



## ESTATES SUPPORT SERVICE

### Project Briefing Document

#### Section 2 – Mechanical Services design guide and specifications

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## **1.0 Communications Generally :**

All communications by designers with University personnel must be agreed with the Estates Project Manager. Where references are made in this document regarding contact with Estate personnel, the Estates Project Manager will set up meetings and co-ordinate at each relevant stage of the RIBA Plan of Work.

## **2.0 Introduction and General Guide :**

### **Mechanical Services Design Guide**

The purpose of this document is to outline the design standards that are acceptable to the University in terms of materials, methods of working and design criteria with respect to the Mechanical Engineering services installations.

This document does not cover all aspects of Project Design, it is primarily concerned with those areas where the University wishes to express a preference and should be read in conjunction with further detailed specifications, room data sheets and other supporting documentation provided by the University.

The Design Engineer should liaise with the building users and ESS maintenance (via the Estate Project Manager) as far as possible to fully understand the operation and use of the building.

Although all projects will be job specific and may require design standards that complement or match the existing, the following sections identify the standards which are acceptable and preferred; all deviations from the recommendations contained within this document shall be supported by a written justification from the designer and must be authorised, in writing, by the Estate Project Manager. A written reply will be provided by the Maintenance Section, sanctioning the deviation or rejecting (with explanation).

All material specifications are generally to match those already used throughout the University estate and also used by the Direct Works Organisation, however equal and approved options may be allowed at the discretion of the University Estate Support Services. Information relating to any major items of plant and equipment will be submitted to the Estate Support Services for inspection and approval by the Maintenance Section prior to procurement.

The Mechanical services design and installations shall focus on producing a functional, flexible and energy efficient building by utilising best practice in order to provide the following :-

- Robust and resilient engineering systems
- Good comfort conditions for the occupants
- Installations which require relatively low maintenance
- Systems which have relatively low straightforward operational procedures
- Systems which are as energy efficient as possible and minimise carbon emissions

Where there are large or complex services and systems, a specialist commissioning agent should be appointed to advise at design stage and also to carry out and provide the project commissioning plan for the Mechanical services systems.

All commissioning is to be carried out in accordance with the current CIBSE and BSRIA commissioning guides.

All of the services installations and systems shall be designed and installed with due regard for the future maintenance. This is to take into account the sizing and location of plant with respect to routine inspection and servicing requirements and also the future replacement. The requirement to work at height to carry out maintenance / servicing etc, is to be designed out unless permanent access provision is provided i.e working platforms, appropriate fixed ladders etc.

All forms of press fit and crimping type pipeline and fittings systems should generally not be used and only considered in special circumstances. The preference is for traditional welded, screwed and soldered type pipeline joints and fittings to be specified and installed.

For all systems and equipment which require planned preventative maintenance by service engineers the first year maintenance contract should be incorporated into the project requirements and costs.

The University have a set of agreed procedures and permits to work systems for specific mechanical tasks and mechanical isolations which must be complied with and the up to date procedures and documentation can be found on the University, ESS website under health and safety, forms and permits.

For works required on any existing mechanical systems, ESS Maintenance must be notified of all main building system Isolations, drain downs and re- filling of wet systems. This can be facilitated by the Maintenance team, however a minimum 14 day notification period is required in advance of ESS carrying out any of the above tasks.

Generated noise and noise breakout from Mechanical plant and services are to be controlled via acoustic attenuation measures in order to bring the external / internal noise criteria to within acceptable levels as dictated by the HSE guidance and noise at work regulations.

### **3.0 Environmental and Sustainability Strategy :**

As concerns grow for future resources coupled with the effects of environmental pollution and global issues, the role of designers and operators of buildings and their energy use becomes ever more important.

It is essential that, for all minor and major projects, opportunities for improving the efficiency and effectiveness of energy use are examined and fully utilised to ensure energy and environmental savings, whilst maintaining the comfort and health of the occupants.

When areas are to be upgraded, or for new installations, the designers must always consider their design from a sustainable and environmental perspective and will be required to comply with the current Building Regulations.

In order to assist with this the Mechanical services will be designed to minimise CO2 production by providing the following passive measures :-

- High standards of insulation
- High standards of air tightness
- Low emissivity double glazing
- Maximising efficiency and heat recovery on mechanical systems
- Primary plant and equipment shall be selected to minimise energy use and carbon emissions

Designers are required to meet the requirements of all current Building Regulations and are also to be responsible for making all such necessary applications and approvals via Building Control.

In accordance with Government policy, any major refurbishment or new project will be required to provide an option for incorporating building information modelling and soft landings into the project brief (also refer to handover documentation section). A more detailed guide to the University and HEFCE requirements for design and construction policy for sustainable buildings and campus environments can be found on the standard design construction policy document.

Any variation to this guide should be discussed with the designated Project Manager and the Estates Energy Manager at the earliest indication that a change is being considered (this would normally occur at C or D stage of the RIBA Plan of Work).

#### **4.0 Incoming Services – Gas, Mains Cold Water and Drainage :**

It is the responsibility of the design team to include for any necessary works or upgrades to the infrastructure of the incoming services. This shall include carrying out the required notifications and liaising with the appropriate utility providers, carrying out predicted load calculations and coordinating routes of the services into the buildings.

##### **Metering / sub-metering**

The necessity to meter or sub-meter gas, steam, heat / cooling energy meters and water should be determined at design stage. Where applicable, the appropriate meter should be installed together with a unique identification label. This information, together with an accurate location description drawing and details of the service provider, should be forwarded to the University Energy Manager.

The meters would be required to be compatible with the site Building Energy Management System to allow monitoring and targeting can be carried out.

## **Gas Regulations**

All work in respect of the installation and maintenance of gas systems and appliances must conform to the requirements of the “Gas Safety (installation and use) Regulations” 1998 (or the latest edition).

The University have a Gas Safety Management plan in place and it is the responsibility of each designated role to carry out the procedures detailed under the plan. The policy can be found on the University ESS website and within the project briefing supporting documents.

## **Natural Gas Systems**

Natural gas supplies shall be extended from the incoming mains to serve the heating systems and as required by the project specific room requirements.

As detailed above sub meters shall be installed to each supply serving differing buildings and areas of use.

Gas supplies within teaching areas shall be served with an emergency stop button located near the exit and which shall isolate all of the gas supplies to that particular area.

Gas supplies within commercial Kitchen areas shall be provided with a gas proving and interlock system with the extract ventilation system.

Gas schematic drawings must be provided and updated to reflect any alterations to the gas installations. The gas schematic drawings need to be placed at the meter location and also at any other relevant location such as the building or boiler room entry point.

## **Water and Drainage Systems**

The designer shall liaise with the local water authority and regulations inspector to ensure the water services and drainage systems and installations fully meet and comply with their requirements. The design team are to consider surface water and flood risk management as detailed in the relevant standards and regulations.

Water and drainage system schematic drawings must be provided and updated to reflect any alterations to the water and drainage installations. The schematic drawings need to be placed at the meter location and also at any other relevant location such as the building or boiler room entry point. (Also refer to section 6.0 - Domestic Water and Above Ground Drainage Systems).

## **5.0 Heating and Cooling Systems :**

Heating and Cooling loads shall be minimised by utilising the guidelines outlined in the Environmental Strategy and by adhering to the following guidelines :

## **Heating Systems :**

The University have a heating policy document which must be adhered to and can be seen on the University ESS web-site and within the project briefing supporting documents.

An optional appraisal shall be presented to the University which shall cover the heat generation available to the development. The appraisal shall include estimates of life cycle costs, maintenance requirements, energy use and carbon emissions. Possible methods should include Biomass, Ground Source, Solar Thermal, Combined Heat and Power and Conventional Gas Fired.

The heat generation plant shall be high efficiency in terms of energy use and low NOx and carbon emissions in accordance with the Building regulations and BREEAM requirements.

Condensing boilers with fully modulating burners shall be specified for new and replacement installations. If the case for a condensing boiler cannot be justified then the minimum standard will be a high efficiency low NOx boiler.

Careful consideration should be given to the size and number of boilers to be installed as oversized heating plant will reduce seasonal efficiency and increase capital cost unnecessarily.

There are a number of manufacturers of boiler plant which cause maintenance and stock availability problems within the operations department, boiler selections should therefore preferably be based on those manufacturers which are currently installed and successfully operating on the University Campus.

The Design Engineer should be aware that most of the existing heating boiler plant on the Main Precinct is not normally operated during the summer from June until September.

The heating plant will generate low temperature hot water which shall be distributed around the building in a closed, pressurised pipework system with a system pressurisation unit and water treatment dosing system. A low loss header arrangement shall be utilised providing a constant temperature primary circuit and variable temperature secondary circuits.

Pressure, temperature test points shall be provided at all the main system locations with respect to the main items of plant and equipment and also the main flow and return headers.

For all low temperature hot water pumps, consideration must be given to the installation of duty / stand by arrangements. Inverter driven /speed control pump installations which are sized to cope with future expansion should also be provided. Pumps shall be fitted with the necessary anti – vibration mounts and provided with strainers on inlet and non return valves on discharge side.

All expansion bellows to equipment shall be supplied to a minimum double red band rating.

Generally isolating valves shall be butterfly / ball type valves with lever handle and shall be supplied and fitted to all parts of the system to allow isolation of all main and sub circuits and isolation of all plant and equipment.

Commissioning valves and devices to allow measurement and flow shall be provided at all points to ensure the correct and efficient setting to work of the system as determined by the design.

The majority of heat emitters will be fed from a compensated circuit controlled by appropriate modulating valves at the dictates of the Building Management System.

Unless absolutely necessary stand alone systems should not be used.

All radiators and perimeter heating systems will also be fitted with thermostatic radiator valves

All convectors and door curtains, will be connected to a constant temperature circuit.

The University water treatment specialist shall be employed to carry out an analysis of the installed heating system and provide a proposal to flush, clean and chemically dose the system in order to inhibit corrosion and bacterial growth and also to prevent detrimental effects to plant, pipework and equipment.

All heating pipelines shall be thermally insulated using phenolic foam sections with class 'O' rated foil finish. All pipework insulation located externally or in plantroom areas are to be finished with metal cladding.

The services shall be identified by means of colour bands and the name and flow direction of the piped service.

When work is carried out on existing heating systems all redundant pipe-work and equipment will be stripped out.

Schematic drawings must be provided for all new installations and updated to reflect any alterations to the existing heating installations and detailed as 'As Installed Drawings'. The schematic drawings need to be added to the health and safety file and also placed at a relevant location such as the building or boiler room entry point.

All concealed services, in particular system isolation valves which are above ceilings or behind enclosures shall be identified accordingly.

### **Cooling Systems :**

Wherever possible, designers should avoid mechanical ventilation and air conditioning systems. This may require designers to consider the options at early design concept to ensure natural ventilation/free cooling is fully utilised.

Introduction of full air conditioning into a design will dramatically increase the University's energy costs and carbon footprint, therefore it must be avoided wherever possible. Air conditioning/Comfort Cooling systems may only be specified after full consultation and agreement with the Energy Manager and is subject to receiving the necessary approval from the submission of the Air Conditioning and Cooling Case Assessment application form.

End users should be made aware (by the Estate Project Manager) that they may be responsible for energy and maintenance costs of any air conditioning or comfort cooling systems. Therefore all air conditioning and comfort cooling plant will have the electrical supply fitted with a simple totalising meter as the energy charges may be recouped from the school responsible for the installation.

Good control is essential for comfort conditions and energy efficient operation. A suitable interface to the Building Management System will be incorporated so that heating and cooling systems cannot operate simultaneously. Cooling should not commence until the space temperature reaches 24 Deg C unless there is a process requirement for lower temperatures.

An option appraisal shall be presented to the University, which shall cover the methods of cooling / heat rejection and cooling distribution available to the development. The appraisal shall include estimates of life cycle costs, maintenance requirements, energy use and carbon emissions.

Possible methods of cooling should include ground source, dry air coolers, absorption cooling, conventional air cooled chillers with free cooling coils/cycles and variable refrigerant systems with a primary water loop.

All cooling and air conditioning systems shall be supplied, installed and commissioned by a recognised and approved HVCA Contractor specialising in these installations.

Refrigerant based direct expansion split systems shall only be used for small specialist areas where none of the above systems are appropriate. The chosen refrigerant gas installation and system will be environmentally friendly and will comply with the current F gas regulations. Condensate discharge will be installed with an air break, normally a tundish arrangement, to a suitable agreed waste point, the tundish will be labelled to indicate which unit it serves.

Generally isolating valves shall be supplied and fitted to all parts of the system to allow isolation of all main and sub circuits and isolation of plant and equipment.



Commissioning valves and devices to allow measurement and flow shall be provided at all points to ensure the correct and efficient setting to work of the system as determined by the design.

Pressure, temperature test points shall be provided at all the main system locations with respect to the main items of plant and equipment and also the main flow and return headers.

The University water treatment specialist shall be employed to carry out an analysis of the installed cooling system and provide a proposal to flush, clean and chemically dose the system in order to inhibit corrosion and bacterial growth and also to prevent detrimental effects to plant, pipework and equipment.

All cooling pipelines shall be thermally insulated using phenolic foam sections with class 'O' rated foil finish. All pipework insulation located externally or in plantroom areas are to be finished with metal cladding.

The services shall be identified by means of colour bands and the name and flow direction of the piped service.

The installation will be installed complete with a service contract in place for the first year, service reports will be forwarded to the Estate Support Services on completion of each visit.

Where condensing units are located on roof areas the unit must either be installed on a proprietary support system or hung from a parapet. Sufficient space underneath equipment must be allowed so that roof repairs can easily be carried out.

The Estate Support Services maintain a Schedule of Systems in respect of refrigerant gas systems. It is imperative that Project Managers update the document and inform the Maintenance Officer in charge of the F-gas regulations for each project where air conditioning units or refrigeration units are installed.

When work is carried out on existing cooling systems all redundant pipe-work and equipment will be stripped out.

Schematic drawings must be provided for all new installations and updated to reflect any alterations to the existing cooling installations and detailed as 'As Installed Drawings'. The schematic drawings need to be added to the health and safety file and also placed at a relevant location such as the building or boiler room entry point.

All concealed services, in particular system isolation valves which are above ceilings or behind enclosures shall be identified accordingly.

## **6.0 Domestic Water and Above Ground Drainage systems :**

### **Water Regulations**

The designer shall liaise with the local water authority and regulations inspector to ensure the water services and drainage systems and installations fully meet and comply with their requirements.

As part of the Water Supply (Water Fittings) Regulations the contractor working on these systems will need to be a member of an approved scheme, which may exempt the project from certain Water Authority notification and inspection procedures.

The approved Contractors will be required to be a member of one of the following groups : Water Industry Approved Plumber Scheme, The Institute of Plumbers, The Association of Plumbing and Heating Contractors and the Scottish and Northern Ireland Plumbing Employers Federation.

The installation shall include all appropriate means and measures to prevent back-syphonage as required by the water regulations.

The University water treatment specialist shall be employed to flush and disinfect all domestic hot and cold water systems as per current legislation and guidance.

### **Legionella**

All work on new or existing installations shall comply in all respects with the latest editions of ACOP, the Control of Legionella Bacteria in Water Systems and the Estate Support Services procedures. The University retain the services of a company to manage the control of legionella in accordance with the ACOP; details of the current provider can be obtained from the Maintenance Section of Estate Support Services.

The University have a control of legionella policy and procedure in place and it is the responsibility of each designated role to carry out the procedures detailed under the plan. The policy can be found on the University ESS website and within the project briefing supporting documents.

It is the duty of the Contractor to ensure that the building legionella risk assessment has been revised to show any alterations or additions to the system.

Generally :

In existing buildings which are been refurbished it is a requirement for Contractors to carry out a simple flushing / purging regime for the duration of the works to prevent water stagnation as part of the management and control of legionella.

Where eye wash or drench showers are installed, a tee-piece with quarter turn valve, drain cock and hose connection are to be installed to allow legionella flushing to be carried out.

Where Infra-red taps and flow regulators are installed the installation must be provided with a purge valve to allow legionella flushing to be carried out.

## **Water Systems**

An options appraisal shall be presented to the University, which shall cover the possible integration of rain water harvesting and solar thermal hot water generation to the development. The appraisal shall include estimates of life cycle costs, maintenance requirements, energy use and carbon emissions.

Cold water systems, where possible shall avoid cold water storage tanks. outlets shall be served from the mains via a break tank and booster set, providing a potable water supply system.

For all water system pumps, consideration must be given to the installation of duty / stand by arrangements. Inverter driven /speed control pump installations which are sized to cope with future expansion should also be provided.

Pumps shall be fitted with the necessary anti – vibration mounts and provided with strainers on inlet and non return valves on discharge side.

The University have a safe drinking water policy document which must be adhered to – The policy can be found on the University ESS website under health and safety, policy and safety arrangements.

Hot water systems shall be provided from a central source with a distribution system comprising of flow and return circuits together with a circulating pump.

Where large quantities of hot water are not required, hot water storage systems should be avoided and where feasible instantaneous or plate heat exchangers systems should be utilised for the provision of hot water.

In small or isolated locations it may be more practicable to install small independent storage or instantaneous hot water heaters.

All hot water heaters are to have isolation valves, drain points and be fitted with visible temperature gauges.

Fire fighting rising mains shall be provided in accordance with the fire strategy, current regulations and legislation.

Local fire fighting equipment will be provided in the form of fire extinguishers and where feasible any existing fire hose reel systems should be made redundant, stripped out and removed.

Generally isolating valves shall be butterfly / ball type valves with lever handle and shall be supplied and fitted to all parts of the system to allow isolation of all main and sub circuits and isolation of plant and equipment.

Each water appliance or group of outlets, will have local Ballofix isolating valves fitted to aid removal of appliances and taps.

Mains isolation valves will be inspected and renewed as required even if they are outside of the project area, access locations to isolating valves will be clearly identified and labelled.

All hot and cold water pipelines shall be thermally insulated using phenolic foam sections with class 'O' rated foil finish. All pipework insulation located externally or in plantroom areas are to be finished with metal cladding.

The services shall be identified by means of colour bands and the name and flow direction of the piped service.

### **Drainage / Waste Systems**

All waste pipe-work will be carried out using push-fit connections, solvent welded fittings are not acceptable.

Access to waste systems and rodding points on pipe-work will be provided and clearly identified and all systems are to be designed and installed to be fully accessible for maintenance and clearing blockages.

All new Laboratory drainage and waste systems are to be installed using appropriate vulcathene pipeline and fittings. All Lab vulcathene waste pipeline systems are to be installed using the purpose designed fittings and mechanical fixing system.

Generally :

Water boilers shall be provided to kitchenette areas.

Water flow control regulators will be installed where appropriate to all water outlets.

Thermostatic mixing valves will be used for accessible and health facilities.

Where tank and mains water cold water supplies feed a building, all pipe-work and drinking water outlets will be clearly labelled.

When planning new laboratory area's it should be noted that eyewash facilities or localised drench showers may be required in Chemical, Biological and some Engineering spaces.

When work is carried out on existing plumbing systems all redundant pipe-work and equipment will be stripped out.

Schematic drawings must be provided for all new installations and updated to reflect any alterations to the existing water and drainage installations and detailed 'As Installed Drawings' are to be provided. The schematic drawings need to be added to the health and safety file and also placed at a relevant location such as the building or boiler room entry point.

## 7.0 Ventilation Systems :

The University policy is to employ natural ventilation where possible. Therefore, where the external environment is favourable in terms of noise and pollution, natural ventilation shall be designed and utilised as outlined in the CIBSE natural ventilation guide and the building regulations for ventilation and energy.

Wherever possible, all designers should co-ordinate their work to consider the optimum position for rooms which would benefit from the use of passive cooling and avoid mechanical ventilation and air conditioning systems (Also refer to sections 3.0 environmental strategy and 5.0 Cooling Systems).

The purpose of the Ventilation system will be to achieve one or more of the following:

- To provide adequate indoor air quality by removing and/or diluting pollutants from occupied spaces
- To provide adequate ventilation for the effective operation of processes
- To provide a heat exchange mechanism
- To prevent condensation within the building

An option appraisal shall be presented to the University, which shall cover the methods and possible systems of ventilation available to the development. The appraisal shall include estimates of life cycle costs, maintenance requirements, energy use and carbon emissions.

The project ventilation options, strategy and requirements should be determined by following the guidelines detailed in the Ventilation and air conditioning CIBSE guide.

Where mechanical ventilation is a requirement then the possibilities of combining mechanical and natural ventilation systems through hybrid or mixed mode solutions should be considered. For example, seasonal hybrid systems might use natural ventilation in the summer, when windows can be opened and mechanical in winter, when it is cold outside and heat recovery from exhaust to supply air provides an energy efficiency and comfort advantage. Spatial hybrid solutions might have mechanical ventilation for the internal zones with natural ventilation at the perimeter.

With the exception of process or specialist ventilation systems such as laboratories, kitchens and toilets all air handling units shall incorporate a heat recovery system.

Good control is essential for comfort conditions and energy efficient operation. A suitable interface to the Building Management System will be incorporated so that heating and cooling systems cannot operate simultaneously. Cooling should not commence until the space temperature reaches 25 deg C unless there is a process requirement for lower temperatures.

## **Mechanical Ventilation :**

Air handling units shall provide the supply and extract air to the specified area's with distribution via sheet metal ductwork systems, which shall be constructed and installed in accordance with the current HVCA specification and good practice guide.

There are a number of manufacturers of air handling units and ventilation plant which cause maintenance and stock problems within the department. Selection should therefore be preferably based on those manufacturers which are currently installed and successfully operational on the University Campus and where components and parts are readily available.

Generally the ventilation systems should be designed on the basis of low velocity and low pressure drops.

All air handling unit heater batteries will be connected to a constant temperature circuit and heat output will be controlled by appropriate valves operating from the Building Management System. Stand alone controls will not be installed. All heating batteries will be installed with adequate access for maintenance and cleaning.

The Design Engineer should be aware that most of the heating boiler plant on the main precinct is not normally operated during the summer from June until September.

All Air Handling Plant shall be fitted with variable speed inverter driven supply and extract fans. This shall allow the control of variable air volume systems within areas of variable occupancy and intermittent use. For constant volume air systems, the variable speed inverters will facilitate accurate and efficient commissioning.

All units are to be direct drive and standard frame type - those rated 1kW and above will be to the new energy IE3 premium efficiency standard.

All ventilation and cooling systems are to fully comply with the current guidance, codes of practice and regulations relating to fire precautions and the building fire strategy. The supply and extract air distribution systems shall be ducted to and from each room terminal. All main branch connections will have volume control dampers to allow for correct air balancing of the ductwork system.

Connections to each terminal are to be fully accessible with each having a volume control damper and flexible duct connections when fitted to a ceiling mounted diffuser or grille.

Access doors shall be provided to enable cleaning and inspection of all fire dampers, restrictions, bends, branches, dampers and heater batteries and at not more than 6 metre intervals on straight runs as outlined in the HVCA guidance.

All ventilation ductwork shall be thermally insulated using phenolic foam sections with class 'O' rated foil finish, unless the system is extract only. All ductwork insulation located externally or in plant room areas are to be finished with metal cladding or weather proof membrane with colour finish to match surrounding environment. The services shall be identified by means of colour bands and the name and flow direction of the ducted service.

Humidification systems will not normally be required except in special circumstances and full discussions between the Estates team and the Engineer will be required prior to a system being specified.

Where ever possible ventilation plant will not be placed on outside roof areas however where plant is installed on external roofs then a proprietary support system will be used. Sufficient space underneath plant must be allowed so that roof repairs can easily be carried out.

Where external plant is being considered the Head of Capital development should be consulted to ensure that the location and aesthetics do not compromise the environmental coherence of the overall campus. The reasoning for the decision to install externally shall be provided to the head of Maintenance for consideration. Attenuation and acoustic treatment shall be provided to the ventilation systems in order to meet acceptable noise levels.

All localised ventilation fans will have high efficiency motors, low energy and carbon specification. These installations shall be controlled locally, preferably automatically via sensors detecting air quality, humidity or occupancy, alternatively a local controller should be provided.

### **Process Ventilation - Fume Cupboards, Safety Cabinets and Local Exhaust Systems :**

All cupboards, cabinets and fume hoods should be capable of operating independently of the building's main ventilation systems.

Storage facilities built into the cupboard that require the extract system to run continuously must be avoided or run of its own independent system.

Unless there are overriding safety issues, Low volume fume extract systems are preferred with face velocities in the region of 0.3 m/sec. and must comply with the containment tests detailed in the current CEN guides and legislation.

All cupboards and their fans should be able to be shut down and on multiple systems when cupboards are shutdown or out of use the extract fan should sequentially ramp down. This will need to be in conjunction with the supply system which will also need to ramp down but also maintain the pressure regime within the process area.

All fume extract fans are to be direct drive units with motors sited external to the air stream.

Flue dilution should be considered for multiple fume extract systems and each system must be provided with a vertical discharge stack and cone at a minimum height of 3 metres above the highest part of the building.

Laboratory fume extract and process extract duct and fan systems will generally be constructed and installed in rigid polypropylene which is chemical and corrosive resistant and meets the installation requirements of HVCA specification for plastic ductwork installations.

Clean rooms and specialist areas, identified in the brief or room data sheets may require close environmental, temperature and humidity control. These specialist rooms are to be designed to meet the requirements of their classification but will more than likely be provided with their own dedicated close control equipment and ventilation plant.

Where a process produces airborne contaminants such as dust, mist, fume, vapour or gas in a workplace, then the designers are required to provide a local exhaust ventilation system. The systems will fully comply with the HSE guidance for controlling airborne contaminants at work. LEV systems shall be capable of operation independent of the building general air systems.

The University Safety Office should be consulted by the Project Manager on all Fume extract and Safety Cabinet Installations.

Schematic drawings must be provided for all new installations and updated to reflect any alterations to the existing ventilation systems and installations and detailed as 'As Installed Drawings'. The schematic drawings need to be added to the health and safety file and also placed at a relevant location such as the building or plant room entry point.

## **8.0 Building Energy Management Systems :**

A Building Energy Management system will be provided to control and monitor all the installed Mechanical services plant and any peripheral equipment.

The designated University BEMS controls specialist in conjunction with the controls Contractor shall be responsible for the complete design, supply, configuration, documentation and commissioning of the BEMS including all hardware, software and supply of all connected sensors and actuators, including all control wiring and power wiring from control panels to equipment or motors.

The controls specialist shall include for generating suitable graphic schematics for each new ducted or piped system and is to include real time plant status, sensor and actuator values etc. The graphics shall fit within the existing University BEMS hierarchy, a copy of which is available from the Estates Energy Manager.



The BEMS installation shall be completed prior to the commissioning of the Mechanical plant and the controls specialist shall be responsible for full pre and operational commissioning of the BEMS and co-ordinating this with the other relevant mechanical installations.

### **Performance Testing :**

The new system shall be fully merged and integrated into the existing BEMS controls system and then fully interrogated to ensure that all control systems, strategies, routines and functionalities are operating correctly.

The testing and commissioning programme shall include for the continuous system performance tests as outlined below.

The University should be provided with a programme and prior notification so that they have the opportunity to be in attendance to witness these tests.

These tests should be run in conjunction with the testing and commissioning of the BEMS installations.

Systems are to be run continuous to demonstrate that equipment, materials and systems are operating correctly, controls are properly adjusted and systems interact as intended and that the systems maintain the specified conditions within the building.

Test the performance of systems to demonstrate conditions are maintained under the summer and winter design conditions.

As the prevailing weather conditions may not be suitable at the time of commissioning then an additional visit and outstanding tests will be carried out in either the summer or winter. Should the system fail to perform, then any defects or faults shall be rectified and the system re-tested and proven to work as part of the project conditions.

Upon completion of the installations and following the successful testing and commissioning of the BEMS, the controls specialist will carry out the necessary demonstration and training to the end user.

A more detailed specification and installation guide for the Building Energy Management System can be found on the full BEMS specification document.

Generally all new BEMS control equipment should be compatible with Siemens Building Management System and PX controllers. The University has a maintenance contract for the existing Siemens control systems under which all their equipment is maintained and replaced under the terms of the contract.

Exceptionally, as in the case for some of the existing Medical School Buildings where a Schneider Electric (Satchwell) BEMS systems is already installed, then these may also be used.

## **9.0 Handover Documentation :**

The Mechanical handover information and documentation is to follow the current BSRIA guidance document 'Handover, O + M manuals, and Project Feedback'.

In accordance with the Building Regulations and the BSRIA guide, for all new buildings, a building log book will be produced and handed over. This document will describe the operation of the building and how to efficiently operate and maintain the buildings in terms of energy and carbon emissions. The log will also allow the building manager to record and log the operation and building energy in order to monitor the energy performance of the building.

The Mechanical Services section is to form part of the overall Health & Safety file and should therefore be designed so that it can easily be formatted and incorporated into the overall document, which will be handed over to the University on completion of the project. Mechanical manuals will not include manufacturers' brochures a simple schedule of equipment incorporating model numbers, serial numbers and manufacturer's details will suffice.

Timescales for preparing handover information should be set at the start of the project so that sufficient lead in times are times allowed for collating, checking and approving the information.

At the point of "Practical Completion" the contractors will supply an interim Operations and Maintenance manual which will detail items of equipment which have been removed or installed in the project area, details of any service contracts with specialist suppliers, details of warranty and service intervals and a list of contact numbers to be used in the event of a defect being reported.

One complete electronic copy should be presented to the Estates Office on handover of the project, should the file require any updates after it has been handed over the whole manual will be re-submitted.

<b>Document Review</b>			
Author	Paul Nicholson		
<b>Version</b>	<b>Amendment</b>	<b>By</b>	<b>Date</b>
2	Issue 1	PN	Dec.2016