UNIVERSITY OF LINCOLN

Standard Mechanical Requirements for both Consultant's Specification Requirements and Standards to be included by Estates Staff in all Electrical works

Contents

NOTE:
This document is intended to be in addition and supplementary to the standards as laid down in Building Regulations, Energy Performance of Buildings Directive, HVAC guides, CIBSE guides, British Standards, European Nomenclatures, BSRIA guides etc.

To avoid confusion and/or contradictions in specification clauses, consultants/designers must integrate these items into their specification documents and must NOT attach this document as an appendix.

General

1. Obligations under the principles of prevention for design, installation operation, maintenance and replacement of plant and equipment must be included for all items.
2. All plant and machinery must be designed to be fully accessible without the need for specialist access equipment or PPE. Designers will use the hierarchical principles of ERIC (Eliminate, Reduce, Isolate and Control) for installation, operation maintenance and replacement. Full justification for the access protocol must be submitted for to the CDM co-ordinator to ensure that this methodologoy can be justified prior to adoption.
3. This document is intended to be in addition to the standards as laid down in CIBSE guides, British Standards, European Nomenclatures, etc. To avoid confusion and/or contradictions in specification clauses, consultants must integrate these items into their specification documents and must NOT attach this document as an appendix.
4. All designs must comply with articles given in the European Performance of Buildings Directive 2005.
5. No option to supply equipment and services “equal and approved” or “offered” shall be included
6. All products to be energy efficient, complying with the Government Energy Technology list from ***www.eca.gov.uk.*** Web-site.
7. All equipment must be considered for full life cycle costs for energy payback periods.
8. Full carbon assessments shall be carried out to ensure carbon emissions do not exceed those specified by building regulations and CIBSE codes.
9. Full compliance with Building regulations parts ADL1, ADL2 (A & B as applicable) and European energy legislation.
10. Each building that has refurbishments over 1000m^2 gross floor area, major changes in excess of 10% of building floor area and all new buildings must have a full energy performance survey by a competent assessor to incorporate a new building energy performance certificate.
11. All live phase cable sheathing to be brown coloured and neutral phase cable sheathing to be blue coloured, all labelled L1, L2, L3 & N respectively in accordance with harmonised standards for cable identification. Armoured cables will have the new harmonised colours of brown, grey, black, blue for L1, L2, L3 & N respectively colour coded, brown, brown, brown, and blue. Use of grey and black conductor insulated single core cables will not be permitted. All fuse boards will be labelled with warning notices for differing colours between pre and post harmonised installations.
12. All energy usage for water, heat, chilled water, steam, compressed air, electricity and gas in excess of 10kW output must be accounted for with metering in accordance with building regulations and European Directives. Meters to all have digital read-outs, RS485 cable outputs and no-volt pulsed outputs for each and every meter, all connected back to the University Automatic Monitoring and Targeting system.
13. No changes to this specification will be permitted. Any deviations from this document will be replaced with standard and costs remediated at the consultants/designers expense.

(No alterations shall be permitted to this specification will be permitted unless specificically agreed in writing by the University. Any unathorised deviations from this document will be replaced with materials/equipment in compliance with the specification and costs remediated at the either the consultants/designers expense if instigated by their design without prior approval, or by the contractor if an unathorised alteration is made by the contractor.

Mechanical

General

- The Contractor shall allow for the design, co-ordinate, supply, take delivery of, install, test, set to work, commission and leave in full working order all items indicated within this specification and shown on the accompanying drawings. All ancillary equipment shall be included to provide full working systems.

- The Contractor shall include for all necessary plant, equipment, brackets, jointing material and alike to ensure a full and complete installation.

- The Contractor shall include for all access and handling equipment associated with these works.

- The Contractor shall allow for and take account of all work being undertaken to comply with relevant standards, codes of practice and statutory requirements.

Design Philosophy

- An attractive, neatly arranged, functional engineering design is required. The design of the engineering must allow the user control of the local environment and the external engineering services must be kept visually low profile as far as possible.

- Engineering materials and components must be durable and reliable, consistent with affordability. Minimum capital expenditure, value for money and cost in use will be prime considerations. Products seen and used regularly by the occupants shall be attractive and will need to be approved by the Contract Administrator.

- An agreed level of reliability and redundancy should be provided with good quality standards and selective provision for future expansion.

- The capability to operate and maintain the facility effectively and efficiently must be inherent in the design. Simplicity of design, operation and maintenance is a key objective and only solutions which have been reasonably “tried and tested” should be considered.

Maintenance Philosophy

- The new systems should provide an appropriate level of automatic monitoring and alarms, consistent with the designed use of this building.

- Engineering systems must be designed to avoid over complexity and the need for intensive maintenance.

Access for Maintenance and Replacement

Systems should be designed such that plant and components requiring replacement may be disconnected and removed without causing major disruption or disturbance to other elements.

In rooms with high ceilings means should be provided to gain access to high level components and equipment where necessary. Engineering risers should have fire compartment slabs at each floor level and services passing through shall be sealed to prevent spread of fire.

Doors and access panels to engineering services plant rooms and risers must be designed to satisfy requirements for fire compartmentation, acoustic integrity, air tightness, physical size and ease of opening for plant removal.

Adequate space should be provided in services risers and in congested horizontal zones to allow access for maintenance and cleaning (particularly the cleaning of internal air ducts and access to smoke detectors in cleaning voids). Such space should also allow for the future use of welding and lever based tools wherever appropriate

Replacement plant access routes must be demonstrated during the design phase to ensure that design clearances are maintained.

Proposed Design Parameters

The following data shall be used within the design of the mechanical and electrical engineering systems, based on our assumptions to meet with the College requirements and fully comply with current standards and legislation.

Winter Outside Conditions	-	minus 5^{o}C / 100% saturation
Winter Internal Conditions	-	20^{o}C +/- 1°C, air temp, teaching spaces.
	-	21^{o}C, areas with lower than normal level of physical activity due to sickness or physical disability.
	-	16^{o}C, circulation spaces.
	-	18^{o}C, general wc spaces.
Summertime Outside Conditions	-	30^{o}C db / 20^{o}C wb (where applicable)
Summertime Internal Conditions	-	21°C – 25°C . Where air conditioning has been installed the minimum cooling temperature should be set to 25°C.

WC Air Change Rates	-	8-10 ach/hr.
Occupied Spaces	-	10 l/s/person. Minimum of 4 ac/hr.
LPHW Heating	-	80/60^{o}C (operating pressure 2-3 Bar (g)
Hot Water Services	-	Point of Use electric water heaters where applicable.
Noise Levels	-	NR 25 – 35 teaching spaces and lecture halls.

A. Low Pressure Hot Water Heating

The heating system shall be designed to be capable of maintaining the minimum air temperatures quoted in the design parameters. Where areas are not specifically identified therein, CIBSE guidelines and Building Bulletin 87 shall apply. The new boiler installation shall be fully compliant with BS6644 and the Non-Domestic Heating, Cooling and Ventilation Guide (section 2).

The new development shall be provided with central high efficiency boiler plant to generate low pressure hot water for the heating systems. Additional capacity shall be provided via condensing operation gas fired boiler plant located within a plant room. The plant shall be powered by a natural gas supply with LPHW primary mains circulated around the site.

All primary LPHW headers, pipework, expansion and pressurisation, dosing pots and the like shall be sized to accommodate an additional 10% over the design heating load.

Boiler sequencing shall be controlled via the B.M.S. according to load demand.

Each gas fired boiler shall be condensing, fully modulating, ultra low NOX (<70 mg/kWh) and compliant with BS 5978, BS 6644 and BS 6798. Boiler plant shall have two return water connections. This is to facilitate a high temperature return from constant temperature circuits and a low temperature return from variable temperature circuits. This will enable the system to maximise energy recovery from boiler condensing mode operation, whilst still providing a high temperature circuit to meet the requirements of air handling unit heating coils. Boiler sequencing shall be controlled via the BMS according to load demand.

All new plant shall be installed in accordance with the relevant manufacturer's recommendations. Main plant items are to be commissioned by the manufacturers own labour.

Heating of the buildings core areas shall generally be provided via steel panel radiators. The radiators shall be of the 'Planer' type (as Stelrad range). The mechanical contractor shall co-ordinate radiator heights with window and dado heights, and radiator positions with final furniture layouts. Radiators shall not be located on main teaching walls (i.e. below or adjacent to whiteboards). Different strategies may be required to suit area function.

Dosing pots and strainers should be fitted when necessary to protect equipment e.g. automatic control valves,boilers, pumps. Strainers shall be provided with a means of isolation to facilitate cleaning. Drain valves shall be fitted to all low points in the system.

Exposed pipework connecting radiators in student accessible areas shall be run in steel to minimise mechanical damage and expansion. Copper pipework runs will be permitted in offices and staffrooms. Main distribution pipework and branches shall be run within ceiling voids.

In areas designated for use by disabled persons, Low surface temperature radiators (LST) shall be installed and all pipework shall be concealed above the ceiling and boxed in where dropping to low level. This includes disabled and ambulant WCs and showers.

All fire escape stairwells/routes where wheelchair refuges are present shall utilise LST radiators, complete with boxed in/concealed pipework.

All radiator systems shall be served via a dedicated variable temperature, weather compensated LPHW circuit. Local control shall be via lockable thermostatic radiator valves, with remote sensors where LST radiators are installed.

Over door heaters shall also be installed all main entrance lobbies to minimise draughts. These shall be connected to the constant temperature LPHW circuit. This is to be link to the BMS system.

Variable (compensated) temperature LPHW shall be provided to each floor complete with 2 port zonal control valves and automatic differential pressure regulating valves.

Design low pressure hot water heating flow and return temperatures will be lower than tradition to help maximize benefit from condensing boiler plant. Heating flow and return temperatures of the main constant temperature (C.T.) system shall be 80^{o}C / 60^{o}C respectively.

Pump sets will be variable speed, run and standby configuration to enhance resilient operation. Pump sets shall be complete with isolation valves, strainers, non-return valves, pressure and temperature gauges.

B. Air Conditioning

No comfort cooling will be considered unless it has completed and satisfied the University of Lincoln: Sustainable Construction Guidelines.

Air conditioning units shall be complete with integral BMS control card to fully control and monitor unit function via no-volt control cabling back to the local BMS system. All units to have a separate room sensor and controls protocol installed to facilitate connection and control via the BMS. Air conditioning units shall generally be Mitsubishi and a Mitsubishi MA remote controller.

All units to be inverter driven rather than conventional on/off controlled. Chilled water systems must be used over DX.VRV systems wherever possible. Should a multiple DX.VRV system be considered, this must have oxygen depletion warning in all areas that pipework, condensors or fan coil units are installed as standard and must be linked via specialist interfaces to both the Building energy management system and fire alarm system.

Air Conditioning chilled water pipework shall be installed in accordance with the HVAC and CIBSE guidance with full anti-vapour sealed “isogenopak” insulation to the correct thickness. Where insulation is run externally, it shall be covered with aluminium clad covering to prevent bird/vermin attack. All interconnecting wiring from and between units will be clipped separately on independent tray work with cleats or stainless steel ties. Nylon tie-wraps will not be permitted. All phase conductors will be labelled Brown (L1), Brown (L2), Brown (L3), Blue (N) and the earthing conductor Green/yellow/ No tape identification will be permitted – heat shrink identification shall be used on entire length of conductors.

Air Conditioning DX pipework shall be installed in accordance with HVAC and CIBSE guidance with full anti-vapour sealed “armaflex” insulation to the correct thickness. Where

insulation is run externally, it shall be covered with aluminium clad covering to prevent bird/vermin attack. All interconnecting wiring from and between units will be clipped separately on independent tray work with cleats or stainless steel ties. Nylon tie-wraps will not be permitted. All phase conductors will be labelled Brown (L1), Brown (L2), Brown (L3), Blue (N) and the earthing conductor Green/yellow. No tape identification will be permitted – heat shrink identification shall be used on entire length of conductors.

All air conditioning systems will be installed to comply with the FGas regulations, all parts.

C. Ventilation

The following design and installation standards shall apply, where relevant:-

Current Building Regulations

CIBSE Guides

CIBSE TM26 - Hygienic Maintenance

HVCA DW143 - Leakage Testing

HVCA DW144 - Sheet Metal Ductwork

HVCA DW154 - Plastic Ductwork

HVCA DW172 - Kitchen Ventilation

HVCA DW191 - Glass Fibre Ductwork

HVCA DW/TM2 - Cleanliness of New Ductwork (to a minimum of intermediate level)

HVCA DW/TM3 - Fire Dampers

HVCA TR/17 - Provision of Access for and Methods of Cleaning Ductwork

BSEN5588 - Fire Precautions

BSEN12237 - Strength and Leakage

BSEN12236 - Hangers and Supports

BSEN13403 - Ductwork Made From Insulation Boards

BSEN13501 - Fire Classification

BSRIA TN6/94 - Fire Dampers

HTM 2025 - Ventilation in Healthcare Premises

National Health Service Model Specification

Generally, all teaching and learning spaces shall utilise mechanical heat recovery ventilation distributed through the building via ceiling mounted ductwork. Air distribution within rooms will utilise low velocity high level supply diffusers and extract grilles.

Dedicated mechanical ventilation will be provided to areas with specific requirements including lecture theatres and kitchens.

All ventilation ductwork, with the exception of WC block and kitchen extract ductwork shall be fully insulated and vapour sealed.

The building's general office, teaching and learning spaces, and ancillary rooms, shall be served by heat recovery air handling units (AHU). Each AHU shall have as follows; thermal wheel complete with hydroscopic coating capable of 80% heat recovery, filtration, high efficiency variable speed fans, LPHW pre-heat coil, LPHW heating coil, acoustically lined panels, mounting frame, suitable for internal mounting as Swegon Gold RX unit or equal and

approved. All new AHU plant shall be installed in full accordance with the manufacturers' requirements and commissioned by the manufacturers own labour.

AHU's shall be complete with integral controls, suitable for communication with the BMS, to undertake all necessary control functions including; speed control (dependant on external static pressure), thermal wheel control, temperature sensing and the like. Demand shall be controlled under the dictate of local room controllers and the BMS.

Supply air to rooms will be via high level diffuser terminals, suitable for the environment. Return air shall be extracted via the use of suitable grilles located at high level. Dampers shall be controllable via room units and also direct via the BMS, to allow for override and night time purging.

AHU's shall be fitted with silencers and transfer ductwork with crosstalk attenuation to ensure compliance with the required noise criteria.

The ventilation system shall be designed to meet the individual areas fresh air requirements by providing a sufficient volume of tempered air as required to keep CO2 levels to an acceptable level. Natural Ventilation to areas shall be achieved by means of mechanically operated dampers within external louvres positioned at ground floor level, these will allow for an adequate volume of fresh air to enter the building.

Motorised dampers and actuated roof lights shall be complete with integral controls, suitable for communication with the BMS, to undertake all necessary control functions including; temperature and air quality sensing. Operation shall be controlled under the dictate of the BMS system and shall allow for override and night time purging.

Consideration shall be given to attenuation to ensure compliance with the required noise criteria.

The ventilation system shall be designed to meet the areas fresh air requirements by providing a sufficient volume of fresh air as required to keep CO2 levels to an acceptable level.

The WC blocks, shall all be served by dedicated variable speed fan capable of automatically regulating airflow to match demand

Units shall be 'twin' high efficiency fans for run and standby operation. Units shall be installed in full accordance with the manufacturers requirements.

Extract air shall be ducted from WC blocks via ceiling grilles and galvanised steel ductwork. Each room shall have a dedicated automatic control damper and occupancy sensor with 15min adjustable overrun timer.

Extract fans shall be fitted with silencers and transfer ductwork with crosstalk attenuation to ensure compliance with the required noise criteria.

Commercial kitchen and serverys shall be serviced by a dedicated extract fan and supply AHU. The kitchen extract fan shall be of the high efficiency backwards curved type, suitable for variable speed, with motor outside the air stream, contained within an 'aluzinc' corrosion resistant housing as Nuaire 'Squif' or equal and approved.

Extract ductwork shall be suitably fire rated to comply with BS3476 and BS5588 as well as DW172 and DW144 and shall connect the extract fan to kitchen canopy. Ductwork shall be fitted with suitable fully sealed access hatches to enable cleaning of all ductwork, bends, sets, tees, transformations and the like. Remote kitchen mounted fan speed controllers shall be provided for user fan speed control, with controls being interlinked with the supply AHU for automatic speed control of both units.

The extract fan shall be suitable for external mounting and shall be designed to ensure compliance with the acoustic requirements of the project.

The kitchen extract canopy shall be complete with its own integral fire suppression system.

The kitchen supply AHU shall have as follows; kitchen grade filtration, high efficiency variable speed fan, LPHW pre-heat coil, LPHW heating coil, DX cooling coil, acoustically lined panels, mounting frame, suitable for internal mounting as Swegon Gold RX unit or equal and approved. All new AHU plant shall be installed in full accordance with the manufacturers' requirements and commissioned by the manufacturers own labour.

The AHU shall be complete with all necessary integral controls suitable for connection to the BMS controllers, sensors and the like, and for communication with the kitchen extract fan, to undertake all necessary control functions including; damper control, fan speed control, temperature sensing and the like. Demand shall be controlled under the dictate of the BMS and local user controller.

Supply air shall be distributed through the building via galvanised steel ductwork, with supply to the kitchen via the canopy (canopy by others) and via ceiling diffusers. The supply AHU shall be fitted with silencers to ensure compliance with the acoustic requirements of the project.

D. Chilled Water

No comfort cooling will be considered unless it has completed and satisfied the University of Lincoln: Sustainable Construction Guidelines.

Chilled water systems must be used over DX/VRV systems wherever possible. Should a multiple DX/VRV system be considered, this must have oxygen depletion warning in ALL individual areas that pipework, condensors or fan coil units are installed as standard and must be linked via specialist interfaces to both the Building energy management system and fire alarm system.

Air Conditioning chilled water pipework shall be installed in accordance with HVAC and CIBSE guidance with full anti-vapour sealed "isogenopak" insulation to the correct thickness. Where insulation is run externally, it shall be covered with aluminium clad covering to prevent bird/vermin attack. All interconnecting wiring from and between units will be clipped separately on independent tray work with cleats or stainless steel ties. Nylon tie-wraps will not be permitted. All phase conductors will be labelled Brown (L1), Brown (L2), Brown (L3), Blue (N) and the earthing conductor Green/yellow. No tape identification will be permitted – heat shrink identification shall be used on entire length of conductors.

Air Conditioning DX pipework shall be installed in accordance with HVAC and CIBSE guidance with full anti-vapour sealed "armaflex" insulation to the correct thickness. Where insulation is run externally, it shall be covered with aluminium clad covering to prevent bird/vermin attack. All interconnecting wiring from and between units will be clipped separately on independent tray work with cleats or stainless steel ties. Nylon tie-wraps will not be permitted. All phase conductors will be labelled Brown (L1), Brown (L2), Brown (L3), Blue (N) and the earthing conductor Green/yellow. No tape identification will be permitted – heat shrink identification shall be used on entire length of conductors.

E. Hot and Cold Water Services

The water services shall be taken from the University of Lincoln water network. Estimated water consumption is based on guidance with BB87, to minimise water useage. The existing water infrastructure shall be surveyed and inspected to ensure it conforms to the requirements of the current Water Regulations.

The domestic hot and cold water services installation shall be designed to the recommendations laid down in the CIBSE guide, Water Regulations, ACOP L8, and to current practice and the following parameters: -

Hot and cold water system maximum pipework velocities shall be as detailed in the CIBSE guide dependant upon pipe size.

Hot water flow temperatures to be 60oC minimum with a return temperature of 55oC (circulation systems).

Flow rates are to be calculated by a demand unit basis to determine maximum simultaneous flow rates all as detailed in the CIBSE Guides. Demand units are to be based upon a public basis.

The system shall be designed specifically in accordance with statutory and recommended and recognised guidance for the control of legionella. Recommendations as given by the department of health for the control of legionella in health care premises shall be strictly adhered to and shall be applicable to this project. In this regard the following shall be noted: -

The maximum hot water dead leg shall be limited to 5 metres. (5 metres unblended, 2 metres blended).

A vapour seal shall be applied to all mains, cold water and all domestic hot water in plant rooms, voids, and underground ducts etc. shall be insulated.

The new domestic hot and cold water systems shall be fully compliant with the WRAS water regulations guide.

Hot water to all areas shall be provided via point of use electric water heaters generally located under sinks and within IPS voids. All point of use water heater shall be fully accessable for inspection and maintenance.

All storage systems shall be complete with all necessary pressure and temperature safety systems, pressurisation equipment.

Hot water to the kitchen / servery shall be provided via a dedicated hot water storage cylinder located at high level within the kitchen store. The cylinder shall be complete with a pumped re-circulating return, pump de-stratification circuit, and all necessary safety, expansion and control devices required.

Thermostatic Mixing Valves in accordance with BS 1415 Part 2, will be required on all wash hand basins. On sinks, where mixing valves are not required, labels reading “caution – very hot water” shall be provided on all hot water outlets.

Water saving fittings shall be specified where possible for all domestic hot and cold water outlets in line with the sustainable principles of the project.

In order to reduce the risk of minor leaks in toilet facilities, solenoid valves are to be installed on all water supply branches to WC areas. The flow of water through each solenoid valve shall be controlled via infra-red movement detectors within each toilet facility or a sensor placed at the entry doors to each facility.

F. Sanitary Ware

All water systems, fittings and installations must be WRaS (Water Research Council approved Scheme) approved.

Hot and cold water taps shall be of the standard pattern type manufactured by either; Armitage Shanks Dart Valley, Ideal Standard or Twyfords.

All in toilets and high risk areas, wash hand basins will be fitted with TMV3 DO8 anti-scald mixing devices, complete with isolation valves. Other Wash hand basins will be fitted with TMV2 anti-scald mixing devices complete with isolation valves. All taps to be DDA compliant and minimis water use.

Flexible hoses/ flexible tap connections must not be used on any fixed equipment. All final connections to sinks, WHB's and any other fixed equipment must be in solid copper pipework. Manufactures hoses for washing machines/dishwashers or other items of non-fixed accessories are the only exception to this but must STILL be agreed in writing by University of Lincoln prior to inclusion in any specification documents. Where it is not possible to preclude the use of flexible hoses (e.g. rise and fall basins, baths, etc) these must be both WRaS approved and also of the PEX lined (Cross linked Polyethylene)construction.

G. Natural Gas

The buildings natural gas infrastructure shall be taken from the University of Lincoln gas network. The gas service shall enter the building at ground floor level in a dedicated riser with uninterrupted access to the meter and isolation valve.

The buildings natural gas supply should be surveyed to ensure the existing gas infrastructure conforms to the requirements of the current gas safety installation and use regulations.

H. Compressed Air

Spacific requirements of individual project compressed air systems will be set out as part of the clients requirments.

I. Vacuum Systems

Spacific requirements of individual project vacuum systems will be set out as part of the clients requirments.

J. Controls

The new building management system shall provide strategies for automatic control of all new plant items. keypad. A laptop shall be provided by the controls contractor with all necessary software uploaded for remote monitoring purposes.

The new building management systems shall be fully compliant with the University of Lincoln: Sustainable Construction Guidelines.

The building management system shall be fully compatible with the university's existing site wide system of which it shall be linked back to.

The following controls facilities shall be provided: -

- Optimum start/stop facilities.
- Status of all major plant items (run/off/trip/alarm)

- Display/adjustment of AHU supply temperatures and common return temperatures.
- Display/set point adjustment of common space temperature sensors.
- Display of primary heating flow and return temperatures.
- Weather compensation of variable temperature facilities.
- Display of variable temperature flow and return temperatures.
- Various alarms for plant failure/sensor readings.
- Monitoring of gas, water and electricity energy meters.
- Plant duty sharing, i.e. rotational changeover of lead boiler / pump systems.

A concise building log book shall be provided on completion which shall comprise copies of predicted design energy ratings for the building broken down across various systems, i.e. lighting, heating, domestic hot water etc. The BMS shall permit interrogation of measure values for the same, which again should promote effective operational energy management.

Within performance specifications, a return visit from commissioning and controls engineers to review operational energy performance and adjust BMS control set-points etc to help optimise operational efficiency. In this way, it is intended that the performance of the building as-built shall be more consistent with the design intent.

BMS interface with building lifts, such that lift halt at certain floors may be excluded out of normal hours, to ensure that building security is not compromised.

K. Above Ground Drainage

From drainage connections provided at ground slab, a new UPVC solvent weld soil and waste drainage system shall be provided to comply with current legislation. The following British Standards will apply to the design and installation: -

BS 219:1984, BS 416:1973, BS 864:1983, BS 1184:1981, BS 1494:1964, BS 2494:1986, BS 2598:1980, BS 2871:1971, BS 3943:1979, BS 4991:1982, BS 5572:1978, BS 5292:1980.

The detailed design of the above ground drainage systems will be developed and co-ordinated in conjunction with the Project Architect at a very early stage during the detailed design process. Reference shall be made to the Architects layout drawings for the scope and extent of sanitary appliances requiring above ground drainage connections.

L. LEV

A specialist LEV designer shall be engaged to undertake the whole LEV system design. The designer shall be experience and competant as set out in Health and Safety Executive HSG258.

The LEV system shall take account of the Proposed Design Parameters as setout earlier in this document.

Fume cupboard fans to be fitted with three phase direct drive BSEN60034-30 IE3 motors with VSD control locally set and enabled locally from the individual fume cupboard controller complete with 2 No 2 pole no-volt BEMS contacts wired back to relevant BEMS outstation(s).

M. Testing and Commissioning

All testing and commissioning shall be carried out in acordence with the CIBSE and BSRIA guidance.

N. Operation, Maintenance Manual and As Fitted Drawings

Provide any system record documents and full documentation as required and in acordence with the CIBSE and BSRIA Operating and Maintenance Template guidelines to include

BMS, installation commissioning certificates, Operation & Maintenance manuals in paper and electronic format including a copy of all as fitted record drawings in CAD format.

O. Preferred Manufacturers

Listed below are manufacturers for plant items and equipment to be specified for the project.

Item	**Manufacturer**
Mechanical Plan	
Boilers	Remeha
	Ideal
	Vaillant
Air Handling Unit	Swegon
	VES Andover
	Nuaire Ltd
	FlacktWoods
Pumps	Grundfos
Point of Use Water Heaters	Heatrae Sadia
	Santon
	ZIP
Water Heaters	Lockinvar
Automatic Controls	Delta
Grilles	Waterloo
	Gilberts
Sanitary Ware	Armitage Shanks
	Dart Valley
	Ideal Standard
	Twyfords
Radiators	Stelrad
Thermostatic Radiator Valve	Danfoss
	Herz