree of protection specified for the switchboard and have the operating mechanism interlinked with the access door.

Switches are to be provided with the auxiliary contacts indicated in the drawings but as a minimum, switches used to isolate the final connections between a starter and its motor shall be fitted with one set of contacts connected to open the starter coil circuit when the switch is open.

11. TIME SWITCHES

Time switches shall be suitable for operation on a 240 volt 50 Hz a.c. supply and be driven by a self –starting synchronous motor with a spring reserve mechanism which will enable the clock to continue to function for a period of at least 30 hours after interruption of the supply. Separate motor and switch terminals to be provided.

Switch contacts are to be rated at 20 amperes and a device or push is to be incorporated which, when operated, will bring into effect the next operation that the switch would otherwise have performed.

The time switch is to be fitted with a 24 hour dial complete with the required sets of ON and OFF levers. A selective day omitted device is to be provided.

The time switch is to be provided with an "ON-off" by pass switch to completely override pre-set switching functions.

The switch is to be totally enclosed in an insulated dust-proof housing, which shall be mounted in sheet steel box arranged for conduit entry, in instances where switches are not located within other panels or boxes.

SECTION 3 SMALL POWER

1. EXTENT

The work to be carried out under this section of the specification is to include all works necessary for the provision and installation of all small power as indicated on the drawings and detailed in the specification

The electrical contractor shall supply, fix and connect all socket outlets, connection units, isolators, etc., in the positions shown on the drawings and agreed with the architect. All electrical installation shall be designed and installed to comply with the current BS7671 IET Wiring Regulations.

All outlets are to be wired from their respective distribution board.

2. INSTALLATION

The final positions of all outlets shall be agreed with the Architect before the work commences.

Where false ceilings are provided the installation shall be hidden within the building fabric and be rewireable. In all customer and kitchen areas the wiring will be concealed within the building fabric.

In back of house areas where no ceiling is provided, exposed galvanised steel conduits/trunking shall run surface run parallel or perpendicular to the walls and vertical down the walls.

All accessories are to be manufactured by MK, finishes to be as indicated in the equipment schedules, wired using 6491B LSZH cable in galvanised steel conduit/trunking concealed within the building fabric.

Suitable mechanical protection shall be provided within partitions and ceiling/floor voids to comply with BS7671.

All cable drops in walls must be vertical and protected with concealed protective conduit suitable for rewiring.

Outlets will be fixed 450mm above the finished floor level to the base of the outlet or to comply with DDA requirements.

3. 13 AMPERE SOCKET OUTLETS

Provide 13A switched socket outlets manufactured to BS 1363.

Socket outlets will comprise a double pole switch (neutral make first and break last) controlling a 13A 3 pin shuttered socket outlet.

Socket outlets shall generally be either single or twin 13A switched pattern.

Unswitched 13A socket outlets (switched via 13A switched fused connection unit) are to be provided for final connection to equipment beneath worktops as indicated on the drawings

4. SWITCHED FUSED CONNECTION OUTLETS

Provide switched fused connection outlets comprising a double pole switch controlling a single outlet and fitted with a 13A fuse-link to BS1362. Manufactured to comply with BS 1363, DP switches to comply with BS EN 60669-1.

Double pole switches and switched fused connection units shall have neon indicator lamps and when mounted adjacent to equipment they supply, the plates shall have flex outlets unless the equipment is switched via an unswitched socket outlet. All fused connection units will be engraved stating the item of equipment they supply, e.g. supply to immersion heater will be labelled “WATER HEATER”.

5. KITCHEN APPLIANCES

Provide a local isolator remote from the equipment with concealed cable run and final connection located adjacent to the equipment it serves. Wiring between the isolator and outlet shall be concealed within the building fabric.

6. POWER FOR ANCILLARY SYSTEMS

Small power outlets are to be provided as required for each of the ancillary systems i.e. BT, Fire Alarm Panel, etc. Allow for liaison with the relevant providers to establish the extent of their requirements.

7. ELECTRIC HAND DRYER

Provide a conduit system and wiring to serve hand dryers in the extension toilet areas.

Hand dryers shall be wall mounted Dyson Airblade range.

- Manufacturer: Dyson
- Model: Airblade dB (with HEPA Filter)
- Electrical rating: 1.6kW, 7 amps, 230V/50Hz
- Dimensions (mm): W247 x H661 x D303
- Warranty: 5 years

At locations of hand driers provide a switched fused connection unit, RCD protected, 100mm below the ceiling and a vertical flush conduit to a flush outlet box to be installed concealed behind the hand dryer.

8. KITCHEN AREAS

Provided above work-top twin 13A SSO for general use.

Provide a multi-gang switch plate to provide local isolation of kitchen appliances. The switch plate shall comprise of 20A double pole isolator switches with neon indicators, switch to be appropriately labelled (dishwasher, fridge, hob, boiler, extract fan, etc. as MK printed modules range), the adjacent gang on the plate shall house the fused connection. This feed shall then serve a switched or unswitched socket outlet or flex connection located below the work top/behind or adjacent to the appliance it is serving. Multi-gang plate shall be sized to suit each kitchen area/number of appliances.

Multi-gang switch plate to be located above worktop, the architect shall confirm final location that may be in a high level cupboard.

The multi-gang switch plate shall serve all appliances up to 20A fuse rating. All other appliances shall be fed via a dedicated 32A DP isolator switches or 45A DP isolator switches installed adjacent to the multi-gang switch or above the worktop and feed a flex outlet connection concealed adjacent to the appliance.

Care should be taken to ensure that the socket outlets do not impinge on the space available for appliances.

Where equipment dictates that hard wiring may be more suitable than connection via flex cable outlet this shall be used subject to confirmation/approval by the Engineer.

Arrange all logically to the direction of the Architect. Provide protection as necessary for use close to a sink.

All electrical outlets should be positioned at least 600mm from the edge of the sink/wet area.

Outlets are to be mounted 225mm above work top to centre of outlet or as directed by the architect.

9. COOKER ISOLATOR

Provide adjacent cookers a double pole isolator rated not less than 45A. Unit will also house a single switched socket outlet. Both shall have neon indicator lamp, switches will be appropriately engraved stating item of supply and position of switch. Unit will be manufactured to comply with BS 4177.

Outlet plate will be of same type to match socket outlets.

SECTION 4 ELECTRICAL SERVICES FOR MECHANICAL INSTALLATION

1. EXTENT

The Electrical Sub-contractor shall provide main cable supplies, accessories, connections etc. for mechanical installations. Controls wiring will be undertaken by others.

The Electrical Sub-contractor shall be responsible for co-ordinating electrical services installations to serve mechanical installations.

The Electrical Sub-contractor shall make provision for power supply to the following services;

- Ventilation Fans
- Boiler plant
- LTHW and HWS pumps
- Power to HWS immersion heater
- VRF fan coil units
- External Condensers
- Etc

Carefully review the extent of services described in the mechanical section and provide power supplies either by local connection or connection to MCB.

Any power provided by MCB is to be carefully co-ordinated with the controls supplier

2. SYSTEM

All power cables serving mechanical equipment must be installed on cable tray or clipped neatly within plant spaces. Isolators must be located adjacent to the mechanical equipment. Final connections to each item of equipment from the local isolator must be made using single core stranded copper, PVC insulated cables in flexible steel conduit or flexible leads.

Provide all cables as required for the mechanical services and ensure earth continuity throughout.

Co-ordinate with the Mechanical Installer and receive any loose equipment as provided and then install and connect this as appropriate, terminating with final connection to each mechanical appliance, and supply and incorporate any necessary additional equipment which will include an isolator adjacent to the appliance when this is required.

All accessories in front of house areas are to be flush, switch plate finishes shall be as indicated within the equipment schedules, wired using 6491B LSZH cable in galvanised steel conduit/trunking concealed within the building fabric.

All accessories in service voids and plant rooms are to be surface mounted MK Metalclad Plus range wired using 6491B LSZH cable in surface galvanised steel conduit/trunking.

All external isolators shall be minimum IP54 rated and padlockable in the 'off' position.

All final connections from isolators to mechanical plant items must be carried out using 6491B LSZH cable in flexible steel PVC sheathed conduit.

3. ISOLATORS

Provide isolators as required in Part 1, Section 4 and ensure that isolators for switches starting plant are arranged and wired to break the coil circuit of the remote starters when opened. Spur units are to be as noted in the Small Power section of this Specification. Weatherproof isolators are to have a rating of at 30A and protected to IP56.

SECTION 5 LIGHTING

1. EXTENT

The work to be carried out under this section is to include all works necessary for the provision of lighting for all areas of the building as indicated on the drawings.

For examples of suitable luminaire types refer to the Luminaire schedules.

Lighting to meet the requirements of the CIBSE/SLL Lighting Guides, Building regulations, British Standards, Secure by Design standards.

All lighting points are to be wired from their respective distribution boards/consumer units, as detailed on the drawings and schedules, and the position and loading of all points is to be checked before the commencement of works. Particular attention is to be given to the position of switches in relation to the hanging of doors. Switches are to be installed adjacent to the closing side of doors unless indicated otherwise. Refer to the architect's drawings for locations of all lighting and accessories and confirm locations prior to installation.

All light fittings shall be fit for the intended use with particular attention to the Ingress Protection rating and vandal resistant where required.

Some of the light fittings shall be supplied with their own integral battery packs and invertors in order to operate as emergency luminaires upon power failure to the building.

2. SYSTEM

Lighting points shall be wired using 6491B LSZH cable in galvanised steel conduit. The whole installation shall be concealed within the ceiling/service voids where provide. Where no ceiling void is provided the containment shall be installed surface exposed to view, services will run parallel and perpendicular to the building structure and at equal spacing to form a considered and neat installation.

Lighting control system switches to be as manufactured and detailed below in the lighting control section.

At a height of 1200mm from finished floor level to the top of the switch plate to comply with DDA recommendations.

All switches shall be manufactured to comply with BS 3676.

All circuits shall be RCBO protected.

3. LIGHT FITTINGS

Where possible all fittings will be LED or provided with energy efficient LED replacement lamps, as a minimum comply with the requirements of AD Part L.

Ceiling pendant fittings are to terminate no lower than 2300mm above finished floor level, heights to be confirmed by architect.

Where luminaires are fitted within a false ceiling the electrical contractor as directed by the ceiling specialist shall fix them. In areas where a trunking run is not shown the electrical contractor shall install conduit terminating at a BESA conduit box with plug in ceiling rose not more than 1.5 metres from the luminaires.

4. LIGHTING SWITCHES/CONTROLS

All light switches shall be flush mounted in the locations shown on the drawings. Switches are to be 10A rated complying with BS 3676 and having brushed stainless steel cover plates or similar.

Switches are to be mounted on adjustable steel grids, enclosed in pressed steel boxes with electrolytic zinc plate.

Switches within plant rooms shall be constructed of heavy gauge steel, lacquered and surface fixed.

Lighting controls within the main habitable areas shall be provided by local manual switches.

Common access routes (corridors), toilets and store areas shall be provided with ceiling mounted movement detectors (PIR or microwave) lighting control. These shall be zoned as indicated on the drawings.

All switch drops are to be flush mounted at a height of 1100mm from finished floor level to top of switch plate to comply with DDA recommendations.

Where conventional switch plates (86x86mm) are too large, Architrave (32mm wide) switch plates shall be provided.

The electrical sub-contractor shall supply, install and test the lighting control system in accordance with the current version of the IET wiring regulations. All sensitive electronic equipment shall be removed from circuit whilst electrical testing is conducted, as specified in the current version of the IET wiring regulations. They are also to ensure that the lighting installation and its associated controls are fully compliant with the current requirements of AD Part L of the Building Regulations.

5. EMERGENCY LIGHTING

Design and provision of a complete external lighting system to provide pedestrian access lighting, safe exit from all Provide a complete escape and emergency lighting system designed in accordance with the Building Regulations and BS5266.

Emergency luminaires are to be manufactured in accordance with BS 4533, Lighting BS 5266 and ICEL. standards for the Construction and Performance of battery operated emergency lighting equipment. Luminaires are to be provided on each landing and at exits from floors and the building. At each floor and main exit the emergency luminaire is to incorporate the EC legend as required within BS5266.

The battery inverter/control unit is to have sufficient capacity to provide full lumination for a period of 3 hours upon main supply failure.

A clearly visible charge operation/failure indicator is to be incorporated in each luminaire.

The battery inverter pack of each emergency luminaire is to be connected to an unswitched (non-controlled) circuit serving the general lighting in the areas concerned. In instances where emergency luminaires are connected to remote battery packs above false ceilings provide a steel channel support frame for mounting the pack. The pack must be located in a position that can be accessed without demounting large areas of ceiling or damaging plasterboard type ceilings.

Adjacent to each emergency luminaire provide a test key switch. Each switch to be supplied with its own key.

6. EMERGENCY TEST SWITCHES

Provide a wall mounted key operated isolating switch gang on the general lighting switch plate for the emergency lighting in each of the areas concerned.

Each isolating switch is to have a 15/20 ampere inductive rating and comply with the specified requirements for lighting switch. Each switch cover plate is to have the words "Emergency Isolation Switch" plus details of the area concerned engraved thereon and filled in red.

Each switch is to be supplied with its own key.

7. LAMPS AND TUBES

The installer is to allow for the supply and fitting of lamps to all luminaires. All lamps of a particular type are to be supplied by the same manufacturer.

Any lamps found to be defective or damaged shall be replaced by the electrical contractor at his own expense.

SECTION 6 FIRE ALARM INSTALLATION

1. EXTENT

The works to be carried out under this section of the specification shall include the design, provision, test and commission of an addressable fire alarm and detection system ('fire alarm system') in accordance with the recommendations of BS 5839-1:2017 Category L1 and all components are to comply with BS 5839 and BS EN 54 as appropriate.

The fire alarm system shall be an open protocol addressable system, a closed protocol single supplier system shall not be accepted.

The fire alarm system shall be designed so that the operation of any single detector or manual call point will trigger a full evacuation alarm; the extent of the system is as shown on the engineer's drawings.

2. SYSTEM

The fire alarm and detection system shall be of the open protocol addressable type connected to associated field devices, comprising call points, detectors, sounders, sounder / detectors, sounder / detector / beacons, sounder/beacons, beacons and interface modules.

A flush fire alarm control panel and a zonal display unit shall be wall mounted adjacent to each front entrance (lobby of main hall and lobby of small hall) as indicated on the layout plans. A double pole mains isolator fused key switch marked "FIRE ALARM - ON/ OFF" shall be located adjacent to the fire alarm control panel in accordance with the requirements BS5839-1:2017 Sub-section 29.2e.

There shall be interfaces with the AV, gas valves, access control door controllers (if required) and other plant/ equipment where deemed necessary, in order that the plant may be shut-down in event of an alarm being raised and on the alarm condition being cleared the plant must automatically be reset.

Fire alarm sounders shall be installed throughout the building to give a minimum sound level of 65dBA, or 5dB above the background noise in all areas, whichever is the greater.

Combined sounder/ flashing beacons and flashing beacons shall be installed for compliance with AD Part M and DDA/Equality Act requirements.

3. SYSTEM COMPONENTS

The fire system shall be addressable and devices are to be installed throughout the areas nominated as part of the system design. The system shall consist of addressable fire detection, wired or wireless smoke and heat detectors, manual call points, sounders and visual alarm indicators to communicate with the control and indicating equipment (CIE).

The system shall be designed in accordance with the requirements of BS5839-1 or relevant codes of practice.

4. CABLING

The fire alarm system wiring shall be in red sheathed FP200 Gold.

5. TEST AND COMMISSIONING

The fire alarms, detectors, etc. are to be complete in all respects, with all cables, connections, batteries, relays, annunciators, supervisory bells, buzzers, pushes to provide a complete installation. Allowance is to be made for testing and commissioning together with demonstrations to the Architect, Consulting Engineer, Employer and Building Control, as requested

SECTION 7 TELECOMMUNICATIONS/DATA INFRASTRUCTURE

1. EXTENT

The work to be carried out under this section is to include the supply, installation and commissioning of telecommunications and data infrastructure cabling installation to serve the building.

Existing systems serving the office are to be maintained, with new systems added to the existing data cabinet adjacent to the office.

Include for careful liaison with the telecommunications supplier and install all cables, power supplies, wire ways, etc., to their instructions and diagrams. Due allowance is to be made for all these services in the tender.

Care shall be taken to ensure telecoms/data services to the adjacent areas are maintained and not disrupted due to these construction works.

The design and installation shall accord with the following standards in so far as they apply to this work:

- ANSI/EIS/TIS-568-A-1995, Commercial Building Telecommunications Cabling Standard.
- BS EN 50173 Information Technology – Generic Cabling Systems.
- TIS/EIA-TSB-67 Transmission Performance Specifications for Field Testing or Unshielded Twisted-pair Cabling Systems.
- ANSI/TIA/EIA TSB95. Field tester accuracy requirements.
- ANSI/EIA/TIA-569-1990 Commercial Building Standard for Telecommunications Pathways and Spaces.
- BS 6701: 1994 Code of practice for Installation of apparatus intended for connection to certain telecommunication systems.

2. SYSTEM

Provide from the main incoming position for BT a system of conduit/trunking/tray to the main patch rack within the staff office as indicated on the drawings.

Contractor to provide a lockable data cabinet of suitable size to house the AV equipment, CCTV equipment, banking and credit card systems, incoming telecoms/broadband equipment and patch racks to serve all the data outlets within the building, at tender stage allow for the provision of a new 36U cabinet, final details to be agreed on site prior to installation.

As a minimum allow for CAT 5e UTP cabling to RJ45 outlets. Cable to each outlet is to run to the data cabinet located adjacent to the main office. Sockets are NOT to be daisy chained with master slave type arrangement. All cables to be terminated at both ends within the outlet plate and patch panel and complete system tested.

Final locations of outlets shall be agreed on site with Architect prior to commencement of the works.

Outlet plate will be of same type to match socket outlets.

The conduit/trunking/tray system shall run concealed from view on a route agreed with the Architect on site.

SECTION 8 ACCESS CONTROL SYSTEMS

1. EXTENT

Employ a specialist access control contractor to carry out the design, provision, installation and commissioning of access control to the front entrance doors of the main and small hall, including fob readers, power suppliers, distributors, door release, cabling, containment and all necessary accessories to provide a complete installation.

All internal wiring associated with the access control system shall be carried out using LSF insulated multi-core cables, recommended specialist cables are to be supplied by the system manufacturer.

Include for careful liaison with the specialist manufacturer/supplier and install all equipment, power supplies, cables etc. to their requirements.

Review options to install a standalone proprietary smart lock, as manufactured by Yale, Conexis L1 Smart Door Lock, that can be accessed via proximity fob and/or smartphone app.

2. ACCESS CONTROL SYSTEM

The work to be carried out under this section of the specification is the provision, test and commission of proximity technology access control systems.

The access control systems are to be complete in all respects including proximity readers, local door controllers, fire alarm interfaces (if required by building control for emergency release), lock release, power suppliers, cabling, containment and all necessary accessories to provide complete installations as indicated on the drawings.

Include for careful liaison with the specialist supplier/installer and provide all necessary assistance, power supplies and containment, etc to their requirements.

The systems provided shall be user friendly, simple to operate, extendable to allow for future expansion and designed to accept a minimum of 100 users. All proximity readers shall be located in accordance with Part M and Equality Act/DDA requirements.

The system serving the two main entrance lobbies (main hall, small hall) shall comprise:

- External vandal resistant proximity access control reader.
- The electric lock releases shall be high quality units designed for heavy duty use.
- Controlled doors shall be fitted internally with a manual internal handle to allow manual opening of the door (no requirement for emergency exit green break glass or interface with fire alarm).

3. OPERATION

The access control system shall be based on proximity tag technology to allow authorised access at the controlled doors. The access control system shall have local controllers, with the programming of all proximity tags including the setting of system parameters/profiles (out of hours, weekend, etc) being carried out at each local controller.

When a valid tag is offered to a reader the system will allow access and the electric lock will release for a pre-set (adjustable) time allowing the door to be opened.

4. LOCK RELEASES

Electric lock releases shall be provided at all the controlled doors. The releases shall be high quality units for heavy duty use.

SECTION 9 CCTV System

1. EXTENT

The contractor shall survey and extend the existing CCTV system serving the building and surrounding key areas of the village/estate.

Design, provide, install, test and commission a high resolution colour CCTV system including external and internal vandal resistant cameras, interface with and extend the existing DVR/control equipment, monitor, power suppliers, cabling, containment and all necessary accessories to provide a complete installation.

The CCTV system provided shall be user friendly, simple to operate and be extendable to allow for future expansion. The CCTV system shall be provided with and allow remote access for offsite monitoring and management of the system.

Employ a specialist CCTV installation company to survey, supply and install the CCTV system, they are to ensure that the CCTV system is designed to capture events in detail, even under extreme conditions.

Include for careful liaison with the specialist CCTV company and provide all necessary assistance, power supplies and containment, etc to their requirements.

The CCTV system shall be installed by an NSI approved contractor and comply with BS EN 50132 and BS 8418, system to be commissioned to comply with Rotakin standards. The CCTV shall be fully tested and commissioned, with test sheets included in the O&M manuals.

The locations of all CCTV equipment shown on the drawings are provisional, the final locations must be agreed on site.

All CCTV equipment is to be approved by the design team.

2. SYSTEM

The CCTV system shall comprise:

Internal vandal resistant fixed Day/Night colour/b&w auto-iris vari-focal cameras with built-in infra red lighting mounted to provide coverage as indicated on the drawings.

External weatherproof vandal resistant fixed Day/Night colour/b&w auto-iris vari-focal cameras wall bracket mounted, positioned to provide coverage as indicated on the drawings.

All cameras shall be micro dome type as manufactured by Pecan. Refer to drawings for indicative locations of the CCTV cameras.

A 17” monitor and controller in the staff office.

A DVR/control equipment located within the IT server rack, all images to be viewed and recorded, with full system access and software features (digital recording to USB for evidence purposes, system management, event monitoring, etc) and remote access for off site management of the system.

Provide a secure lockable cabinet within the office to house the CCTV control equipment.

The cameras shall be recorded and connected to a multi way system controller/ digital video recorder (DVR), the DVR shall be capable of multi camera display and have optional sequencing with variable dwell timings.

The DVR shall also have Video Motion Detection (VMD) for each camera input with independent programmable record rates for the VMD and be capable of recording for 31 days at 4CIF (Common Intermediate Format 704 x 576 pixel) resolution at a minimum of 3 IPS (images per second) at 18Kb per image per camera input.

3. OPERATION

The CCTV system shall enable the individual images from the CCTV cameras to be recorded and then reviewed following an incident. The system shall allow the monitoring, recording, copying, event logging and review of the images from all cameras via the 17” monitor in the office and via remote access for off site management of the system.

SECTION 10 INTRUDER ALARM SYSTEM

1. EXTENT

The work to be carried out under this section is to design, provide, install, test and commission an intruder alarm system, including all movement detectors, door contacts, keypad/ control equipment, sounder unit, power supplier, cabling, containment and all necessary accessories to provide a complete installation.

Employ a specialist intruder alarm company to supply and install the intruder alarm system, the specialist intruder alarm company must be NACOSS and/or NSI registered.

Include for careful liaison with the specialist intruder alarm company and provide all necessary assistance, power supplies and containment, etc to their requirements.

The intruder alarm system shall be designed and installed to conform to the relevant sections of EN50131 and PD6662:2017 - Grade 3 system with Notification Option C, supplemented by DD243 Code of Practice for intruder alarm systems designed to generate confirmed alarms.

The intruder alarm system must be fitted with sequential alarm confirmation technology and be connected to an approved Alarm Receiving Centre via BT Redcare GSM.

2. SYSTEM

The following is a brief description of the intruder alarm system and is given for guidance only and is not intended as a comprehensive design, the specialist intruder alarm company shall produce a scheme based on the working parameters of their particular equipment.

The intruder alarm system shall provide coverage of the ground floor main reception area and ground floor secondary escape stair

The intruder alarm system shall comprise:-

a) Dual technology motion detectors, generally as indicated on the drawings.
b) Door contacts shall be fitted to all ground floor external door.
c) Door contacts shall be fitted to all internal doors and roller shutters into the bar and bar store areas.
d) A keypad shall be mounted on the main reception desk.
e) Intruder Alarm control panel shall be mounted within the basement electrical switch room.
f) The system/ zoning shall allow a minimum of 10 setting permutations.
g) 2no. internal sounders shall be provided (main and small hall) and two external sounders/beacons (front and rear).
h) Redcare GSM remote monitoring facility shall be provided.

SECTION 11 ACCESSIBLE TOILET ASSISTANCE ALARM SYSTEMS

1. EXTENT

Design, provide, install, test and commission accessible toilet assistance alarm systems including all equipment, power suppliers, cabling, containment and all necessary accessories to provide complete installations in each Accessible toilet. Include for careful liaison with the specialist manufacturer/ supplier and install all equipment, cables etc to their requirements.

The assistance alarm systems shall be designed and installed in accordance with the recommendations of BS 8300, the requirements of AD Part M Volume 2 and The Equality Act.

All internal wiring associated with the assistance alarm systems shall be carried out using PVC insulated multi-core cables installed throughout in conduit and trunking independent of all other wiring. Recommended specialist cables are to be supplied by the system manufacturer.

2. SYSTEM

Each toilet assistance alarm system shall comprise of the following equipment:

A Call Unit c/w Pull Cord, coloured red with two red bangles of 50mm diameter, one set at a height between 800mm and 1000mm and the other set at 100mm above floor level located so that it is reachable from the WC or a wheelchair.

A Reset and Visual/ Audible Reassurance unit wall mounted so that it is reachable from the WC or a wheelchair.

A visual/audible indicator unit outside the toilet, located so that it can be seen and heard by those able to give assistance.

The assistance alarm system shall be provided with suitable control/ power supply unit. The electrical supply shall be from the distribution board, the final connection must be made via an unswitched fused connection which shall be surface mounted adjacent the control/ power supply unit.

3. OPERATION

When an assistance call is made by operating the pull cord a visual/ audible indication shall operate in the toilet to provide reassurance that a) a call has been made and b) is being actioned, and operate the visual/ audible units mounted outside the toilet.

SECTION 12 AUDIO FREQUENCY INDUCTION LOOP

1. EXTENT

The Contractor shall provide, install, test and commission two individual audio frequency induction loop system (AFILS) installations to serve the main hall and small hall areas. Include for careful liaison with the specialist manufacturer/ supplier and install all equipment, cables etc to their requirements.

2. SYSTEM

An AFILS shall be provided to serve the main hall, with audio connections to both the stage and audio equipment and the small hall with connections adjacent to the audio equipment. The system shall comprise of a concealed wired induction loop driven by fixed equipment. The equipment shall comprise of;

- Microphone
- Amplifier
- Aerial/induction loop
- Power Supply Unit
- Induction Loop Sign

The system shall be compatible with standard hearing aids with induction loop sensitivity.

Specialist contractor to carry out site survey prior to installation to ensure the correct equipment is installed and any performance /radio interference issues are established and resolved.

System shall be compatible and not reduce the performance of all other systems on the site.

The unit shall be as manufactured by Cranford, Signet range Induction Loop.

3. TESTING AND COMMISSIONING

Allowance is to be made for testing and commissioning with demonstrations to the Architect, Consulting Engineer and Employer, as requested. Copies of the test certificates shall be submitted to the employer within seven days of the tests being carried out and included within the O&M record information.

Allowance is also to be made for additional training and demonstrations to the staff and manager.

SECTION 13 CARBON MONOXIDE DETECTION

1. EXTENT

Adjacent to each combination boiler the contractor shall design, supply, install, test and commission a mains powered with individual battery backup carbon monoxide (CO) alarm, cabling, containment and all necessary accessories to provide a complete installation.

Each carbon monoxide (CO) alarm shall be designed and installed to comply with the relevant sections of Part J - Building Regulations, BS EN 50291, BS EN 50292 and the Code of Practice for Carbon Monoxide gas detection, as appropriate.

The electrical supply for each carbon monoxide alarm shall be from the same dedicated circuit at the distribution board.

Employ a specialist company to supply and install the carbon monoxide alarms, include for careful liaison with the specialist company and provide all necessary assistance, power supplies and containment, etc to their requirements.

All equipment shall be supplied by Aico Limited, Tel: 0870 758 4000 www.aico.co.uk or equivalent.

2. SYSTEM

The carbon monoxide alarm shall be installed in the plant room or kitchen where the fixed gas fuel appliance is located and be ceiling mounted between 1m and 3m horizontally from the appliance and at least 300mm from any wall.

All the carbon monoxide alarms shall be fitted with 10 year + lithium cell battery back-up, 'hush'/ test buttons and produce a sound output of 85dB(A) at 3 metres.

3. TESTING AND COMMISSIONING

The installed carbon monoxide alarm shall be proven capable of satisfactorily responding to an appropriate system performance test.

It shall be verified that all alarm and fault indications are fully operative by means of activation of the signals.

Allowance is to be made for testing and commissioning together with demonstrations to the Architect, Consulting Engineer, Employer, and Approved Inspector, as requested.

SECTION 14 EARTHING AND BONDING

1. EXTENT

Provide under this Section of the Specification, all main equipotential and supplementary earthing and bonding conductors, including identifications, cross bonding all as required by the IEE Regulations, British Standard Code of Practice BS 7430, Section 3 of this Specification and as later specified.

2. SYSTEM

Unless otherwise specified or approved, all cable earthing and bonding conductors are to be within a protective containment system such as conduit or trunking.

Earth and bond the cable glands/armouring of all armoured cables to the earthing bars/earthing terminal of the equipment served.

3. MAIN EARTH BAR

Provide a main earthing bar in the electrical intake cupboard, 600mm long with a cross section of 50mm x 8mm but as minimum in compliance with BS 1433. The main earth bar is to be provided with a disconnecting link for test purposes.

Mount the main earthing bar on rigid impact resistant moulded plastic insulators fixed to the structure by means of plastic "Rawlplugs" and brass screws.

The earthing bar insulators are to rigidly support the bars and provide a clear space of not less than 25mm between the back of the bar and the structure.

At each point of connection between the main earthing bar and the earthing/bonding tapes and conductors, the main earthing bar and the earthing/bonding tape shall be drilled, cleaned and tinned and connection made by means of cadmium plated high tensile steel set stud, washers and nut.

Terminate all earthing/bonding cable conductors in a cable lug suitable for bolting to the main earthing bar as described for the earthing/bonding tapes.

4. TAPES & TAPE FIXINGS

Provide all earthing/bonding tapes of solid copper complying with BS 1432.

All earthing/bonding tapes are to be LSF sheathed copper.

Where earthing/bonding tapes are installed on the surface of the structure, comprising concrete, brickwork, building blocks and similar materials and in concrete trenches, fix the tapes by means of one hole fixing polypropylene spacer type saddles plastic rawlplugs and brass screws.

Where earthing/bonding tapes are connected to earthing terminals on equipment the tape shall be drilled and tinned at the point of connection. Similarly where earthing/bonding tapes are connected to cable gland earthing lugs the tape shall be drilled and tinned at the point of connection and connection made by means of cadmium plated high tensile steel set stud, washers and nut.

5. ARMOURED CABLES

Bond the cable armouring and the cable glands of all armoured cables to the main earthing bar and/or the earthing terminal of the equipment served by means of copper tape as previously specified or LSF insulated copper earthing cables complying with BS 6004.

The earthing/bonding tapes and earthing cables used for connections between the cable armouring/cable glands and the equipment served to be sized as follows:-

Cable Size & Type	Size of Earthing/Bonding Tape or Cable
XLPE/SWA/LSF cables with conductors up to 16mm^2 cross section	LSF insulated copper earthing cable sized as main conductor or 6mm^2 whichever greater
XLPE/SWA/LSF cables with conductors larger than 16mm^2 up to and including 35mm^2 cross section	16mm2 LSF insulated copper earthing cable or 20mmx2mm copper tape
All XLPE/SWA/LSF cables with conductors or 50mm^2 or greater	Copper tape sized as half main conductor or 30mmx4mm whichever greater

6. MAIN EQUIPOTENTIAL BONDING

Provide main equipotential bonding between the main earthing bar and the incoming water, etc. services.

Provide a tape connection from the main earth bar in the intake cupboard onto the nearest lightning protection earth rod.

7. CIRCUIT PROTECTIVE CONDUCTOR

Provide circuit protective conductors for all circuits in compliance with the regulations. Do not use conduit or trunking for this purpose but run LSF insulated yellow/green coded flexible cables with the live conductor terminating them on terminal or busbars in an approved manner.

Protective conductors must comply with Chapter 54 and Table 54.7 of the IEE Wiring Regulations.

8. SUPPLEMENTARY EQUIPOTENTIAL BONDING

Provide supplementary bonding to meet the regulations to the following:-

- Simultaneously accessible extraneous metal parts including water and similar pipework, sinks, ducting, heating, ventilation, metal handrails, and any exposed metal work of the building structure. All connections are to be accessible.
- Simultaneously accessible exposed conductive parts. Using copper tape, bond by means of bolted connections, the LV switchgear, trunking and other metal work containing live conductors.

Where full equipotential zones are not created by these allowances the Consulting Engineer is to be advised in writing.

9. TESTING

Test all earthing and bonding for correct impedance to permit protective devices to operate within the correct time, to carry prospective fault currents in safety and to prevent the establishment of dangerous potential under normal or abnormal conditions to exposed conductive surfaces.

SECTION 15 RECORD DOCUMENTATION

1. EXTENT OF WORKS

The Electrical Contractor shall include in his tender for the production of complete record documents in accordance with the details contained in this specification.

Great importance will be placed on the clarity and accuracy of the record documents.

The record documents to be provided comprise:-

- Record drawings and schedules.
- Operating and maintenance instructions.

General

Three sets of hard copies and disk copies of all record drawings shall be provided.

- To record clearly the arrangements of the various sections of the contract works as actually installed and to identify and locate all component parts thereof.
- To make it possible to comprehend the extent and purpose of the works and the method of operation thereof.
- To set out clearly the extent to which maintenance and servicing is required and how, in detail, it should be executed.
- To provide sufficient and readily accessible information to facilitate the ordering of spares and replacements.

The record documents shall be correlated so that terminology and the numerical and/or other references used therein are consistent with and similar to those used in the physical identification of component parts of the works.

Three sets of the maintenance instructions shall be provided and each shall incorporate a set of prints of the record drawings.

All record drawings shall be prepared using computer aided design methods and the Electrical Contractor shall utilise the later release of AUTOCAD. Provide copy disk of all record drawings in addition to the drawings contained in the manuals.

Record Drawings and Schedules

The record drawings provided by the Electrical Contractor shall comprise the documents listed in the following paragraphs, as applicable. All such documents shall clearly be endorsed RECORD DRAWING near to the title block.

Drawings or sets of drawings to a scale consistent with any used for tender drawings which shall show the “as fitted “location of the following:-

- Main and sub main cables showing origin, route and termination size and type of each.
- Trunkings and any major conduit runs for single and three phase lighting and power circuits and for all miscellaneous services, including data cable and containment system routes. The drawings shall indicate the origin, route termination and size of each trunking, basket etc. together with the number and size of each cable enclosed within. Further, the route of each item shall be described, i.e. surface, flush, in suspended ceiling/floor etc.
- Locations of switchboards, distribution boards, switches, draw in boxes, joint boxes, joints etc.
- Location of all earthing tapes, electrodes and test points, bonding points with cable sizes.
- The location, type, route, number of cores etc. of all fire alarm and Public Address cables.
- Manufacturers drawings or sets of drawings which shall show:-

The internal wiring of each piece of electrical equipment supplied together with physical arrangement drawings, where necessary to locate and identify the component parts.

In conjunction with schedules of location, the detail and reference, voltage and wattage of all luminaires.

System diagrams, circuit diagrams, wiring diagrams and interconnection diagrams, which shall show:-

How each installation or item of equipment operates.

The interconnections between items of equipment, including those provided by others, to which the Electrical Contractor is required to carry out connection.

The size, type and length (to the nearest metre) of each LV cable, together with the measured earth fault loop impedance.

The terminal numbering and cable core identification for all alarm and control circuits.

Comprehensive schedules illustrating procedures for fault finding and for action in the event of equipment or system failure.

Comprehensive schedules of spare parts, lubricants, etc. including itemised specifications, identification numbers and sources of supply.

2. OPERATING AND MAINTENANCE INSTRUCTION

Three hard and three disk copies of operating and maintenance instructions shall be provided by the Electrical Contractor and shall comprise the following, as applicable (all contained in volumes strongly bound in flexible four ring binders suitable for heavy usage over a long period) written to be read in conjunction with the record drawings: -

- A general description of the scope, purpose and manner of working of each system or apparatus forming part of the works.
- A detailed description of the scope, purpose and manner of working of each system of controls and special services.
- Data on general design parameters together with manufacturers information concerning correct operation, etc. based on commissioning activity.
- Clear and comprehensive instructions for switching on, operation and closing down of each system of apparatus.
- Clear and comprehensive instructions for dealing with emergency conditions for each system of apparatus.
- Instructions in respect of any precautionary measures from time to time necessary.
- Instructions in respect of the care of apparatus normally subject to seasonal disuse.
- Instructions as to the nature, extent and frequency of servicing necessary to maintain the works in good condition, including periodical testing and the materials to be used for the purpose. The information may be supported in detail, but not replaced by information from or by the suppliers of particular components or apparatus.
- The names and addresses for all major components of the works that may be potentially required to obtain spare parts or replacements.
- Components of manufacturer's data shall be supplied with respect to the nature, type of method of operation of individual pieces of equipment, together with their detailed maintenance instructions. Such data, in the form of individual booklets and the like, shall be indexed and cross referenced to the Operating and Maintenance Instructions and presented in suitably protected box files or folders.

3. TESTING AND COMMISSIONING

General

The Electrical Contractor shall conduct tests during and at completion of installation and finally at completion of the defects period as and when required by The Engineer or their nominated representatives, to demonstrate compliance with the IEE Regulations for Electrical Installations (BS 7671), Bye Laws, Factories Act, and Electricity Supply Regulations.

The Electrical Contractor shall include copies of NICEIC certificates in Operating and Maintenance Manual.

Testing & Apparatus Records

The Electrical Contractor shall provide all necessary testing apparatus and shall agree with the Engineer or his nominated representative the exact details of each test to be carried out.

Records shall be kept of all tests carried out and duplicate copies giving full information shall be given to the Engineer within seven days of each test.

Labelling

The Electrical Contractor shall provide all labelling as required by the general standards of workmanship section of this specification (section 2) and any other documentation forming this specification.

In addition the Electrical Contractor shall provide suitable labels on all switchgear, fused connection units, cables, equipment etc. to facilitate future maintenance as follows: -

Main Switchgear - Provide traffolyte or similar label for each breaker within LV Main Switchboard to identify equipment served, location and electrical supply characteristics including current capacity and prospective fault level, e.g.

LV MAIN SWITCHBOARD - POWER DISTRIBUTION UNIT LOCATED

LOWER GROUND FLOOR STORE GRID LINE --/-- 250A TPN PSC----kA - Provide traffolyte or similar labels on each outgoing MCCB way to identify equipment served, location and electrical characteristics. e.g.

LOWER GROUND FLOOR DISTRIBUTION BOARD LOCATED

STORE ROOM GRID LINE --/-- 125A TPN

All labels shall be engraved with legend to the site standards and shall be glue and screw fixed.

Labels shall also be provided on armoured cables installed to identify equipment served comprising proprietary plastic cable marking accessories (such as Critchley Ltd. or similar). Cable markers shall be provided every five metres, either side of walls and slabs, and entering or leaving the equipment.

PART 5 EQUIPMENT SCHEDULES

SECTION 1 ELECTRICAL EQUIPMENT SCHEDULE

Where not listed in the specifications the following preferred suppliers or equal and approved by the Engineers shall be used: -

ITEM	MANUFACTURER/RANGE
Main Distribution Boards	Schneider KQ LoadCentre, with three separately metered sections Lighting Small Power Mechanical Power
Isolators	MEM
Socket Outlets & Switched Fused Connection Units	Main public areas – MK Edge flush – White Kitchen and Bar areas – MK Edge flush – Stainless Steel Staff Only areas – MK Logic Plus flush – White Concealed in service voids and/or within plant rooms, surface fixed - MK Metalclad Plus External – minimum IP56 rated – MK Masterseal Plus
Cables	Pirelli /BICC Limited
Trunking	Philip Grahame
Cable Tray	Philip Grahame
Conduit	Walsall Limited

Provide sample of accessories for Architect approval prior to placing order with the supplier.

SECTION 2 ELECTRICAL LUMINAIRE SCHEDULE

Article	Ref.	Description	Manufacturer	Cat. Ref.
	A	**Vapour Light Linear LED Fitting** Surface/suspension mounted linear LED luminaire. High visual comfort. White steel body with Opal prismatic diffuser Lumen output: 71W LED, 8450lm, Colour Temperature: 4000K, Dimensions: 1441 L x 120 W x 111mm high. Standard electronic driver.	Spear Lighting	Cruze LED
	B	**Vapour Light Linear LED Fitting** Surface/suspension mounted grey vapour proof (IP66 rated) linear LED luminaire with innovative duo-therm technology, impact proof polycarbonate body and UV stable diffuser with fibreglass reinforced clips. Lumen output: 42W LED, 6260lm Colour Temperature: 4000K, Dimensions: 1272 L x 95 W x 111mm high. Standard electronic driver.	Spear Lighting	Commodore LED
	C	**Recessed Downlight** Recessed LED downlighter with white powder coated aluminium bezel, transparent tempered glass and a 99.85% pure high gloss aluminium reflector. 50 degree beam angle. IP44 rated. Lumen output: 13W LED, 1550lm, 136lm/W Colour Temperature: 4000K, Dimensions: 120 Ø x 110mm high. Standard electronic driver.	Spear Lighting	Bari Mini LED
	D	**Recessed Downlight** Recessed LED downlighter with white powder coated aluminium bezel, transparent tempered glass and a 99.85% pure high gloss aluminium reflector. 50 degree beam angle. IP44 rated. Lumen output: 8W LED, 1050lm, 136lm/W	Spear Lighting	Bari Mini LED

Article	Ref.	Description	Manufacturer	Cat. Ref.
		Colour Temperature: 4000K, Dimensions: 120 Ø x 110mm high. Standard electronic driver.		
	E	Denote emergency light fitting. Fitting complete with 3hr emergency battery pack		
	F	**External Wall Mounted Light** A versatile, energy efficient, IP65 LED projector luminaire that provides direct illumination Die-cast aluminium body with 3mm soda lime tempered clear glass Lumen output: 32W LED, 4440 lm Colour Temperature: 4000K, Dimensions: 240 L x 112 W x 115mm high. Standard electronic driver.	Spear Lighting	Phoenix LED
	P	**PIR Presence Detector** Recessed or surface mounted to suit the installed location	CP Electronics	
	Exit	**Emergency Exit Sign** Surface mounted IP65 rated, Polycarbonate white body. ISO legend format to suit the final location. Lumen output: 4.2W LED, 135lm, Colour Temperature: 5000K, Standard electronic driver.	Spear Lighting	EM3H ESCAPE LED

NOTE:

All lamps to be colour 4000K.

The contractor shall provide a sample of the light fittings for approval prior to placing order with the suppliers.

SECTION 4 Mechanical EQUIPMENT SCHEDULE

The equipment listed below are should not be deemed as the final selection but to assist the contractor for the purpose of pricing. The final selection will be confirmed after full detailed design and technical submission by the nominated contractor has been approved by the Engineer and Contract Administrator. Alternatives named supplier equal and approved can be submitted subject to the approval of the Engineer or Contract Administrator.

Schedule 1 - LTHW Boilers
Schedule 2 - Heat Emitter Schedule
Schedule 3 - Toilet Extract
Schedule 4 - VRF Equipment
Schedule 5 - Electric Water Heaters
Schedule 6 - Acoustic Attenuation

NOTE * - indicates or equal and approved.

SCHEDULE 1 - LTHW BOILER*

Boiler reference	Model	Capacity @ 80/60 (kW)	Boiler input (kW)	Dimensions (W x D x H) mm	Electrical supply (V / ph / Hz)
BR-1	Greenstar 30i	24kW CH 10.8 l/min	30.61	400 x 330 x 710	230 / 1 / 50
BR-2	Greenstar 30i	24kW CH 10.8 l/min	30.61	400 x 330 x 710	230 / 1 / 50

Notes

1) Boiler model is based on Worcester Greenstar combi or equal and approved
2) Individual room sealed concentric balanced flue, discharging at rear of the building or though roof. Contractor to determine termination point in accordance with Approved Document Part J and manufacturers standard details. Contractor to include for the required accessories to maintain the weather tight structure.
3) LTHW circuits to be supplied with a Greenstar System Filter, sized to suit the required system output.
4) Each boiler to be controlled via Bosch Greenstar Comfort+ II RF controller.

SCHEDULE 2 – HEAT EMITTER SCHEDULE

Room reference	Heater Reference	Type/Make	Heat Output (Watts)
A24	EH 01	Adax Neo (Elec)	1000
A23	EH 02	Adax Neo (Elec)	600
A20	EH 03	Dimplex LST (Elec)	750
A19	EH 04	Dimplex LST (Elec)	500
A18	EH 05	Adax Neo (Elec)	400
A17	EH 06	Dimplex LST (Elec)	1500
A17	EH 07	Dimplex LST (Elec)	1500
A23	EH 02	Adax Neo	600
A24	EH 01	Adax Neo	1000
A2	RAD 01	Stelrad / K2	1000
A5	RAD 02	Stelrad / K1	600
A3	RAD 03	Stelrad / K2 LST i Plus	650
A17	RAD 04	Stelrad / K2 LST i Plus	2400
A16	RAD 05	Stelrad / K1	300
A14	RAD 06	Stelrad / K2	1300
A12	RAD 07	Stelrad / K2	1050

SCHEDULE 3 – TOILET EXTRACT

Reference	EF-1
Manufacturers	Soler Palau *
Extract	0.115m³/s @ 130 Pa (external to unit)
Type	TD-500/150-160

Reference	EF-2
Manufacturers	Airflow *
Extract	0.015m³/s @ 50 Pa (external to unit)
Type	iCON 30

Reference	EF-3
Manufacturers	Soler Palau *
Extract	0.03m³/s @ 30 Pa (external to unit)
Type	Silent – 200 CHZ Design 3C

SCHEDULE 4 – VRF EQUIPMENT*

The VRF Heat Pump equipment has been based on Mitsubishi Electric equipment, contact John Ensell, Mitsubishi Electric (Tel: +44 (0) 1737 387170)

All Mitsubishi Electric equipment shall be supplied, installed and commissioned by a named Mitsubishi "Business Solutions Partner" approved contractor, such as Coolair Equipment (Tel: +44 (0) 1622 762222) - John Otterson

All condenser units are Located at Roof Level.

All systems within the building shall be controlled via one central controller, a Mitsubishi touch screen AT50B controller. Local remote controller shall be provided to each zone.

Internal Fan Coil Units System A

External Condenser Unit

Reference	CU 01
Model	PUMY-SP112YKM (Three phase)
Nominal Cooling Capacity	10.0 kW
Nominal Heating Capacity	13.9 kW

Internal Fan Coil Units

FCU Ref	FCU Model	Sensible Cooling Output (kW)	Nominal Cooling Output (kW)	Nominal Heating Output (kW)	Supply Volume (Low speed)
FCU-01	PLFY-P50VEM-E	5.0	5.6	6.3	217-300 l/s
FCU-02	PLFY-P50VEM-E	5.0	5.6	6.3	217-300 l/s

Internal Fan Coil Units System B

External Condenser Unit

Reference	CU 02
Model	PUMY-SP112YKM (Three phase)
Nominal Cooling Capacity	10.0 kW
Nominal Heating Capacity	13.9 kW

Internal Fan Coil Units

FCU Ref	FCU Model	Sensible Cooling Output (kW)	Nominal Cooling Output (kW)	Nominal Heating Output (kW)	Supply Volume (Low speed)
FCU-03	PCFY-P63VKM-E	6.32	7.1	8.0	233-300 l/s

Internal Fan Coil Units System C

External Condenser Unit

Reference	CU 03
Model	PUMY-SP112YKM (Three phase)
Nominal Cooling Capacity	10.0 kW
Nominal Heating Capacity	13.9 kW

Internal Fan Coil Units

FCU Ref	FCU Model	Sensible Cooling Output (kW)	Nominal Cooling Output (kW)	Nominal Heating Output (kW)	Supply Volume (Low speed)
FCU-04	PCFY-P100VKM-E	10.0	11.2	12.5	350-467 l/s

Internal Fan Coil Units System D

External Condenser Unit

Reference	CU 04
Model	PUMY-SP112YKM (Three phase)
Nominal Cooling Capacity	10.0 kW
Nominal Heating Capacity	13.9 kW

Internal Fan Coil Units

FCU Ref	FCU Model	Sensible Cooling Output (kW)	Nominal Cooling Output (kW)	Nominal Heating Output (kW)	Supply Volume (Low speed)
FCU-05	PCFY-P100VKM-E	10.0	11.2	12.5	350-467 l/s

SCHEDULE 5 – ELECTRIC WATER HEATERS *

Reference	WH-1
Manufacturers	Heatrae Sadia *
Capacity	30 Litres

Reference	WH-2 & 3
Manufacturers	Heatrae Sadia *
Capacity	15 Litres

SCHEDULE 6 - ACOUSTIC ATTENUATION EQUIPMENT

Provide and install sound attenuators/acoustic louvres as manufactured/supplied by Emtec Products Ltd [Telephone 0208 848 3031]. All in accordance with the requirements of the specification.

PART 6 TENDER SUMMARY

Leybourne Village Hall, West Malling, Kent ME19 5QL
TENDER SUMMARY – MECHANICAL SERVICES

This section of the specification is to be completed by the tenderer and carried forward to the tender price summary in the tender documents.

1. Preliminary matters £_____
2. Any other items in order to fully meet the requirements of the specification and which is not otherwise listed:- £_____
3. Samples £_____
4. Provision of Design and Working drawings £_____
5. Toilet extract fan including ductwork, ceiling valve £_____
6. Acoustic attenuation £_____
7. Gas distribution system £_____
8. Gas Fired Boilers (inc flues, pumps, pressurisation unit, etc.) £_____
9. Radiator system £_____
10. Electric panel heater system £_____
11. Electric water heaters and pipework £_____
12. DX Split system including condensate drain £_____
13. MWS and HWS to all outlets £_____
14. Pipe and ductwork insulation £_____
15. Automatic controls £_____
16. Above ground drainage installation (soil, waste & condensate) £_____
17. Rain water collection, gutters and down pipes £_____
18. Water treatment £_____
19. Testing and Commissioning £_____
20. Provision of Operation and Maintenance Manuals and As Installed drawings £_____

Total **£**_____

Our representative Mr/Mrs ……(name) has visited the site on ……(date) and we have made due allowance in our tender for site constraints and dealing with existing services, diversions and maintaining live services to the tenants.

Signed _____ Position _____ Date _____

Company _____

Leybourne Village Hall, West Malling, Kent ME19 5QL
TENDER SUMMARY – ELECTRICAL SERVICES

This section of the specification is to be completed by the tenderer and carried forward to the tender price summary in the tender documents.

1.	Preliminary matters	£_____
2.	Samples	£_____
3.	Provision of design and working drawings	£_____
4.	Isolation and removal of redundant electrical services	£_____
5.	MCB boards and energy metering	£_____
6.	Small power installation	£_____
7.	Lighting wiring and containment	£_____
8.	Luminaires (please provide separate schedule of rates for each luminaire inc lamps)	£_____
9.	Lighting control systems	£_____
10.	Fire detection & alarm system	£_____
11.	Data/Telecommunications - wiring and containment	£_____
12.	Power to mechanical services	£_____
13.	Intruder Alarm system	£_____
14.	CCTV system	£_____
15.	Access control systems	£_____
16.	Accessible toilet Assistance alarm system	£_____
17.	Audio Frequency Induction Loop	£_____
18.	Earthing and bonding	£_____
19.	Containment for all electrical services	£_____
20.	Testing and Commissioning	£_____
21.	Provision of Operation and Maintenance Manuals and As Installed drawings	£_____
22.	Any other items in order to fully meet the requirements of the specification and which is not otherwise listed:-	£_____
	Total	**£_____**

Our representative Mr/Mrs ……(name) has visited the site on ……(date) and we have made due allowance in our tender for site constraints and dealing with existing services, diversions and maintaining live services to the tenants.

Signed _____ Position _____ Date _____

Company _____

Belfast

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