DIRECTORATE OF ESTATES & FACILITIES

PROCEDURE AND INFORMATION MANUAL

EPM PM7

Code of Practice for Design Teams

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7	Dec 2016	Appendices 6, 7, 8 and 9 added, Sections 12.1.10 and 12.1.11 added
8	March 2019	Revised Appendix 6&7, Index updated, section 5&6 updated

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1.0 Purpose of the Document

1.1 General

1.1.1 This document sets out the broad standards required of designers and design teams when commissioned to undertake design (as defined by the Construction (Design and Management) Regulations 2007) for alteration, refurbishment and new build works on behalf of The University of Manchester.

1.1.2 The Directorate of Estates and Facilities (DOEF) at the University of Manchester is responsible for maintaining the University building stock and, therefore, has an active interest in any new build or refurbishment project undertaken. This Design Teams Guide has been produced to provide guidance to Design Teams on issues that would influence the sustainable installation, the build process, operation, and future maintainability of the building/element. It also provides a useful guide to designers on how to organise various project related tasks, when working on behalf of the DOEF. It is not intended to be exhaustive in its recommendations but shall be considered as a guide to standards required, and issues to be addressed during the life of any project.

1.1.3 On all projects appropriate contact shall be maintained with the relevant Estates personnel to ensure appropriate advice is sought throughout the project.

1.1.4 This Guide is provided to aid Design Teams and it is not intended to be exhaustive in its content. Where particular guidance is not explicitly provided, further advice shall be sought from the appropriate Estates personnel. Nothing contained within this Guide shall interfere with, or absolve, the Design Team from its professional responsibility for the overall design.

1.1.5 For the design of new facilities or buildings at The University of Manchester, designers are expected to follow legislative standards, the principles of sustainability, industry best practice and their own practice standard specifications. The DOEF does, however, from time to time require particular specifications, statement of requirements and advice to be incorporated into the design.

1.1.6 Where the standards within this document cannot be met, a Derogation Report shall be issued by each designer to the Project Manager for onward issue to the relevant University of Manchester personnel. In the event that no derogation report is issued then the design will be deemed compliant with EPM PM7. The project shall not proceed until this has been agreed and signed off as detailed in Section 12.

2.0 Background to Estates

2.1 Function of Estates

2.1.1 The function of the DOEF is to contribute to the aims and objectives of the University by providing and caring for a physical environment, in which we live, learn and work. The Directorate aims to do this by:

- providing professional advice on the management, operation and maintenance of the University estate
- assisting, advising and providing data to meet the University's strategic priorities
- being responsive to the operational needs of the University and the changing requirements of the University community
- monitoring and reacting to the possible impact of estate developments and facilities provision on the local community and the environment
- providing a safe, secure and sustainable built environment for the University community
- seeking effectiveness, efficiency and value for money in respect of all activities undertaken and services provided in keeping with the University financial regulations
- seeking to maximise client satisfaction in respect of facilities and services provided, within available resources and compliance with statutory requirements and codes of good practice and
- Promoting a comprehensive quality management approach for the Directorate and pursuit of a staff training and development programme to improve skills and working performance standards of the Directorate.

2.2 Guidance Documents

2.2.1 To ensure the adoption of a consistent approach to carrying out various processes for and on behalf of the DOEF, a series of policies and procedures are being developed. A number of the policies are referred to throughout this document and a full list of these can be found on the Estates website. A summary of the documents is attached in Appendix 2. A number of the documents are in draft form or have not yet been written, although there is likely to be established practice as to how items can be undertaken.

2.2.2 There are a number of guidance documents available from the University Health and Safety Services offering guidance about working at the University. Particular guidance in regard to demarcation between Estates and Building occupiers responsibilities being detailed in Chapter 23 of the H&S Arrangement documents available through the University Health & Safety Website.

2.3 Estates Contacts

2.3.1 To aid designers who are unfamiliar with established procedures a list of University contacts is provided in Appendix 1. The contacts will be able to provide assistance in resolving project and design related issues that may arise for the design team.

2.4 Consultation

2.4.1 This guide sets out broad parameters for various issues relevant to design consultants working at the University of Manchester. The key to the success of any project is a disciplined approach to communication with Estates personnel – who hold a wealth of knowledge on many aspects of the physical estate, systems and procedures. It is vital that all designers set up a culture of communication and liaison with the DOEF.

2.4.2 To ensure environmental sustainability is embedded within the design of all projects, the University has developed EPM tESv3 - Environmental Sustainability Project Tracker and Tracker Lite, as detailed in Appendices 3 and 4. The Tracker document used will depend on the type and value of the

project. The tracker shall be completed by the Design Team at key project stages and presented to the Environmental Sustainability Team for sign off.

2.5 Estate Legal Guidance

2.5.1 Advice on ownership issues shall be sought from the Estate Surveying Manager. The responsibility for negotiating any temporary or permanent alterations to rights of way, planning approvals etc. shall be with the project design team.

2.5.2 The University Estate has many public highways and rights of way running through it. As a consequence project work may affect or be affected by these. The initial course of action is to establish land ownership and boundaries. This can be done via the University Project Manager (Client Representative) but also through formal contact with The Estate Surveying Manager.

2.6 BIM

2.6.1 For all Capital Projects a Building Information Modelling (BIM) strategy should be produced by the Architects BIM coordinator or Information Manager during Work stage 1. Unless the Strategy clearly highlight's that the project should not use BIM then it will be expected to be adopted as part of the project lifecycle with each core consultant discipline providing BIM services.

2.6.2 Project strategies are generally focused around BS1192:2007, PAS1192-2:2013 and the UK government BIM strategy with Projects delivering Level 2 BIM where ever feasible. The strategy should cover all stages of the project from concept scheme design, through design and construction and finally to handover and managing the facility in the future. A BIM Execution Plan (BEP) should be produced for all projects utilising BIM which will as part of the work stage 2 sign off gateway.

2.6.3 The University are developing its processes for the input of BIM deliverables. Systems such as our Space Management tool Archibus, and our asset management tool Oracle are being enabled for the receipt of BIM output data with current test projects underway.

3.0 Design Team Duties

3.1 CDM Regulations 2007

3.1.1 The University requirements for compliance with CDM Regulations are detailed within the Policy and Procedure document EPM HS14, EPM HS14a, and EPM HS14b.

3.1.2 As required by the Construction (Design and Management) Regulations 2007 Design Teams shall design out health and safety risk for construction, future use and maintenance by the application of the hierarchy of risk control.

3.1.3 Design Teams shall use the principles of prevention to direct their approach to identifying and implementing precautions, which are necessary to control risks associated with a project.

3.1.4 Design Teams shall identify residual risks existing on the site and draw these to the attention of the Design Team and Principal Contractor, including highlighting where surveys and additional design development may be required to quantify risks.

3.1.5 It is incumbent upon the Design Team (and when appointed the project manager) to ensure that all necessary surveys and investigations are prepared and reviewed prior to starting the relevant works.

3.1.6 It is a legal requirement to provide a suitable and sufficient Demolition and Refurbishment (Asbestos) Survey in advance of starting any relevant works. Reference shall be made to the University Asbestos policy. (EPM HS25)

3.1.7 If risks cannot be completely removed then measures must be implemented to reduce them so far as reasonably practical. Where it is not possible to design out risks and where risk remains after construction, they should be brought forward to the Health & Safety File for the future building user to incorporate into safe systems of work or consideration for future dismantling or demolition. Any residual risks deemed to be significant or requiring particular system of access shall be discussed with the DOEF Health and Safety Officer as soon as practicable after the issue becoming apparent.

3.1.8 The University CDM Procedures document (EPMHS14, EPMHS14a, and EPMHS14b) contains a pro-forma for recording residual hazards.

3.1.9 Design Teams must identify design elements, materials and processes which are either to be avoided because they are judged to represent significant risk to construction personnel, facilities users and/or the environment or to be preferred because they represent a reduction in such risks.

4.0 Design Risk Management

4.1 General

4.1.1 Design Teams are expected to actively promote health and safety and ensure that the Principles of Prevention are adopted throughout the Design Risk Management process. Design Risk Management shall form an instrumental part of design team meetings, staged reviews and workshops.

4.1.2 Long term maintenance and operational requirements are critical elements in the design process.

4.1.3 By consideration of health and safety from concept design, the whole project team shall provide the University with a project that is focussed on design risk management and the health and safety needs of those constructing, maintaining and using buildings and structures.

4.1.4 This early consideration will provide whole project benefits for health and safety, value for money and other resources, including time, quality, sustainability and building or structure whole life cycle management. The early stage co-ordination has proven to provide significant opportunities for effective elimination or avoidance of major hazard issues.

4.1.5 The Design Risk Management process should adopt the following Five Stage pre-planned review when project health and safety is examined. The Design, Access and Workplace Regulations Assessment shall be used to assist with this process throughout the duration of the projects.

4.1.6 The process acknowledges that design is always in a transitional state and establishes focused reviews of relevant health and safety considerations throughout design development.

4.1.7 The Five Stages of design review shall comprise the stages detailed in the following sections.

4.2 Stage 1 (RIBA 1/2 or PRINCE Stage 1 – Concept Design)

4.2.1 This stage is to be undertaken as soon as the key design and project team members have been assembled. The aim of the review is to establish standards for the project and prepare the team for the commitment that will be required for the scheme ahead, thereby establishing the foundations for a safety culture.

4.2.2 At this stage the Design, Access and Workplace Regulations Assessment is administered and explained to all team members. The assessment is then effectively live from this point until project completion.

4.3 Stage 2 – (RIBA 3/4 or PRINCE Stage 2 – Early Detail Design)

4.3.1 At this phase of the project, the design of the structure should be well defined. Information regarding the existing use of the site and its surrounding environment should be well established and inherent risks identified.

4.3.2 At this stage the design team should be focusing on the build process and therefore if appointed, introduction to the potential Principal Contractor of the outline proposals should be encouraged.

4.3.3 A general understanding of the overall building finishes is also being developed at this stage, therefore outline consideration of end use issues should be considered, especially whilst considering future maintenance strategies.

4.3.4 On large complex projects, it may be necessary to hold specific design workshops prior to the main collective stage 2 review.

4.3.5 Stage 2 is considered the most important stage because design ideals are formed, but not set. The design team has the right to amend initial proposals if a proposed strategy has major health and safety implications towards the build process and end use.

4.3.6 Consultation regarding design and maintenance issues is required throughout the life of a project. It is at this stage that it is essential that all necessary Estates Personnel are consulted. The Design Team is reminded that key to the success of any project is a disciplined approach to communication with Estates personnel. It is, therefore, vital that all designers set up a culture of communication and liaison with the DOEF.

4.4 Stage 3 – (RIBA 4/5 or PRINCE Stage 3 – Detail Design)

4.4.1 The key aim of the Stage 3 review is to confirm existing environment risks have been controlled and final building outcomes have been considered. A further important aim is to confirm in detail, the overall maintenance and operation strategy for the final end users/ occupiers.

4.4.2 At this stage of the design, it is still relatively straight forward to make minor amendments to design proposals. Therefore it is critical and considered a 'last chance' review prior to the scheme being committed in to an actual structure on site. This is the final stage of review prior to construction so the aim of the team should be total close out of all issues raised.

4.4.3 Where issues have not been closed due to project constraints, all outstanding issues must be communicated to the tendering contractors, preferably during the pricing/ tender stage. This will allow tendering contractors to allocate resource for further studies/ actions and allow them time for planning.

4.4.4 The reviews should only highlight unusual or significant issues that a competent contractor could not reasonably expect to foresee or easily manage.

4.5 Stage 4 – (RIBA 6/7 or PRINCE Stage 4 – Operations on Site)

4.5.1 The Stage 4 review is focused on the end user aspects of the structure and the process of how the structure will be transferred into University ownership; allowing consideration of any user training needs, information requirements and providing the sufficient time to prepare for their own statutory obligations prior to occupation.

4.6 Stage 5 - (RIBA 7 – Completion / Feedback)

4.6.1 The Stage 5 review provides a mechanism to review the success of the project and confirm that all outstanding health and safety issues have been sufficient addressed and communicated by the relevant stakeholders.

5.0 Guide to Energy Efficiency

5.1 General

5.1.1 The University has committed to a 40% reduction in carbon emissions by 2020 and a minimum of 80% reduction by 2050. Any factors of a project having implications on the consumption of energy shall be approved by the Principal Mechanical & Energy Engineer.

5.1.2 For any project work involving renovation of a building the target energy consumption post-renovation (both electricity and heating) shall be at least 50% less than the pre-renovation figures. Consumption data figures may be obtained from the Energy Team. In specialist cases where a 50% reduction is not achievable, this must be agreed with the Principal Mechanical & Energy Engineer. All capital projects of a value of £5m+ to have a designated Sustainability Advisor.

5.1.3 Designs relating to the usage of energy within new builds and substantial refurbishments shall be subject to the issue of a detailed Carbon Management Strategy (CMS) as per sections 5.2.1 – 5.2.4.

5.1.4 Ensure that energy conscious design is adopted in all new build and refurbishment projects with particular consideration throughout the design process to the following issues:

- Building massing and envelope design
- Heating
- Hot and cold water services,
- Water tank storage
- Water System Management
- Air handling plant
- Centralised and local cooling plant, refrigeration (exceptional circumstances only)
- Compressed air plant
- Electrical lighting and power installation
- Controls and BMS Monitoring
- Monitoring and metering of utilities

5.1.5 All work and design shall be carried out in compliance with all relevant legislation, Codes of Practice and industry standards.

5.1.6 The design must consider energy consumption for the purchase of all items of equipment and be fully compliant with current best practice.

5.1.7 Adapt new technologies and ideas into the design wherever practicable, e.g. renewable energy, LED lighting, high efficiency motors etc..

5.1.8 The designers shall develop designs that maximize energy efficiency and give consideration to low and zero technologies (including, but not limited to):

- Solar Gain/Solar Shading
- Natural Ventilation
- Air-tightness
- Green-roofs
- High insulation levels
- Use of natural light
- Rain water harvesting
- Wind turbines
- Solar PV and Solar thermal
- Ground / Air Source heat pumps
- Hydrogen fuel cells
- Biomass

5.1.9 In accordance with Part L of the Building Regulations; at the handover of any new building / refurbishment project a CIBSE Building log book shall be submitted by the contractor. The log book shall be produced in line with CIBSE TM31. The designer shall ensure this is included in the specification.

5.1.10 The Energy Performance of Buildings Regulations (2012) requires that when a building is erected the person carrying out the work must provide an energy performance certificate to the owner of the building. The designer shall ensure this is included in the specification.

5.1.11 Life Cycle Cost analysis calculations shall be provided for all energy consuming equipment/systems. Where available building energy data shall be evaluated and a report issued demonstrating the overall reduction/increase in Carbon emissions. Renewable heat sources shall be assessed for suitability and cost effectiveness. (e.g. Solar Thermal & Ground Source Heat Pumps)

5.1.12 As required in Approved document L of the building regulations, a building log book shall be provided for

- New Buildings
- Refurbished Buildings
- Where significant changes have been made.

The log book should give the University readily available access to information on the design, commissioning and energy consumption of their own building. It will enable fine tuning of the building with consequent improvements in energy efficiency. The log book will also provide explicit information about the metering strategy implemented in the building, and on the scope for monitoring and benchmarking energy consumption. CIBSE's TM31 Building log book toolkit should be used as the basis for all log books provided.

5.2 Carbon Management Strategy (CMS)

5.2.1 A Carbon Management Strategy shall be produced for all projects which have implications for energy consumption within the University. Any variation to this requirement can only be approved by the Principal Mechanical & Energy Engineer.

5.2.2 The CMS shall be submitted to the Principal Mechanical & Energy Engineer during Stage 3 of the process.

5.2.3 The CMS will (as a minimum) comprise the following sections:

- Present Energy Demands and System Overview
- Predicted Energy Demands from new installation
- U Values for glazing, insulation, cavity wall, wall cladding
- List of Legislative Requirements and how they are complied with
- Consequential Improvement Plan (for applicable projects)
- Carbon targets per square meter, and how these will be met

5.2.4 For all Capital Projects a CIBSE TM54 (Evaluating operational energy performance at design stage) report is to be provided.

5.3 Metering

5.3.1 Designs of metering systems shall comply with the requirements of EPM PM21 – Energy & Water Metering Specification.

5.3.2 A Metering Strategy and Schematic shall be submitted to the PSU for approval at Stage 3 of the design process. Water services shall be included to ensure Leak / Wastage Monitoring as a stipulation of the University's Carbon Trust Energy Efficiency Accreditation Scheme.

5.3.3 All lighting loads shall be separately metered at distribution boards or electrical riser level dependent on the load. Refer to EPM PM21 – Energy & Water Metering Specification.

5.3.4 All metering (electric, water, gas, heat and steam) shall be metered in accordance with the Building Regulations Part L2A and L2B for New and Existing Buildings.

5.3.5 In the event that no local contract/agreement exists, the University shall recharge external organisations occupying space with the university regarding Energy and Water Usage.

6.0 Guide to Mechanical Engineering

6.1 General

6.1.1 Each RIBA stage report shall be supplied with Derogation report. The consultant is required to report on any deviations from the design team guide. In the event that no derogation report is produced then the design will be deemed compliant with EPM PM7.

6.1.2 The Design Teams are to carefully consider their duties under Regulation 9 of CDM regulations 2015 & consider the usability and maintainability of all HVAC plant & equipment provide via construction projects. The design team shall ensure that all designs consider and facilitate ease of maintenance and replacement of component parts (i.e. filter replacements) to all HVAC systems throughout the life of the building. By implication this also means replacement of HVAC systems shall be considered and easily achievable.

6.1.3 In accordance with the CDM Regulations all plant and equipment shall be accessible e.g. ladders, platforms, fixed and mobile. Please also refer to section 8.13 for more detailed requirements for maintenance and cleaning.

6.1.4 A plant replacement & maintenance strategy document shall be produced and submitted covering all main HVAC plant identified at Stage 2. The document shall consider how the equipment shall be accessed, maintained and replaced throughout the life of the installation. This shall include, but not be limited to, air handing units, chillers, fans, boilers, flues and water tanks.

6.1.5 A Mechanical HVAC calculations file shall be submitted with all projects that proceed to tender. The calculation file shall be submitted along with the Stage 4 RIBA stage report. Calculations that are required shall include the following as a minimum. This list below isn't exhaustive but should be used for guidance only:

Heating -Heat loss calculations including safety margin allowance (infiltration and conductive), U-Values, emitter selection, plant factor for pre heat, simultaneous maximum plant load , pipe sizing, pump sizing, pressurization unit sizing, safety valve selection, control valve selection, commissioning set selection.
Domestic Water Services - Hot & cold water pipe sizing (internal/external, gravity fed & boosted), booster set sizing, hot water circulation pump sizing, cold water storage volume, hot water storage volume, plate heat exchanger selection, calorifier heat up period, safety valve selection.
Ventilation - Minimum fresh air rates, air change rates, cooling/heating driven ventilation rates, ductwork leakage assumptions, fan volume & pressure , pressure regime, AHU heating coil sizing, cooling coil sizing, grille and diffuser selection, louver selection.
Cooling & Humidification - Heat gain calculations (sensible and latent gains), humidifier duty, control valve selection, commissioning set selection.
Above Ground & Rainwater Drainage = Gravity pipe sizing, rainwater tank selection
Natural Gas - Natural gas pipework sizing. Gas booster sizing.

6.1.6 Details of all plant installed shall be brought to the attention of the Principal Mechanical & Energy Engineer in order that asset numbering can be carried out in accordance with University procedure and information manual, EPM FM1 – Maintenance Strategy. This information should be provided prior to any tendering or upon completion of Stage 4.

6.1.7 All redundant plant shall be formally offered to Maintenance Services Unit (MSU) before disposal off site.

6.1.8 HVAC Room data sheets (RDS) shall be produced for all projects. The RDS shall highlight all mechanical service requirements within the room it relates to.

6.1.9 Where connections into existing system (pipework or ductwork) are required for a project, a statement is required from the designer as to how the integrity and system characteristics of the existing system will remain.

6.1.10 HVAC Consultants shall be required to conduct sufficient witness testing to verify the HVAC systems are fully working as per the design intent. Witness testing of all HVAC controls shall be as per the written control strategies as required in sections 6.9.3 & 6.10.12. This shall include, for example, simulating summer/winter strategies, full/part load conditions. The consultant shall be responsible for leading and organizing a pre-commissioning co-ordination meeting, with the contractor, to ensure the design intent of the system is understood. It shall also be made clear what level of testing is required to demonstrate the systems are working as per design intent. This is particularly relevant for complex HVAC systems operating with differing strategies for differing times of the day/year. The consultant shall produce a schedule of tests that are required to demonstrate & verify the installed system works as design. The HVAC consultants shall ensure that the University's Mechanical Inspectors are fully involved in this process for all projects. The consultant shall also be responsible for signing off all commissioning documentation.

6.1.11 Newly refurbished plant rooms shall ensure floors are provided with a levelling screed (if required) and finished with a anti-slip painted floor (refer to section 6.1.12 below). Plant plinths shall be painted in yellow, plant room floor in red with walkways/maintenance routes in green.

6.1.12 All HVAC plant that it to be floor mounted shall be mounted on a minimum of 100mm concrete plinth (or equivalent). No plant shall be mounted direct to the floor.

6.2 Plant Location

6.2.1 No equipment shall be installed outside Plant rooms on roof spaces, with the exception (if authorised) of refrigeration equipment.

6.2.2 All effort shall be made to locate plant within dedicated Plant Rooms. Where it is necessary to locate plant outside a Plant Room (Roofs / Ceiling voids etc.) this must be brought to the attention of and agreed with the Principal Mechanical Engineer as early as possible in the design process.

6.2.3 All condensers and heat rejecting equipment (i.e. air compressors) should be located externally and not inside buildings. This is also true for faculty based equipment.

6.2.4 No mechanical plant (i.e. AHU's, heat recovery unit, fans etc) shall be installed within emergency escape stairs.

6.3 Heating

6.3.1 Calorifiers, Plate Heat Exchangers, DHW multipoint heaters shall have fitted flow and return temperature sensors and gauges - the sensors shall be connected to the University's Building Management System (BMS). PRV, pump sets etc. shall incorporate pressure gauges prior and subsequent to the equipment to inform the pressure drop across the plant.

6.3.2 Steam, condensate, MTHW/LTHW and domestic valve and flange bodies shall be insulated with easy removable muffs. In the case of the plate heat exchanger packages, these shall also be insulated and covered with a single easy removable muff.

6.3.3 Large steam-raising plant shall incorporate modulating control and be used to progressively increase the output of each boiler. The design shall ensure specification and comparison of plant to evaluate the efficiency at each stage of capacity and to ensure that full modulating control is available across as wide a range of the boilers. The design shall ensure ("turn-down ratio") are at the best possible efficiency. Boilers should be sized to satisfy the maximum hourly steam demand while operating within their maximum continuous rating (MCR).

6.3.4 All installations shall as a minimum comply with current Building Regulations and the Energy Performance in Buildings Directive.

6.3.5 Large buildings shall be broken down into separate heating zones by orientation and/or by user/department, with externally compensated internal temperature controls fitted, via the Building Management System

6.3.6 Gas fired condensing and/or high efficiency boilers shall be specified where existing services cannot be utilised. The design shall fully consider the utilisation of lower return temperatures to ensure full efficiency benefits are realised. All routes to drain associated with the condensate – shall be by gravity, where feasible. Multiple boiler arrangements shall, where individual modules are progressively switched on (sequenced) as the load increases, offer the greatest efficiency by ensuring the system matches the demand for heat more closely therefore each boiler shall performs close to its individual design duty.

6.3.7 In residential buildings although natural gas is the preferred fuel consideration should be given to electric heating where corresponding high values of insulation have been or are to be installed.

6.3.8 Where activities or specific processes produce a surplus of heat, designers shall assess in terms of suitability and cost effectiveness energy recovery systems to further reduce the requirement for heat and power. (e.g. Computer cluster heat rejection to adjacent offices.)

6.3.9 Internal temperatures and air change rates shall be as recommended in the CIBSE Guide/Building Regulations and agreed with the Principal Mechanical & Energy Engineer.

6.3.10 Heating boiler plant and Plate Heat exchangers (not calorifiers) where used for intermittent heating shall have a maximum 2 hour heat up period.

6.3.11 All pipe work shall match the existing specification, and shall be to BS EN 10255 : 2004
H series, heavy gauge seamless tubing irrespective of use. All heating pipework shall be designed to be self-venting.

6.3.12 In the unusual circumstance where compression/crimped fittings/joints are approved for use, the contractor is required to demonstrate a robust on site QA procedure to demonstrate no future joint failures shall occur.

6.3.13 Radiators shall be used in preference to natural or fan convectors.

6.3.14 In existing radiator circuits where single pipe arrangements exist, two pipe systems must not be introduced.

6.3.15 Ball valves (full bore type) shall be used to isolate LPHW heating systems up to 50mm pipe diameter; above 50mm lugged wafer valves with EPDM liners shall be used.

6.3.16 Drain-off valves should all be installed at suitable locations throughout all pipework systems to facilitate pipework modifications without the need for a full system drain down. All rising pipework mains contained within mechanical risers shall be fitted with drain points.

6.3.17 Individual thermostatic radiator valves shall be specified for use on compensated circuits and their use shall be agreed with the Principal Mechanical & Energy Engineer.

6.3.18 The University has a mixture of STEAM, MTHW and LTHW installations. Under no circumstances shall STEAM or MTHW pipework be run through occupied areas. The route of this pipework shall be restricted to designated service risers and plant rooms.

6.3.19 All heating pipe work shall be insulated to minimise heat loss and prevent frost damage. All calculations must be provided to demonstrate the appropriate thicknesses in accordance with BS EN ISO 12241:2008 using specific conditions where applicable.

6.3.20 Drain off cocks shall be of a gland design. MTHW air vent points will be double valved, have adequate cooling legs and safe discharge points.

6.3.21 Fan coil units are not the University's preferred method of heating/cooling. Where there use cannot be avoided, permanent access provision shall be provided to enable all maintenance activities (i.e. filter changes, motor replacement, drain downs etc.). Approval for installation of fan coil units shall be obtained from the Principal Mechanical & Energy Engineer.

6.3.22 The choice of fuel/heat source for buildings shall not restrict a future change to an alternative fuel/heat source (i.e. dual fuel burners, biomass, biofuel, heat network). Designs shall provide both a resilient and flexible solution and must be agreed with the Principal Mechanical & Energy Engineer.

6.3.23 The heat linking of buildings shall be maintained to allow the adoption of CHP.

6.3.24 All valve configurations on steam and air systems shall incorporate double block and bleed configuration to ensure adequate depressurisation in accordance with The Pressure Systems Safety Regulations 2000. Numbered valve charts shall be displayed within all plant rooms.

6.3.25 All steam boiler installations shall incorporate high integrity controls and include TDS blow down heat recovery systems and boiler economisers to capture waste heat from the boiler's hot stack gas.

6.3.26 All main heating plant shall be provided with a minimum redundancy level N+1. This level shall be agreed in writing with the Principal Mechanical & Energy Engineer.

6.3.27 For new internal pipework installations all attempts shall be made not to bury pipework in duct/trenches/ducts. Should this not be achievable all pipework shall be made fully accessible so as to enable easy inspection, repair or replacement.

6.3.28 All fan convectors or fan coil units shall be connected to pipework system via flexible hoses. All hoses supplied shall have minimum guarantee of 10 years. Evidence of certification shall be provided within the H&S file.

6.3.29 All newly installed heating installations shall be installed complete with a suitable corrosion inhibitor. For modification to existing installations, a sample shall be taken from the existing systems to determine if inhibitor is installed. The Principal Mechanical Engineer shall then be consulted.

6.3.30 Prior to stage 4, schematic drawings shall be produced and provided for all mechanical/HVAC works associated with the project or scheme. For refurbishment projects, this shall show the interface to the existing infrastructure.

6.3.31 Refer to sections 6.6.6. & 6.6.7 for pipework jointing requirements.

6.3.32 Heated air curtains should be installed on all main building entrances/exits to avoid the introduction of swathes of cold external air. This will prevent nuisance draughts and reduce energy consumption. All air curtains shall be LTHW supplied where locally available.

6.3.33 All complete new heating systems shall include the installation of a side stream filtration unit (e.g. Enwamatic unit). Units shall be complete with stainless steel vessel. For modifications to existing heating systems, please discuss with the Principle Mechanical Engineer the requirement for their inclusion.

6.3.34 In order to reduce energy consumption, all high bay areas (i.e. Atriums, Lecture theatres, Halls etc) shall include the installation of destratification fans.

6.3.35 Cast iron steam isolation valves are not permissible for use anywhere on UoM campus.

6.3.36 All secondary heating and chilled water circuits shall be installed complete with non-return valves. This will prevent inadvertent flow when some circuits are off (i.e. summer CT for hot water, VT off).

6.3.37 All pumps and fans shall be provided with a minimum of spare capacity of :

- 20% of volume.
- 25% on pressure

6.4 Water services

6.4.1 All installations shall comply with the requirements of current British Standards (BS EN 806 and BS8558), CIBSE TM13, ACOP(s), The Water Regulations 1999 and the University Legionella Policy (EPM HS4).

6.4.2 Drinking water outlets shall be provided in accordance with the Water supply (Water quality) Regulations 2010. Outlets shall be taken directly from the incoming mains cold water supply, as close to a rising main as possible.

6.4.3 Drinking water outlets are to be labelled (see water regulations guide and workplace Health & Safety approved code of practice) as close to the rising main as is possible.

6.4.4 Following any work on domestic water services, 'as-fitted' drawings and schematics shall be provided together with all testing and commissioning documentation.

6.4.5 The University has made an undertaking to provide chilled drinking water for all building users.

- For new build projects the Design Team shall consider a full level of provision as part of the brief.
- For any refurbishment project Design teams shall fully consider any opportunity to improve current provision of chilled drinking water.
- All chilled drinking water installations shall be serviced by a potable supply and fully compliant with the requirements of the Water Regulations, be plumbed to waste
- All installations will require approval from the Principal Mechanical and Energy Engineer.

6.4.6 Bottled water machines shall not be installed for sustainability reasons. (also refer to clause 6.4.5).

6.4.7 Vending machines shall be installed in accordance with the latest ;

- Regulation (EC) No. 852/2004 on the hygiene of foodstuffs
- The Food Hygiene (England) Regulations

6.4.8 Mains powered PIR controlled urinal flush controls with a hygiene flush cycle shall be installed. (Waterless urinals shall not be installed)

6.4.9 Schematic drawings of the system shall be provided with numbered and labelled valves charts. This will reduce confusion and save time in trying to identify appropriate isolating valves and other system components. In addition the University's schematic drawings associated with the Legionella Risk assessments shall be updated accordingly.

6.4.10 Low-use outlets, with a potential legionella/poor water quality risk such as showers, drinking outlets, shall be installed upstream of higher use outlets to maintain frequent flow; e.g. a safety shower can be installed upstream of a WC. (refer to appendix 6).

6.4.11 Potable water supplies shall not be used for the purposes as the primary cooling source for plant and equipment which results in excessive wastage therefore; reasonable provision shall be made in the installation to ensure water efficiently and for the prevention of undue consumption of water.

6.4.12 Where small DHW loads are required, consideration shall be given to local point-of-use water heating rather than centralised production and storage. Where local point of use water heaters are utilised they shall be of the unvented type non/minimum storage

6.4.13 Drinking water systems shall be designed with the provision for the pipework to be purged every four hours by incorporating in the design with other outlets such as toilet flushing boxes.

6.4.14 Drinking water outlets shall be installed in designated kitchen areas as close to the rising main cold water service as practicable.

6.4.15 Any modification to existing drinking water pipework shall be approved by the Principal Mechanical Engineer, and existing CAD drawings shall be updated to reflect the changes.

6.4.16 All water fittings shall be WRAS approved. Any final connection to showers, wash basins or any potable supply shall not be made with flexible hose connections, due to degradation of the material over a period of time causing potential Legionella & Pseudomonas colony formation.

6.4.17 Shower facilities shall be of the low flow type with the flow of water below 6 litres / minute. This shall be agreed with the Principal Mechanical and Energy Engineer.

6.4.18 Instantaneous water heaters for single or multi-point outlets devices serving one draw-off only and are either electrically or gas-heated shall follow the general principles and limitations of instantaneous water heaters are given in the latest BS EN standards. In essence:

a. The flow rate is limited and is dependent upon the heater's hot water power rating.
b. Where restricted rates of delivery are acceptable, the heater can deliver continuous hot water without requiring time to reheat.
c. This form of hot water heating should only be considered for smaller premises or where it is not economically viable to run hot water distribution to a remote outlet.

6.4.19 a. Trace heating shall be provided on non-recirculating hot water distribution pipework where the discharge temperature would not otherwise reach 50°C in 1 minute.

b. Unless agreed in writing with the Principal Mechanical & Energy Engineer electric trace heating as a means to maintain hot water service temperatures shall not be utilised. Where electrical trace heating is used, it shall be connected to the university BMS to enable data logs for continuous monitoring to ensure water temperature above 55°C.Care should be taken to ensure there are no cool spots.

6.4.20 Thermostatic mixing valves (TMV's) shall be sited as close as possible to the point of use. A single TMV should not serve multiple tap outlets and the mixed water pipework should be kept as short as possible. TMV's for showers and taps should comply with NHS Model Engineering Specification - D08 for Type 3 Valves. BS EN 1111 & 1287. Sufficient access shall be provided to enable regular temperature monitoring to take place with minimal disruption.

6.4.21 Where applicable, all domestic hot water calorifiers, cylinder and directly fire water heater shall include de-stratification pumps to ensure continuity of temperature throughout the stored water supply and shall incorporate time controlled for energy reduction purposes.

6.4.22 All Direct Gas Fired Storage Water Heaters shall **not** be of the type that includes vitreous glass lining.

6.4.23 a. The storage capacity and recovery rate of the calorifier shall be selected to meet the normal daily fluctuations in hot water use without any loss in service and supply temperature.

b. For open vented domestic hot water systems the design shall ensure all vent pipe from the calorifier allows is sufficiently sized for the increase in volume, and suitably sited on the water circuit, to prevent hot water being discharged.

c. All drain and vent shall be discharged safely and via a tundish arrangement and in accordance with British standards and water regulations.

6.4.24 All calorifiers shall include a drain valve located in an accessible position at the lowest point of the vessel so that accumulated sludge can be drained easily and the vessel emptied in a reasonable time. A separate drain should be provided for the hot water system vent (particularly if the feed to the calorifier incorporates a non-return valve).

6.4.25 Hot water circulating loop shall be designed to give a return temperature to the calorifier of no greater than 5 °C and a minimum of 50°C. The pipe branches to the individual hot taps should be of sufficient

size to enable the water in each of the hot taps to reach 50°C within 1 minute of operation. Immersion pockets shall be fitted on the flow and return to the calorifier and in the base of the calorifier in addition to those required for control.

6.4.26 All heating and plumbing installers shall be qualified and registered in the "Water Industry Approved Plumber Scheme" for heating and plumbing installers, demonstrating competence and knowledge of the Water Regulations (1999). All appropriate documents shall be retained by project teams and issued to the Mechanical & Energy Engineer.

6.4.27 All works associated with any water supplies shall be fully recorded in building Legionella Log book detailing the activity performed, name of company, name of operative, WRAS registration number etc.

6.4.28 Timed-flow taps or flow regulators are to be installed except those cold water services required for scientific purposes or required to provide untimed flow (e.g. cleaners sinks, kitchen sinks etc..)

6.4.29 Spray taps are not to be specified.

6.4.30 Water conservation measures such as auto control (electronic) for urinal flushing shall be installed.

6.4.31 Cisterns shall not exceed the current regulations and shall be dual flush type

6.4.32 Rainwater harvesting shall be implemented where viable.

6.4.33 The following shall not be specified:

- Drinking fountains (unless approved in writing by the Principal Mechanical & Energy Engineer)
- Spray taps
- Venturi pump water taps
- Entrained air type shower heads
- Waterless urinals

6.4.34 In the course of refurbishment work all redundant pipework shall be removed to where the branch emanates from it's main. A 'dead leg' shall not be left.
(A dead leg constitutes a redundant length of pipe exceeding 1.5 x its diameter in length).

6.4.35 a. Backflow protection should be strictly in accordance with BS EN 1717.

b. The local water supplier can provide advice on the level of backflow protection that should be installed. Wherever practicable, systems shall be protected against backflow without reliance on mechanical backflow protection devices; this shall be achieved by point of use protection, such as a "tap gap" above the spill over level of an appliance.

c. The use of RPZ valves shall be allowed with written consent by the Principal Mechanical & Energy Engineer)

6.4.36 Urinal flushing in lightly used installations, a user-operated or actuated flush for individual stalls or bowls shall be fitted for water saving purposes

6.4.37 Where mains pressure is insufficient to supply the upper floors of a building, mains supply to the lower floors without pumping should be considered.

6.4.38 Water disinfection shall not be carried out no greater than 30 days prior to occupation. The system shall be flushed weekly to maintain a flow of water as described below. The design of the flushing programme should be in accordance with the HSE's Approved Code of Practice L8, Legionnaires' disease – The control of Legionella bacteria in water systems.

6.4.39 In cases, where more than 30 days elapse between the completion of system disinfection and handover of the project, routine flushing shall be carried out to mimic occupancy. Where this flushing does not take place, the building shall be representatively sampled and assessed for microbiological quality to evidence that water meets drinking water standards.

The following tests should be carried out on a weekly basis and be inclusive of:

- total viable counts (TVC) measured at 22 °C;
- TVC measured at 37 °C;
- Coliform bacteria;
- Pseudomonas aeruginosa;
- Legionella (species); and disinfection residuals (taken concurrently with the microbiological samples).
- All test shall be certified by UKAS accredited laboratory and provided in the test and commissioning data package and H&S files

6.4.40 No pipework shall be left buried in walls or floors with no future access provision.

6.4.41 University preference is not to use compression/crimped pipework & fittings for water services systems. Push fit fittings are not to be used at the University of Manchester. Any deviation from this standard shall be agreed in writing with the Principal Mechanical & Energy Engineer.

6.4.42 Where there is no option but to use compression/crimped fittings and approval has been sought from the Principal Mechanical & Energy Engineer, a copy of the contractors QA procedure shall be submitted for approval. Equipment calibration certificates and user training/competency certificates shall also be submitted.

6.4.43 All domestic water service shall be installed in copper tube to BS EN 1057 table X. No plastic pipework shall be used.

6.4.44 Refer to sections 6.6.6. & 6.6.7 for pipework jointing requirements.

6.4.45 As per BS EN 15154-1 : 2006 : Emergency safety showers, potable water or water of a similar quality complying with European or national standards is required for body showers. Materials used in the construction of the shower shall not affect the water quality or contaminate the water supply.

6.4.46 Instantaneous 'point of use' electrical water heaters shall not be used to serve cleaners sinks. Where a buildings hot water services strategy is delivered via point of use water heaters, an unvented local storage unit shall be supplied.

6.4.47 In the selection and specification of taps and water outlets, care should be taken to select outlets that have a pressure drop that is suitable for the pressure available in the system (i.e. a low pressure tank supplied system should not be provided with non-concussive taps that required a high minimum pressure). The mechanical design consultant shall ensure close coordination is held with the Architect/Surveyor in respect to tap specification.

6.5 Cold Storage Water Tanks

6.5.1 Cold water storage tanks shall be sized in order that the stored volume is displaced every 12 hours.

6.5.2 Dual or split tanks shall be installed with total water separation between the two water chambers. Inlets and outlets shall be arranged to ensure no stagnation occurs. Valves shall be installed so tanks shall individually be capable of a full drain down for ease of cleaning/disinfection without interruption to main building supply.

6.5.3 The tank shall have a water meter on each outlet, with remote reading facility the remote facility shall be connected the University's automated meter reading system.

6.5.4 The tank shall be supplied complete with a University Standard make up water filter.

6.5.5 All cold water storage tanks to be of GRP construction complete with integral insulated panels. The panels shall be all externally flanged so as to aid the cleaning and chlorination processes.

6.5.6 The drain point shall be fitted at the base of the tank within a dished panel and shall be of minimum size of 32 mm.

6.5.7 All tanks and cisterns shall have air separation in accordance with the recommendation within the Water Regulations 1999, and delayed action float, or electronic resistance rod level control, in order to ensure that positive water displacement is maintained.

6.5.8 There shall be a minimum of two access points (where practical) including internal steps, at opposing ends of the tank, where this requirement cannot be met the DOEF Responsible Person shall be contacted and the agreed solution recorded in both the Project file and the PSU Group's Water records.

6.5.9 Tanks are to include external access ladders and safety rails to enable maintenance and visual checks required under the Control of Legionella L8 legislation.

6.5.10 DHW Calorifiers & multipoint heaters shall have fitted flow and return temperature sensors and gauges - the sensors shall be connected to the University's Building Management System (BMS).

6.5.11 Every cistern or water tank shall be placed and equipped so that the interior can be inspected and cleansed and the float operated valve can be maintained. A clear space of not less than 350 mm should be provided between the top of the cistern and any ceiling or other obstruction above the cistern. For small cisterns the overhead, unobstructed space may be reduced to 225 mm provided no dimension of the cistern exceeds 450 mm in any plane.

6.5.12 Where BMS availability is present temperature sensors shall be installed at the inlet and outlet points of the tank–the sensors shall be connected to the University's Building Management System (BMS).

6.5.13 Cold water tanks and Cisterns shall incorporate switched control system that 50% of each tank may be drained for disinfection purposes without interruption of the building supply.

6.5.14 Cold water storage tank should be sited in a cool place and protected from extremes of temperature by adequate thermal insulation. Piping should be insulated and kept away from hot ducting and other hot piping to prevent excessive temperature rises in the cold water supply; not more than 2°C increase shall be allowed.

6.5.15 Access ports shall be provided on cold water tanks for inlet valve maintenance, inspection and cleaning.

6.6 Pipework Distribution Systems

6.6.1 Heat (and cooling) distribution systems shall be considered carefully in order to obtain maximum overall efficiency.

6.6.2 All designs shall ensure that heat or cooling from the boiler/chiller reaches the point of use with minimum change to the temperature inside the pipe by using the optimum level of insulation and considering the route of the mains.

6.6.3 The design shall ensure all routes of mains (particularly steam and condensate) are safely accessible for maintenance and can be routinely and easily monitored for leakage and damage to insulation. The building management system (BMS) shall be fully utilised to highlight steam trap failure and detecting mains which are not readily visible or are underground.

6.6.4 All designs shall ensure the heat or cooling from the boiler / chiller reaches the point of use with minimum pumping energy the system shall be designed for low resistance.

6.6.5 All designs shall consider the use of driving absorption chilling using the waste heat from the site steam supply, and or future CHP installation. Consideration shall be given to the future utilisation of the heat network to provide both heating and cooling requirements.

6.6.6 The University prefers not to use compression/crimped pipework and fittings for use in any pipework systems. Push fit fittings are not to be used at the University of Manchester. Any deviation from this standard shall be agreed in writing with the Principal Mechanical & Energy Engineer.

6.6.7 In the unusual circumstance where compression/crimped fittings/joints are approved for use, the contractor is required to demonstrate a robust on site QA procedure to demonstrate no future joint failures shall occur.

6.6.8 Schematic drawings shall be produced and provided to PSU during stage 3,4,5 & 6 for all mechanical & HVAC works associated with the project or scheme. For refurbishment projects, this shall detail the interface to the existing infrastructure.

6.6.9 The utilisation of pulled bends shall be avoided, and only permitted with prior written agreement from the Principal Mechanical & Energy Engineer.

6.6.10 Thin wall carbon steel compression pipework & fittings shall not be permissible for use at the University.

6.6.11 For chilled water & domestic cold water services systems, no fittings (unions, ball-o-fix valves, isolation valves etc) shall be specified/installed in copper/zinc alloys or DZR Brass. This is to prevent stress corrosion cracking.

6.6.12 Mechanical and electrical risers shall be physically separated along their complete length. No wet services should be located in the vicinity of electrical distribution boards, switch gear or main distribution panels.

6.6.13 All pipework & services shall be identified according to BS 1710 : 2014 : Specification for identification of pipelines and services.

6.6.14 All thermal insulation for HVAC services shall be in accordance with BS 5970 :2012 : Thermal insulation of pipework, ductwork, associated equipment and other industrial installations in the temperature range of −100 °C to +870 °C.

6.7 Management of Water Systems - Estates

6.7.1 Where existing systems are to be modified in a building that is occupied and the responsibility for maintaining the existing water system shall remain within the Maintenance Services Unit.

- Designer Risk assessments shall be approved by the DOEF Responsible Person.
- The Project Manager, Design Engineer, CDM Co-ordinator and the contractor shall meet with the DOEF Responsible Person (or nominated Deputy) and agree/record.
- How access to carry out tank inspections can to be achieved.
- How sentinel and additional random tap temperatures are to be undertaken and recorded.
- How water emergencies on the site are to be managed

6.8 Management of Water Systems – Contractors

6.8.1 Where existing systems are to be modified in a building that is part occupied the responsibility for maintaining the water system shall be with the Principal Contractor.

- Designer Risk assessments shall be approved by the DOEF Responsible Person
- The Project Manager, Design Engineer, CDM Co-ordinator and the Principal Contractor shall meet with the Principal Mechanical and Energy Engineer and agree/record.
- The Maintenance regime that shall be implemented by the Principal Contractor for the management and control of legionella in the specified building(s)
- Details of the extent of the nominated contractor's roles and responsibilities shall be clearly identified.

- Details (if any) of responsibilities that are to be undertaken by the DOEF complete with the methodology for carrying out these duties.
- The proposed/agreed methodology that the Principal Contractor shall use for carrying out the inspection and test regime for the management of legionella on the site and the remainder of the building for which he is assuming responsibility.
- How water emergencies on the site are to be managed
- Provision shall be made for independent checks to be carried out by the DOEF Specialist Water Company and/or Specialist Water Consultants as appropriate

6.8.2 New systems in a building that are not occupied and the full responsibility is with the nominated contractor:

- Designer Risk assessments shall in all instances be approved by the DOEF Responsible Person
- The proposed/agreed methodology that the nominated contractor shall use for carrying out the inspection and test regime for the management of legionella on the site and the remainder of the building for which he is assuming responsibility shall be submitted to The Principal mechanical and Energy Engineer.

6.9 Building Management System

6.9.1 Please refer to BMS policy & specification, EPM PM10, for detailed BMS requirements. This policy will override all consultant specifications unless agreed in writing by the Principal Mechanical & Energy Engineer.

6.9.2 The University Building Management System shall be utilized to provide environmental control and condition monitoring and in full accordance with EPM PM10 standards BMS specification. The current Building Management System predominantly used throughout is the Schneider Sigma. . EPM PM10 is under review. For holding document please contact the Principal Mechanical & Energy Engineer.

6.9.3 A controls strategy shall be provided for each project. The controls strategy shall be derived by the M&E consultant and shall explain the workings and interaction of all HVAC/mechanical systems. This is of particular important for complex HVAC systems such as CL3 laboratories or clean rooms. This document shall for the basis for which the BMS engineer shall programme the Building Management System (description of operation). This document shall not be produced by the BMS engineer but shall be the responsibility of HVAC design consultant. This document shall also cover the relevant time scheduling of the various system (i.e. 08.00 -17.00 or 24/7) as this can often inform the outcome of the system design (i.e. 24/7 operation requiring separate plant).

6.9.4 All BMS cabling shall be installed in accordance with manufacturer's recommendations in particular with regard to compliance with the environment in which they are installed. Special consideration shall be given to the UV protection of cables when installed outside in direct sunlight.

6.10 Air Handling Plant & Ventilation

6.10.1 Heat recovery shall be included on all ventilation plant. Normally a pre- heater battery will not be required if heat recovery is installed.

6.10.2 Thermal wheels shall only be fitted in suitable areas for heat recovery. Water carry over from thermal wheels shall be avoided at all times. Hygroscopic wheels shall not be permissible for use.

6.10.3 Air handling units shall be direct drive incorporate an inverter control and comply with current legislation using an IEE3 or IEE4 motor. If not practical a minimum twin V belt drives are to be used. The space saver "SPZ" series shall not be used.

6.10.4 All air filters shall be 'A' grade energy rated pocket filters with a minimum of F7 primary and with F7 secondary rating. All filters shall be supplied with EN 779:2012 certification or later edition thereof. Filters should have common frame sizes of 600mm X 600mm, or 600mm X 300mm with vertical pockets. Filter frame headers should be in galvanised steel with a thickness of 25mm.

6.10.5 Space for future installation of carbon filters shall be included for in all installed air handling plant. This excludes small heat recovery units (HRU's).

6.10.6 As an alternative to Tundish Drains Self-sealing waste valves (e.g. HepvO) shall be installed where-ever possible. U traps may be installed to all HVAC plant with the appropriate access to replace biocide tablets to prevent the proliferation of Legionella.

6.10.7 Design of Duty / Standby plant shall be discussed and agreed dependent upon the application with the Principal Mechanical & Energy Engineer.

6.10.8 All HVAC assets shall be fully identified by applying unique asset numbers in accordance the University's current asset numbering protocol EPM FM1 – Maintenance Strategy.

6.10.9 The Pre Heater Battery (or Frost Battery) shall be bare tube and will not require filtration. Finned type shall not be used.

6.10.10 Suitable access sections with opening doors shall be provided within all air handling units. Access shall be provided to all filters, coils, eliminator plates & fans. All access doors within AHU's shall all be provided with viewing port holes. All AHU's shall be provided with lighting within the units.

6.10.11 In every instance the philosophy of installing fire dampers (fusible link or mechanically operated) in ventilation systems shall be discussed and agreed with the University Fire Officer. Where mechanically operated fire dampers are to be installed, local remote indication shall be installed which highlights if damper is open/closed. The fire damper control panel shall also visually indicate damper position.

6.10.12 All ventilation systems shall be provided with a description of operation in a fire condition. This shall be discussed and agreed with the University Fire Officer.

6.10.13 All Air Handling plant shall be fully controllable via the BMS. Packaged Air Handling Plant with on – board manufacturers controls shall generally not be permissible there may be small refurbishments where this unit type may be considered with formal approval from the Principal Mechanical and Energy Engineer.

6.10.14 As per guidance in 'BS EN 14644 : Cleanrooms and associated controlled environments' & HSE guidance 'The Management, design & operation of microbiological containment laboratories' where any areas are designed to work under ether positive/negative pressure (i.e. clean room or CL 2/3 laboratories), consideration shall be given to incorporating a smoke or pressure test to the building/area envelope. This will ensure designed air flow cascades are achieved when commissioning. This will also ensure air leakage is kept to a minimum.

6.10.15 In accordance with the CDM Regulations all plant and equipment shall be accessible (e.g. ladders, platforms, fixed and mobile.)

6.10.16 Ventilation rates shall be fully compliant with Building Regulations Approved Document F. Air change rates shall, in addition shall be as recommended in the CIBSE Guidance and agreed with the Principal Mechanical & Energy Engineer.

6.10.17 Areas of highest heat gain should be identified and steps should be taken to reduce heat gains if that area is the one which is bringing on the main chiller plant. Alternatively, outside-air free cooling shall be used rather than running large chiller plant inefficiently at part load.

6.10.18 The ventilation plant shall be controlled using measured CO2 levels in the areas being mechanically ventilated. Systems that serve summertime and daytime loads shall be separated from those serving 24-hour loads. This shall avoid excessive fan and pump energy and the operation of centralised systems at low part-load efficiencies.

6.10.19 Where options are available, systems which minimise fan, pump and chiller energy in preference to saving heating shall be preferred, due to the former use of electricity being more costly and emits more carbon than using fossil fuels.

6.10.20 Access sections shall be provided adjacent to all filters, cooling and heating coils, heat recovery devices, attenuators and humidifiers to facilitate easy cleaning and maintenance requirements.

6.10.21 All rooms that are designed to have a pressure differential (i.e. CL2/3 laboratories or clean rooms) shall be installed with a pressure gauge adjacent/above all entrance points to the room. The gauge scale should be suitable for pressure which it is designed to work.

6.10.22 All new ductwork installation shall be handed over in hygienic condition. All new ductwork installations shall be provided with dust accumulation test and certificate. Acceptable levels of dust shall be as listed in the tables below (taken from BS 15780:2011 - Ventilation for building – Ductwork – Cleanliness of ventilation systems). If the test results fall outside the British Standard guidance, the ductwork shall be fully cleaned prior to project handover. Following cleaning the ductwork system shall be retested and certified.

Acceptable dust accumulation in new ductwork

Cleanliness quality class	Acceptable dust accumulation level Supply, recirculation or secondary air ductwork	Acceptable dust accumulation level Extract Ductwork
Low	< 0.9 g/m2	< 1.8 g/m2
Medium	< 0.6 g/m2	< 1.8 g/m2
High	< 0.3 g/m2	< 0.9 g/m2

Quality class

Low	Rooms with only intermittent occupancy eg. storage rooms, technical rooms
Medium	Offices, hotels, restaurants, teaching rooms, lecture theatres, shopping areas, exhibition buildings, sport buildings
High	Laboratories, high quality offices

6.10.23 Toilet and wash room hand driers shall be provided with variable speed fan speed settings (minimum 3 speeds) and ability to isolate heating element. Max electrical rating of 1250W. Driers shall be 'no touch' operation and surface shall be supplied with anti-bacterial protection to prevent the spread of bacteria (inc MRSA and E.coli). Hand driers shall be complete with washable air filter and be complete with minimum of 5 year on-site warranty. Preferred supplier/model being Warner Howard, Smart-dri. Unless instructed otherwise, all hand driers shall be commissioned on high speed/ heat off. The exception to this will be for noise sensitive areas where low speed/heat on will be the required setting

6.11 Local Extract and Fume Cupboard Ventilation

6.11.1 All Fume Cupboards shall be of the non-bypass type and comply fully with Appendix VI: NERC guidance on the safe use, maintenance and testing of laboratory fume cupboards. Fume cupboards shall also be designed installed and tested in accordance with BS 14175 parts 1-6.

6.11.2 The exit velocity of all fume extract stacks shall be maintained as per guidance in BS 14175.

6.11.3 Fume Cupboards and the associated supply and extract system shall be specified on containment rather than face velocity. However designs shall be based on a minimum of $0.4ms^{-1}$ as indicated in NERC guidance and HSG 258 (H.S.E. controlling contaminants at work: A guide to local exhaust ventilation). Designers shall ensure the users of all fume cupboards are consulted to determine the hazard classification of the substances to be used are determined. This will determine the

containment level to be designed and tested to. In the absence of an informed user brief, the designer shall assume work case hazard classification.

6.11.4 As per NERC, guidance containment tests to BS 14175 shall be required for the following situations:

- All new installations
- Following major repairs or alteration to a fume cupboard.
- Prior to the start of a high hazard process.

6.11.5 All systems shall be designed to minimise supply and extract air when not in use.

6.11.6 All fume cupboard systems shall be allocated a distinct identification number which shall not be shared by any other system operating on that site. The number shall be clearly marked on all parts of the system, including ductwork and fans where these might be confused with components of any other system. Asset numbering shall be in accordance with EPM FM1.

6.11.7 The fume cupboard system may contain and convey potentially dangerous or obnoxious fumes from the fume cupboard enclosure to an outside discharge point where it can be safely dispersed at low concentration. Please refer to BS EN 14175 1-6:2003 for detailed requirements.

6.11.8 The fume cupboard, ductwork and system shall be constructed of materials capable of resisting chemical or thermal attack from any substance or equipment used within it, including during escapes other than during normal operations. See BS EN 14175 for details on fume cupboard material selection.

6.11.9 Auto sash closers coupled with a variable air volume system are UoM's preferred arrangement. This is to ensure energy consumption is minimised. The associated supply air system shall also be variable air volume to ensure maximum energy savings are realised. For the eventuality that auto sash closures are not incorporated, the enclosure shall have a movable sash which will normally be lowered during operation, but which can easily be positioned at a higher level to allow periodic access to equipment within.

6.11.10 The sash mechanism must incorporate a device to limit its movement such that a maximum aperture height of 0.5 m is maintained between the base of the cupboard and the underside of the sash. This is to be the considered as the maximum working aperture, and shall not be exceeded during normal operations. When it is necessary to exceed the maximum working aperture height, for instance whilst loading equipment during the setting up experiments, it shall only be possible to do so after deliberately activating a stop-release mechanism.

6.11.11 Where an experiment presents the possibility of accidental spillage of hazardous liquid within the enclosure, it will be necessary to incorporate features to contain the spill within the enclosure. The capacity of this feature must be capable of accepting the volume of the largest container housed within the fume cupboard.

6.11.12 With the exception of electrical supplies, the outlets to services shall be located on the inner surface of the enclosure. The controls shall be located on the external surfaces of the enclosure such that each control can be unambiguously associated with its outlet, and visibly marked in accordance with relevant standards.

6.11.13 All fume cupboards shall incorporate a means of unambiguously indicating to the operator that air is being extracted at a satisfactory rate. Where audible alarms are fitted with a mute facility, it is not permitted to carry out normal operation in the mute mode.

6.11.14 Ductwork shall be constructed of a material suitable for use with the materials intended for use within the fume cupboard. See BS EN 14175 1-6:2003 for comprehensive guidance on material selection.

6.11.15 Each fume cupboard shall have a dedicated duct system and fan set where possible. In the event of multiple fume cupboard extraction facilities must exist to indicate failure of any part of the system and communicate that failure to ALL other parts of the system likely to be effected. All fume cupboard extraction system shall be fully segregated from general and other ventilation systems.

6.11.16 Where systems are used which allow the fumes from more than one enclosure to mix, a comprehensive risk assessment must be made, and control measures introduced to prevent the simultaneous use of incompatible substances.

6.11.17 Internal surfaces of ductwork shall be smooth and free from obstruction.

6.11.18 The configuration of ducting shall be designed to avoid features likely to allow the collection or concentration of contaminant; for example any long horizontal duct runs should be slightly inclined, and incorporate suitable drainage points.

6.11.19 All ducting shall incorporate leak-proof inspection covers to allow easy internal inspections during periodic maintenance and examination.

6.11.20 All ducting between the fume cupboard enclosure and the fan which passes through any occupied space (i.e. offices or manned plant rooms) shall be at negative pressure to the ambient room pressure to prevent the leakage of contaminant into the room during plant failure.

6.11.21 Where possible, no ductwork shall violate the fire compartments of the building in passing between the fume cupboard and its final discharge point. Duct runs shall be external to the building wherever possible. Where ductwork does penetrate a fire compartment, it shall be suitably protected in accordance with Approved Document B of the Building Regulations. Where fire protected, all fume extract ductwork shall be provided with access panels at regular intervals. No fire dampers can be installed in fume extract ductwork.

6.11.22 Where it is proposed to use fire dampers to maintain fire integrity their use shall be agreed with the University Fire Officers and the Principal Mechanical and Energy Engineer. As a minimum fire dampers shall be of suitable corrosion resistant design, and be readily accessible for inspection and maintenance.

6.11.23 Where mechanically operated volume control dampers are located in a duct, they must incorporate a feature to deter the unauthorised operation. A lock-nut and an appropriate warning sign shall be sufficient. All parts of the fan likely to come into contact with the fume or its condensate shall be resistant to them, and be able to withstand the maximum working temperature.

6.11.24 For larger fume extraction systems, consideration shall be given to the use of heat recovery on the fume extract.

6.11.25 All fume extraction ductwork shall be specified to be able to withstand the maximum pressure rating of the fan (closed head) plus 10%. If this is in excess of 750Pa it is outside classification of DW 154 and ductwork should be designed accordingly. All fume extract ductwork shall be pressure tested to its design rating as per DW 154 : Plastics Ductwork.

6.11.15 Pressure sensors (and their associated tubing) controlling fume extraction fan speed shall be constructed of a material able to withstand the atmosphere to which it will be subjected to (i.e. external air). Rubber tubing may not be sufficient. Please ensure that a secondary controls device is provided for the eventuality that the primary controls device fails.

6.11.15 All LEV (local extract ventilation) systems, shall be designed to HSG 258, 2017: Controlling airborne contaminants at works. All designers of LEV equipment (i.e. fume cupboards, canopy extract, dust control etc) shall be undertaken by a competent LEV designer. As per appendix 2, section 16 of HSG 258, professionally competent LEV designers shall have qualifications through BOHS, CIBSE or ILEVE.

6.12 Fume Cupboard Fans

6.12.1 The fan motor shall be situated outside the air stream to prevent the transmission of sparks to any potentially explosive fume within.

6.12.2 Designs incorporating indirect drive using pulley belts are recommended as they are known to allow

flexible operation over a range of speeds (therefore air flow rates).

6.12.3 All components of the fan must allow access for inspection and maintenance, particularly the internal drum of the fan and its casing.

6.12.4 Belt drives must be adequately guarded to prevent accidental entanglement.

6.12.5 Fan sets and associated plant mounted externally at roof level should incorporate barriers and other safety features to prevent falls during maintenance activities.

6.12.6 Fan assemblies shall incorporate vibration damping gaiters between isolating ducting and discharge stack. This will reduce noise transmission and reduce the potential for fatigue failure throughout the duct system.

6.12.7 Designers shall consider separation of Fume Cupboards between 24 hour and non 24 hour Fume Cupboards. Large energy savings can be achieved by separating out 12 and 24 hr fume cupboards.

6.12.8 Fume cupboards shall not be used for general chemical storage in any circumstances.

6.13 General Extract Systems

6.13.1 For small localised systems, consider packaged units which supply make-up air via a heat exchanger; centralised systems shall be zoned to ensure that daytime-only areas can be controlled separately; Heat shall be recovered from extract systems wherever possible.

6.13.2 Prior to stage 4, schematic drawings shall be produced and provided for all mechanical works associated with the project or scheme. For refurbishment projects, this shall show the interface to the existing infrastructure.

6.13.3 Designs shall use passive infrared controllers (PIRs) to set back systems which are in intermittent use, such as Lecture theatres.

6.14 Motors and Drives

6.14.1 All designs shall incorporate IEE3/IEE4 premium efficiency motors on HVAC and pumps throughout the building service design or include high-efficiency motors (HEMs) of equal or greater efficiency. Specific fan power design shall aim to be 2 W/L/s or less to achieve best practice.
All designs shall incorporate IEE3/IEE4 premium efficiency motors on HVAC and pumps throughout the building service design or include high-efficiency motors (HEMs) of equal or greater efficiency. Specific fan power design shall aim to be 2 W/L/s or less to achieve best practice (and be in full compliance with building regulations).

6.14.2 Variable-speed drives (VSDs) shall be used where possible.

6.14.3 Direct drives are preferable to belt drives, where practical, except where motors need to be kept out of the airstream. If belt drives are used, consider modern, flat, synchronous or ribbed belt drives rather than traditional V-belts to reduce drive losses. Sensors shall be added to check the motor load so that the motor can be switched off if idling.

6.15 Cooling Plant / Refrigeration

6.15.1 Consideration shall be explored to reduce internal heat gains where possible to avoid the requirement to require cooling. In the unavoidable event by exploring natural ventilation methods free cooling shall be used increasing the cooling capacity of ambient air to directly cool the space by increasing the fresh air supply rate when the external air is at an appropriate temperature, part of the cooling load can be met, hence reducing the energy consumed by mechanical refrigeration plant. Peak lop close control shall be included to ensure the cooling is available when only absolutely necessary. Peak lop

control shall be via the Universities BMS system. Generally, no local user control of any approved cooling shall be provided. Please refer to EPM PM22, air conditioning policy, for more detailed information.

6.15.2 All installation shall be in full accordance with the University Air Conditioning Policy EPM PM22.

6.15.3 All cooling plant design shall be concluded without the aid of cooling towers or evaporative condensers.

6.15.4 No installation of cooling plant shall proceed without a completed Application form which are issued and authorised by the Principal Mechanical & Energy Engineer. Please refer to EPM PM22 : Air conditioning/comfort cooling policy.

6.15.5 Where provision of comfort cooling cannot be avoided (ref section 6.15.2) consideration shall be given to the use of passive/active phase change materials.

6.15.6 The installation of new chilled water system within new building shall include for the inclusion of Glycol. And shall be to BS 8552:2012, BSRIA BG 29/2012, BSRIA BG 50/2013

6.15.7 Prior to stage 4, schematic drawings shall be produced and provided for all mechanical works associated with the project or scheme. For refurbishment projects, this shall show the interface to the existing infrastructure.

6.15.8 Areas of highest heat gain should be identified and steps should be taken to reduce heat gains if that area is the one which is bringing on the main chiller plant. Alternatively, outside-air free cooling shall be used rather than running large chiller plant inefficiently at part load.

6.15.9 All complete new chilled water systems shall include the installation of a side stream filtration (e.g. Enwamatic unit) should be installed. The unit shall be complete with stainless steel vessel. For modifications to existing chilled water systems, please discuss the requirement for their inclusion with the Principle Mechanical Engineer.

6.16 Compressed Air plant

6.16.1 All installations to be discussed on case by case situation and agreed with the Principal Mechanical & Energy Engineer.

6.16.2 All air compressors installed shall be remotely monitored using air flow gauges to prevent unnecessary use due to leakage.

6.16.3 Heat rejection from compressors shall not be introduced directly into plant rooms. This will avoid excessive ambient temperatures. Where possible, all heat rejection for air compressors shall be recovered reused within other HVAC systems. If heat cannot be recovered or it is not cost effective to do so, rejected warm air shall be ducted to outside. Please also refer to 6.2.3.

6.17 Isolation of Mechanical Services

6.17.1 The isolation of mechanical services within buildings can be extremely disruptive and dangerous if it is not well planned. The need to arrange isolation for a variety of reasons regularly arises however it is important that appropriate arrangements are put into place.

6.17.2 The de-commissioning and re-commissioning of mechanical services is likely to be undertaken by the Maintenance services Unit or a nominated term maintenance contractor. It is highly likely that this work will incur a charge that must be borne by the project.

6.17.3 Requests for isolation of mechanical services shall be made in writing, with a minimum of 48 hours' notice (for certain buildings this period may be longer).

6.17.4 It is imperative the relevant Faculty Estate team is kept involved in the arrangement of shutdowns as they liaise with building users.

6.18 Drainage & Rainwater Systems

6.18.1 Where a project involves working on Laboratory drainage this shall be planned in detail with the facility/building users due to the potential hazards that may be associated with particular departmental functions.

6.18.2 Requests for work shall be made in writing, with a minimum of 48 hours' notice (for certain buildings this period may be longer), to the relevant Head of Faculty Estates (HOFE) as they are responsible for liaising with building users.

6.18.3 Materials used within laboratory drainage shall consider not using dissimilar metals and shall incorporate Vulcathene where appropriate. The use of Yorkshire type fittings for Mpress and Xpress pipe work shall be included using trained personnel and calibrated tools.

6.18.4 Pumped drainage systems (such as Saniflo systems) and macerators are not to be used at the University. Designers shall influence room layouts so as to avoid the need for their inclusion.

6.18.5 In the eventuality that a pumped system is unavoidable, all systems of this type shall be provided with duty/standby pump, remote audible alarm in the room it is serving, appropriate signage & alarms/monitoring on the BMS. This system shall require a formal derogation report to be submitted to the mechanical engineering team. Before this derogation is submitted a discussion shall take place with the Mechanical Engineering team.

6.18.6 All plant rooms shall be provided with suitably located and an adequate number of gulleys. The gulleys shall be located so as to avoid low level pipework becoming a trip hazard. These shall be co-ordinated and be local to all relevant plant (i.e. Pressurization units, AHU's etc). All plant with a drain/overflow shall be hard piped to drain with a suitable fall. No plant item with an overflow shall remain unconnected and without pipework to drain.

6.18.7 All drainage materials shall be specified so as to be suitable for the temperature and hazardous nature of the fluids they shall carry. This is also applicable for 'blow off' drainage pipework for hot water or LTHW systems where standard UPVC pipework may not be suitable.

6.18.8 Syphonic drainage system shall not be used on University projects.

6.19 Sterilisation and Disinfection

6.19.1 Cascade systems shall be employed where conditioned air from the cleanest space (packing) flows to neutral then to dirty areas;

6.19.2 Where practicable, include sterilizer plant rooms adjacent to an external wall, preferably at ground-floor level, to enable heat within the plant area to dissipate naturally.

6.19.3 Steriliser and disinfecting equipment shall be considered on the basis of energy usage as well as performance – energy usage and whole-life costs can differ widely between manufacturers.

6.19.4 Heat recovery from washer disinfection extracts shall be included, ensuring the device can withstand moist, corrosive air; consider heat recovery from heat exchangers in sterilizer drainage (water cannot be re-used).

6.20 Compressed Gases & Pressure Systems

6.20.1 Modification to any existing fixed gas or cylinder installation shall require the production of a Written Scheme of Examination. This shall be procured through the project team and issued to the Project Manager as part of the H&S file.

6.20.2 The location of any pressurised gas cylinders requires input from the University Fire Officer and risk assessment by the school health & safety officer. The final location should be assessed based on a hierarchy of control. This is as per guidance in the Dangerous Substances and Explosive Atmospheres Regulations, Approved Code of Practice and guidance 2013. Guidance is also given in the NERC (Natural Environment Research Council) Guidance safe storage & Installation of Gas Cylinders.

6.20.3 Where compressed gases lines are installed into a room or facility the need for a gas detection system shall be risk assessed by the school H&S officer. This risk assessment should be documented and included in the H&S file for future reference.

6.21 Natural Gas

6.21.1 Natural gas outlets shall be hard piped. It is not acceptable to terminate gas connections to outlets via a flexible hose.

6.21.2 For detailed natural gas requirements please refer to EPM HS17 for University Gas Policy.

6.21.3 All installed natural gas pipework systems shall be sized to accommodate the full connected load. This shall include all connected gas fired appliances, even where resilience is provided. Controls interlocks and management arrangements are not an acceptable way of compliance for an annual Landlords gas safety test.

7.0 Guide to Electrical Engineering

7.1 General

7.1.1 The University requirements for electrical installations are specified within the Standard Electrical Specification (EPM PM8). This document details the minimum standards required and is intended to focus on standards which are not covered in the IEE Wiring Regulations and associated Guidance Notes. In addition the document details other requirements particular to the University of Manchester and indicates preferred suppliers and manufacturers. For advice and/or clarification of the Standard Electrical Specification contact The University Electrical Engineer:

7.1.2 The Design Team shall ensure that full reference is made to the need to adequately and easily maintain the electrical engineering services for the life of the building. The need to provide adequate levels of maintainability to installations, including replacement of components, cannot be overstressed.

7.1.3 Some of the existing University electrical, fire alarm and emergency lighting infrastructure and installations are old and, consequently, Maintenance Services Unit experience difficulty in obtaining replacement components. Where, as part of a project, installations and equipment are being replaced, the DOEF shall be given the opportunity to decide whether any parts of these installations need to be salvaged. Advice on this may be sought from the Principal Electrical Engineer, or the University Fire Alarm Supervisor.

7.2 Main Distribution

7.2.1 Adequate maintenance access and working space shall be allowed around all switchgear.

7.2.2 All sub-stations and Main Switch rooms shall be located at ground floor or basement level and be directly accessible from outside.

7.2.3 All sub-switch rooms/risers etc. shall be accessible from circulation spaces.

7.2.4 The Standard Electrical Specification (EPM PM8) details other specific criteria required in respect of electrical sub-stations, main switch rooms, main switchgear, cabling methods, and distribution equipment.

7.3 Lighting and Lighting Controls

7.3.1 Lighting systems shall take advantage of any available daylight to limit use of artificial lighting. Use task lighting in preference to overall illumination.

7.3.2 Lighting designs shall consider room layouts to ensure that luminaires are located in optimal positions and not just ensure a ‘blanket’ level of illumination. Ideally the lighting should be adaptable and easily adjustable to ensure any changes in the usage of the area can be implemented.

7.3.3 All lighting designs shall not exceed illumination levels of 10% above the statutory minimum (as specified in BS EN12464), where lighting levels above this criteria are requested they must be approved by the Principal Electrical Engineer.

7.3.4 In all cases the most energy efficient lighting system shall be designed.
Where this is fluorescent lighting, dimmable T5 fittings shall be specified as standard.

7.3.5 Tungsten lighting shall not be used, except with specific authorisation of the Principal Electrical Engineer.

7.3.6 Adopt appropriate internal finishes to benefit from higher surface reflectance in the design of the lighting system, low reflectance colours for walls and floors are in most cases not suitable.

7.3.7 Mood, feature and aesthetic lighting is not an approved use of energy.

7.3.8 All refurbishment projects must outline (and be contained within the Carbon Management Strategy):
1. The present and proposed luminaire types, wattages and running times.
2. Control gear types, settings and quantities.
3. Anticipated Carbon savings from new lighting scheme.

7.3.9 Consideration should be given to rise / fall and /or long life fittings/lamps where the replacement of lamps may be problematic and require special access equipment.

7.3.10 The Standard Electrical Specification (EPM PM8) details other specific criteria required in respect of practicalities of fixing and connection of luminaires.

7.3.11 Light switches including kinetic light switches shall be used in series with presence detection in offices, seminar rooms, corridors and break out spaces, and all sensors utilising a push to make switch must be set to Absence Detection.

7.3.12 All absence detectors shall have in built re-trigger capability.

7.3.13 If remote PIR technology is used then it shall have Micro and Macro detection zones with adjustable lockable tilting lens.

7.3.14 The design shall include automatic lighting controls for occupancy, daylight and night setback where applicable.

7.3.15 Daylight dimmable luminaires shall be set to dim to 10% minimum only, and not switch off.

7.3.16 No lighting controls shall be operated by the BMS without prior consultation.

7.3.17 For new build / large refurbishment project as a part of the design stage a lighting control " Cause and Effect " plan shall be produced for control of the lighting.

7.3.18 The lighting controls will require an initial commissioning for the building to be handed over. Once the building is occupied, with carpets and furniture installed, the lightings controls should be finally commissioned.

7.3.19 Lecture Theatre control shall be provided via hardwired networked devices with distributed intelligence, RS232 interface and direct BACnet interface. The system provided shall have the ability to be either pre - commissioned off site and will operate on non-addressable luminaires. The system shall only have two programmable points, and have the ability to have its program saved on one of the Universities Programming Tools offering simple reprogramming for maintenance.

7.3.20 To overcome issues of flicker on Led light fittings any driver shall have a 'Fade Rating' of 7mS or less.

7.3.21 DALI dimming control shall NOT be specified without approval from the Principal Electrical Engineer.

7.4 Power Installations

7.4.1 The Standard Electrical Specification (EPM PM8) details specific criteria required in respect of power installations detailing preferred circuit arrangements, wiring methods, circuit protection etc.

7.4.2 Special consideration shall be given to servicing of computer clusters particularly in regard to servicing of furniture and compliance with BS6396.

7.4.3 Small extract fans, such as used in toilet areas, are normally to be provided with means of automatic control and low energy type motors

7.4.4 All three phase induction motors shall be specified as the highest efficiency (IEE 3 or 4).

7.4.5 Load separation shall be assessed on high consumption items for individual metering.

7.4.6 Inverter drives shall be installed to all electrically driven pumps, fans and air compressors with a motor rating of 1.1kW and above

7.4.7 Direct-drive in lieu of drive belts and pulleys shall be installed.

7.5 Electrical Shutdowns

7.5.1 Electrical shutdowns of buildings can be extremely disruptive if they are not well planned, and it is important appropriate arrangements are put in place, the procedure to be adopted is detailed in Procedure document EPM HS16 – Electrical shutdown procedure..

7.5.2 Project Managers are required to submit a request for a Permit to Work for an electrical shutdown. This shall be submitted with a minimum of 5 working days' notice (for certain buildings this period may be longer) to the Principal Electrical Engineer**.**
Further guidance on the Permit to Work system is detailed in EPM HS12

7.6 Fire Alarm Systems

7.6.1 The University requirements for working on Fire Alarm systems are detailed in policy document EPM HS37 – The Management of Fire Alarm systems. This document details procedures to be followed for designers in completing their duties. Other particular requirements are detailed in the Standard Electrical Specification (EPM PM8). For further advice and/or clarification of either document contact the University Electrical Engineer or Specialist Supervisor (Fire Alarm).

7.6.2 The design of all fire alarm systems needs approval from the University Fire Officer, and the University Electrical Engineer in all cases.

7.6.3 In the design of fire alarm systems consideration needs to be given to cause and effect strategies, particularly in regard to auxiliaries and the University requirement to test fire alarms weekly. The following services (not a full list) should operate as detailed:

- Access controlled doors unlock
- Powered door control – doors open
- Lighting controls switch to full illumination
- Lifts return to main floor
- Emergency communication (Refuge) to become active
- Ventilation systems to be agreed with University Fire Officer

7.6.4 Fire alarm isolation, by its nature presents hazards to building users. Any isolation (electronic or physical) requires a Permit to Work, and further guidance on the Permit to Work system is detailed in EPM HS12.

7.7 Emergency Lighting Installations

7.7.1 Particular requirements are detailed in the Standard Electrical Specification (EPM PM8).

7.7.2 Designers shall consider future maintenance by keeping designs simple and supplementing them with automatic testing systems where possible

7.7.3 For Further guidance on Emergency Lighting, contact the Principal Electrical Engineer or Specialist Supervisor (Fire Alarm).

7.8 Lift Installations

7.8.1 The University requirements for lift installations are specified within the Standard Lift Specification (EPM PM9). This document details the minimum standards required and is intended to focus on standards particular to the University. For further guidance and/or clarification of the Standard Lift Specification contact the University Electrical Engineer or Specialist supervisor (Lifts).

7.8.2 The University Specialist Supervisor (Lifts) shall be kept fully informed prior to any works commencing on any lift installation.

7.8.3 A Permit to Work is required to access and work in any Lift Motor Room.

7.9 Access Control Systems

7.9.1 Access into buildings or facilities will require the use of an electronic proximity card system in order to control building access. The specification and use of such systems needs to meet the requirements of the University. All plans shall be agreed with the University Access Control Manager before any installation work commences.

7.9.2 The University has a number of disparate access systems which in principle are detailed below:
(i) Access to general areas and principal entrances are controlled by the Continuum HID system. This is widespread across the University but does not extend to all lockable doors and requires a wired installation.
(ii) Estates service areas such as Plant Rooms, Roof Access, Risers etc are generally locked off using the Simons Voss wireless gateway system, access to which is controlled via the Permit to Work system.
(iii) Access to Centrally Controlled (CTS) teaching and seminar rooms are also controlled via a Simons Voss system but with associated wireless transmitters to allow remote control of the system.
(iv) Other areas such as individual office doors are generally locked on the EVVA key locking suite.

Design teams shall consider one holistic system for new builds and wholesale refurbishment projects. The system shall utilise the card technology that has been introduced within the multi – function staff ID cards.

7.10 Intruder / CCTV Systems

7.10.1 No installation shall proceed without prior agreement with both the University Specialist Supervisor (Fire Alarm) and the Head of Security.

7.11 Communications Cabling (Voice/Data)

7.11.1 The University requirements for Communication cabling are specified within the document 'Specification for the design and installation of Structured, Fibre Optic and Voice Cabling systems – April 2012' or later document thereof. This document details the standards required for communication cabling installed within the University of Manchester and indicates preferred suppliers and manufacturers. It is imperative this document is referred to by both Architectural and Engineering as it specifies particular standards in both fields.

7.11.2 Commissioning of voice/data systems shall be arranged with the cooperation of Information Technology Services Division (ITSD). It is expected that close liaison has taken place throughout the life of the project and so this process should be seamless. ITSD however does need to be given adequate notice as it has to arrange internal labour to complete this task. Requests for this work shall be given in writing with at least two weeks' notice to the ITSD.

7.11.3 For advice and/or clarification on the Specification and associated requirements contact the ITSD.

8.0 Architectural / Building Requirements

8.1 General

8.1.1 The scope and extent of building materials and products that can potentially be incorporated and specified on any given project is wide ranging. Design Teams should always take into account the need to specify with sustainability, low maintenance, future maintenance and ultimately replacement in mind. There is a significant amount of legislation that affects the design of buildings that must be adhered to. Furthermore, extensive experience and advice is available within the Estates Directorate and timely communication with Estates staff is essential.

8.1.2 Designers shall ensure that all work complies with Building Regulations and all other legal requirements.

8.1.3 The DOEF encourages the standardisation of systems, types of installation, equipment and components to minimise maintenance costs and replacement intervals.

8.1.4 Any product specified shall be considered from the point of view of:

- Cost
- Whole life cycle costing – with calculations to evidence evaluation
- Compliance with relevant standards
- Applicable warranties and guaranties
- Performance
- Function
- Fitness for purpose
- Durability
- Serviceable Life
- Ease of cleaning
- Ease of access
- Compatibility with existing systems, products and adjacent works
- Cost of replacement parts
- Ability to replace products or fittings
- Availability and time taken to source replacement parts
- Recycling at the end of its service life
- Sustainability
- BRE Environmental Rating
- Sound CSR values throughout the supply chain

8.1.5 Design Teams shall collaborate with the PSU Principal Building Surveyor and the appropriate MSU Area Manager's regarding the selection of materials and components during the early stages of the schemes (RIBA Plan of Work Stage 1/2).

8.1.6 Warranties must be evaluated as part of the procurement process to ensure that the terms are realistic and reasonable. Design teams need to read the small print to avoid warranties being invalidated and worthless. (For example warranty of windows not being dependent upon a full inspection every 6 months).

8.2 Description of Materials and Workmanship

8.2.1 The appropriate version of The National Building Specification shall be deemed to be incorporated by reference into the specification. Materials and workmanship generally shall comply with the clauses contained in that document. A copy of the NBS should be consulted and made available. Generally blank spaces in NBS shall be deemed to be filled in:

1. As appropriate to comply with the requirements of the University.
2. As recommended or implied by the NBS for the purpose of the particular item of materials or workmanship concerned.
3. In a way which complies with Standards generally and Specific Requirements given below.

8.3 Standard of Materials and Workmanship

8.3.1 The general standard of materials and workmanship shall be at least as high as that described in the current British Standards Institution Specification and British Standards Codes of Practice.

8.3.2 All timber must be Forest Stewardship Council (FSC) certified.

8.3.3 A minimum of 15% (with an aspiration for 20%) of the total value of construction materials must be derived from recycled and reused content

8.3.4 For each part of the work, all material and workmanship shall be suitable, both in appearance and structurally, for the purpose of that part.

8.3.5 All material and workmanship shall comply with the Building Regulations and satisfy the requirements of Statutory Authorities.

8.3.6 All material and workmanship shall be in accordance with good building practice.

8.3.7 Preparation for and mixing, use and application of all proprietary materials and goods shall be in accordance with the instructions and recommendations of the manufacturer.

8.3.8 Materials and components shall be selected where they have an agreement certificate in preference to those which do not.

8.3.9 All materials and products must be new and unused and from the manufacturer's current ranges unless prior written approval has been obtained.

8.3.10 If an alternative product to that specified is proposed, obtain approval from the Principal Building Surveyor. Submit reasons for the proposed substitution together with the following information:

- manufacturer and product reference;
- cost;
- sustainability criteria;
- availability;
- relevant standards;
- performance;
- function;
- compatibility of accessories;
- proposed revisions to drawings and specification;
- compatibility with adjacent work;
- appearance;
- Copy of warranty/ guarantee.
- Alterations to adjacent work: If needed, advise scope, nature and cost.

8.3.11 Glass Reinforced Cladding (GRC) is not to be utilised upon new build projects.

8.4 Architectural Specific Requirements - Roofs

8.4.1 This section is specific to the installation of new or replacement waterproof roof membranes to flat roofs. It applies to new-build projects where the whole roof or portion of the roof is of flat roof construction and to refurbishment projects which include as part of the works the refurbishment / upgrade of existing flat roof areas. This section does not consider metal clad roofs (sheet lead, copper, zinc, aluminium, coated steel), profile and composite roof decking, pitched roofs of slate or clay tiles

8.4.2 The substrate of flat roofs across the campus include reinforced insitu concrete, precast beam and pot with site cast slab, woodwool slabs on beams, boarded timber and plywood on traditional timber construction.

8.4.3 Integral to the Long Term Maintenance of the estate is the drive to improve environmental conditions. At feasibility stage, consideration shall be given to the viability of installing a 'green' roof system to new flat roofs or replacement roof membranes. As regards the latter, the viability is influenced, amongst others, by the capability of the existing structure to support the additional imposed load on the roof deck, the practicalities of access to mechanical plant and other equipment that may be on the roof or some other section, and the overall size of the flat roof.

8.4.4 In terms of complying with the University requirements of energy conservation there is a need to improve the thermal efficiency of the roof system when undertaking refurbishment where feasible and at the very least comply with the statutory minimum prevailing at the time of the design. Increasing the depth of insulation on a warm deck roof is subject to the relative heights of doorways or openings from inside the building onto the roof, upstands, parapet heights if present and the bearing capacity of the roof.

8.4.5 The DOEF design guide directs that new flat roofs or refurbishments of flat roofs must install an insulated warm deck roof system. The Directorate of Estates does not approve of inverted roofs except where this is part of a green roof installation.

8.4.6 For flat roof membranes the DOEF accepts a choice of two systems, either a reinforced elastomeric bitumen felt roof system or a liquid applied polymer roof system. The former should be the product of choice for most flat roofing applications, whilst the latter is seen as an option for roof areas with complex details and difficult access, where site application will function more effectively than sheet materials.

8.4.7 Where Reinforced elastomeric felt is to be installed it shall comply with the following requirements:

- S5P5 classified cap sheet under BS8747:2007
- The whole system is to be BBA approved and BBA durability statement "in excess of 30 years"
- The system must be BBA approved for use on zero fall roofs
- The system must be Wind load tested under MOAT 64 to 6Kpa
- Fire rated Ext.F.AA when tested as a system to BS476 Part 3:2004
- Vapour control layer to be covered by BBA certificate 07/4409 Detail Sheet 4

8.4.8 The DOEF requires as part of any roofing package, a 25 year guarantee on the design and installation of the roof system and insurance backed guarantees on consequential losses from leaks and breakdown.

8.4.9 Integral to the guarantee is an undertaking to attend to the reported defects, as an emergency response - within a fixed time period of 48 hours, where there is evidence of a breach and consequential damage (physical or operational to the services of the University). For example, if a roof leak manifests itself in an internal room then this would trigger a 48 hour response. If, on the other hand, clear defects are identified on the roof, such as blisters to the cap sheet or excessive ponding, but there is no detected leak or moisture penetration, then it would not be classed as an emergency and could be attended to on a timescale within 20 working days.

8.4.10 When a roofing system has been selected on functional grounds, then the Designer must consult with the manufacturer of the roofing material to provide the detailing and technical specification specific to the requirements of the particular roof.

8.4.11 New works and refurbishment of existing roofs must consider the waterproof integrity of the whole roof system and not just the primary roof covering: the boundaries of the waterproof system must be detailed to prevent a breach in the system, i.e. that parapets must have a damp proof course, cavity trays with weep holes above the flashing detail of the roof. Masonry copings must be adequately pointed to prevent penetrating damp; where the Designer considers it unnecessary to refurbish parapets on the basis of existing condition, then this must be declared in the derogation report at stage 1(feasibility). Likewise where there are penetrations through the roof membrane, such as roof lights, services, access hatches, all should provide a continued lifespan commensurate with the new roof covering, underwritten by the 25 year design and installation guarantee.

8.4.12 The roof must be tested free of leaks at handover after all snagging and other contract inspections

and works are completed. This can be by electronic leak detection and/or thermographic survey.

8.4.13 The System must only be laid by fully certified operatives who have been trained by the manufacturer or approved by the manufacturer and hold a relevant certificate of approval.

8.4.14 The System must be laid with the use of roll bars, and Long Handled Lap Rollers as provided by the manufacturer.

8.4.15 Workmanship that is incorrect and not to Codes of Practice BS 8217:2005, will not be permitted, even if the system is watertight. The client will insist all such faults shall be remedied, before the guarantee is issued.

8.4.16 Any building work which is the responsibility of the roofing contractor and has a bearing on the life of the roof system, must be carried out by fully trained tradesmen.

8.4.17 Consideration shall be given by the contractor at all times to the aesthetic appearance of the roof, i.e. Alternate head laps to be in line and no unnecessary short pieces of capping sheet are to be used. Coloured capping sheets (Grey / Green) must provide a consistent/uniform aesthetic finish to main roof areas.

8.4.18 Where building works are to be carried out by other trades, following completion of the waterproofing, the contractor must make adequate provision for supplying protection to prevent damage to the new membranes.

8.4.19 The final inspection will not be carried out by the independent surveyor until all associated trades are complete and the roof areas are clear from all debris and protection layers.

8.4.20 If any items of plant/equipment are to be situated on the finished roof, a sacrificial layer of capping sheet is to be loose laid beneath. This is to extend a minimum 25mm past the point of contact on all sides. In the case of heavy items it may be necessary to introduce a load-spreading slab.

8.4.21 When laying reinforced membranes generally the following guidelines shall be followed:

- Direction of laying: Unrolled up the slope.
- Where practicable, install so that water drains over and not into laps.
- Side and end laps (minimum): 100 mm, with the exception of mineral surfaced membranes, where side laps are 80 mm, but the head laps to remain 100 mm.
- Head and side laps: Offset.
- Intermediate and top layer/Capping sheet: Fully bond.
- Successive layers: Apply without delay. Do not trap moisture.
- Strips of bitumen membrane for 'linear' details: Cut from length of roll e.g. gutter sole pieces.
- Detail flashings: to be cut from width of roll.

8.4.22 The completed coverings shall be firmly attached, fully sealed, smooth, weather proof and free draining.

8.4.23 In Preparation for the roof covering the Substrate shall be secure, clean, dry, and smooth. The substrate shall also be free from frost, contaminants, loose material, oil and grease, voids, protrusions and organic growths.

8.4.24 The substrate must be compatible with the waterproof system, either inherently or by the use of additional primer / barriers / membranes to manufacturers recommendation.

8.4.25 The new concrete deck should be to a wood float finish or better and allowed to cure thoroughly. Remove rough edges, and surface defects. If the surface is very rough a cementitious screed should be applied and allowed to dry to give a smooth surface. Prime all areas receiving the new waterproofing with bitumen primer and allow to dry fully.

8.4.26 In timber decks, the new 18 mm thick WPB plywood should be BBA certified, conforming to BS5268 Part 2:2002 & CPD/CE compliant, fixed directly to either the joists or firings using recommended fasteners.

8.4.27 Where provided, the falls/cross-falls should be a minimum of 1:60. There must be no deflections or back-falls present if the deck is designed to achieve a 0° level finished surface.

8.4.28 The formation of upstands, kerbs, box gutters, sumps, grooves, chases and expansion joints and the fixing of battens, fillets and anchoring plugs/strips are to be completed before the main roof membranes are applied.

8.4.29 The moisture content and stability of substrate must not impair the roof integrity.

8.4.30 When taping board joints the tape shall be fixed centrally over board joints with 200mm wide strips of manufacturer's taping strip. These can be retained temporarily in place with clout nails, prior to the self-adhesive vapour barrier being laid.

8.4.31 Prime all areas receiving the new waterproofing with fast drying bitumen primer and ensure this is thoroughly dry before applying the new waterproofing.

8.4.32 The vapour barrier shall meet the following criteria:

- Minimum 3.5mm thick, 125g/m² glass fibre reinforced and polyester coated aluminium lined, self-adhesive Styrene Butadiene Styrene (SBS) elastomeric bitumen, with colour coded heat sealable side laps.
- The upper surface is to be coated with heat activated self-adhesive bitumen stripes to allow easy bonding of the insulation.

8.4.33 The vapour barrier shall meet the following technical performance standards:

- Tensile strength (EN 12311-1) Length ≥400N/50mm, diagonal ≥300N/50mm.
- Cold bend resistance (EN 1109) = -25°C
- Heat stability (EN 1110) = +70°C

8.4.34 The vapour barrier shall be cold applied to the deck by removing the peel off release film or continuous coating of SBS (Styrene Butadiene Styrene) thermofusible film. The side laps are to be 100mm and sealed by torching and rolling with a Long Handled Lap Roller to extrude a 5-10mm bitumen bead. Head laps are to be 100mm and staggered, and sealed by torching and rolling to extrude a 5-10mm bead of bitumen. Care should be taken to ensure adhesion when the temperature is below +5ºC. At all abutments and details the bitumen bead must be extruded from the lap joints to ensure a seal.

8.4.35 Ensure that all air entrapped in the vapour barrier layer must be rolled out.

8.4.36 The vapour barrier shall be dressed up all upstands to a minimum distance of 150mm above the height of the insulation. This is to ensure that a 100mm lap is constructed above the fillet. The contractor is to form all details in such a way that a fully bonded 100mm lap is obtained between the vapour barrier and the underlayer.

8.4.37 The vapour barrier is not to be used as a temporary waterproof membrane.

8.4.38 For side and end laps there shall be a minimum of 100 mm with all laps torch sealed to provide a Bitumen bead extrusion of 5-10 mm. Installation methods shall be as recommended by the manufacturer

8.4.39 Edges of insulation at roof edges, abutments, upstands, kerbs, penetrations and the like shall be enclosed with the vapour control layer dressed up 150 mm above the surface of insulation, thus providing a 100 mm (minimum) seal when overlapped by the roof covering.

8.4.40 Care shall be taken to ensure adhesion when the temperature is below +5º C due to the embrittling effects of cold weather.

8.4.41 All insulation shall be Aluminium foil faced, zero Ozone Depletion Potential (ODP) and Global Warming Potential (GWP), 5 rigid urethane insulation fully bonded to the vapour barrier by activating the surface of the vapour barrier with the gas torch. The side with the printed surface must be laid face upwards. The boards are to be close butted and staggered.

8.4.42 All edges of the insulation board must be supported by the substructure, the boards butt jointed and staggered where possible.

8.4.43 The insulation boards shall be fully bedded into the torch activated bonding strips of the vapour control layer surface. Compatible adhesive strip shall be applied to the surface of the insulation boards at all perimeter edges, rainwater outlets, roof lights, vent pipes, penetrations and other similar abutments. Adjacent lengths of strip to be close butted. Where insulated upstands are present secure the angle fillet in to position. Care must be taken to avoid creating water checks, especially around rainwater outlets, chutes and gutters

8.4.44 To protect the exposed edges of insulation use reduced thickness treated timber batten, a minimum width of 150mm and 10mm less in depth than the insulation to accommodate the build up of the waterproofing layers all securely fixed to the deck. Outer edges shall be chamfered at changes in level.

8.4.45 On completion the Insulating Boards shall be in good condition, well-fitted and stable.

8.4.46 Provide protective hard edges using treated timber battens or insulated upstand brackets (as appropriate to given detail situation) at all right angled edges e.g. top edges of parapet walls or abutment upstands.

8.4.47 Provide a minimum 100 mm lap seal between the vapour control layer and under-layer at the perimeter of the insulation layer.

8.4.48 The under-layer of the Waterproof membrane shall meet the following criteria:

- Minimum 3 mm thick, 200g/m² glass-fibre reinforced, elastomeric torch applied bitumen under-layer.
- Tensile strength (EN 12311-1) Length ≥1000N/50mm, diagonal ≥1000N/50mm.
- Cold bend resistance (EN 1109) = -30°C
- Heat stability (EN 1110) = +100°C

8.4.49 The under-layer is to be fully bonded to the insulation by removing the peel off release film. The side laps are to be 75mm , and sealed by torching and rolling with a Long Handled Lap Roller to extrude a 5-10mm bitumen bead. Head laps to be 100mm and staggered, and sealed by torching and rolling to extrude a 5-10mm bead of bitumen. The under-layer must be taken up all upstands and edge details, and fully sealed by torching with the vapour barrier by a minimum 100mm.

8.4.50 The under-layer should have a vapour dispersion mechanism within the roll, with a thermodiffusible film on the upper surface. The lower surface finished in a low-melt modified bitumen, also protected by a thermodiffusible film.

8.4.51 The Approved Contractor must give reasonable notice to the manufacturer of their intention to commence laying the capping sheet. This will allow a discretionary inspection of the under-layer to take place, so that any remedial treatment necessary can be carried out prior to installing the capping sheet. This is particularly important when tapered insulation has been used to ensure that any areas of ponding water that may remain can be addressed.

8.4.52 The capping sheet shall be a minimum of 4mm thick, 250g/m² polyester reinforced SBS elastomeric bitumen capping sheet, with a charcoal grey mineral finish.

8.4.53 The capping sheet shall meet the following minimum technical performance:

- Tensile strength (EN 12311-1) Length ≥1000N/50mm, diagonal ≥1000N/50mm.
- Elongation at break (EN 12311-1) Length ≥45%, diagonal ≥45%.

- Cold bend resistance (EN 1109) = -36°C
- Heat stability (EN 1110) = +120°C
- Fire rating BS476 Part 3

8.4.54 The capping sheet is to be fully bonded to the under-layer by torching in the approved manner. Head laps to be 100mm, side laps to be 80mm. A 5mm to 10mm bead of bitumen must extrude from all laps.

8.4.55 Where applicable, supply and fix 0.6mm thick galvanised steel insulated upstand supports to all upstands. These are to be fixed at 400mm centres using suitable fixings through the vapour barrier, so that the top edge is a minimum of 300mm above the surface of the deck. A 3mm gap should be left between adjacent sections.

8.4.56 PIR / PUR flatboard insulation, 30mm thick is to be applied to all upstands, inserted into the support to provide an insulated upstand height of a minimum 300mm from the surface of the deck. The detail is to be carried out in accordance with the detailed drawing provided.

8.4.57 For upstands to skylights / plinths etc. side laps shall be a minimum of 80mm, and head laps to be a minimum of 100mm. The minimum recommended height for constructing waterproofing details is 150mm from the top of the capping sheet.

8.4.58 Special attention shall be paid to all structures, such as roof lights, counter-flashings, window and door cills, etc. These may have to be raised to enable a 150mm high waterproofing detail to be formed.

8.4.59 Around the top of all upstand details separate flashings / capping shall always be formed. The capping sheet taken up the upstand in one piece shall not be permitted.

8.4.60 Any Timber trims used for upstand fillets or edge detail to insulation shall meet the following criteria

- Quality: Planed. Free from wane, pitch pockets, decay and insect attack
- Moisture content at time of covering (maximum): 22%.
- Organic solvent based timber preservatives are not permitted, as these attack bitumen based materials.

8.4.61 Where insulated upstands are installed PIR/ PUR (61 mm x 61 mm) angle Fillets are to be used at all right angled upstands, (Same material as the main insulation layer) bonded with compatible adhesive.

8.4.62 As with the main layer formations upstand layers shall have staggered joints, with each layer fully bonded.

8.4.63 Where the upstand exceeds 250mm in height an edge trim shall be used to provide additional mechanical fixings.

8.4.64 Welted drips shall be nailed to the face of the drip batten, folded neatly, a minimum of 75 mm above the gutter line, and underlapped with the capping sheet.

8.4.65 On completion all roof areas shall be clean, all outlets clear, and there shall be no storage of materials or damage on the finished membrane.

8.4.66 The finished roof must be thoroughly inspected by the roofing manufacturer site technician. This is to ensure that any remedial treatment that is necessary can be carried out prior to handover and the issuing of the guarantee.

8.4.67 Existing suppliers of high performance elastomeric roofing to the University include

Bauder Ltd, 70 Landseer Road, Ipswich, Suffolk, IP3 0DH
Icopol, Ltd, Barton Dock Road, Stretford, Manchester M32 0YL
IKO PLC, Appley Lane North, Appley Bridge, Wigan WN6 9AB

8.4.68 In each case the final recommended supplier of the high performance elastomeric roofing shall be agreed with the Principal Building Surveyor.

8.4.69 Liquid-applied waterproof membranes are permitted where the roof gantry systems, plant and equipment make the adequate detailing of a bituminous felt system impracticable.

8.4.70 The building up of the roof is, by default, a warm roof deck, with vapour-control barrier, insulation and main waterproof membrane.

8.4.71 Where the existing roof waterproof system has failed, all existing finishes, insulation and vapour barriers are to be stripped off back to the structural deck in order to remove saturated components and to allow the deck to dry off. Adequate protection must be maintained to prevent moisture ingress during this phase. The equilibrium moisture content of the substrate should not exceed 6% by weight or 75% RH. High moisture content will result in blisters and / or poor adhesion.

8.4.72 The substrate is required to be smooth, level, free from exposed aggregate, without abrupt irregularities greater than 2mm. The substrate must be clean, dry and free from dust, latency, grease, oil and any other contaminants, fungal growth and any other form of surface contamination. Cracks and indentations in the roof surface must be made good prior to the application of any primer or vapour control layer, using manufacturers' approved product.

8.4.73 Timber decking and trimming must be quality planed, free from wane, pitch pockets, decay and insect attack and have a moisture content at time of covering not exceeding 22%.

8.4.74 The vapour barrier shall be reinforced polymer modified bitumen with foil finish nominal thickness: 0.6mm with a vapour resistance of 9000 MNs/g, laid flat and without wrinkles minimum 75mm laps

8.4.75 Prior to the installation of the insulation a timber edging section should be fixed at all change in levels, roof edges, etc. using tantalised timber fixed to the roof deck. The timber sections shall be chamfered as required to allow for the changes in levels.

8.4.76 Standard insulation will be PUR or PIR boards, nominally 32kg/m3 density, must be tissue-faced thermal insulation attached using a bonding adhesive.

8.4.77 All edges of the insulation board must be supported by the substructure, the boards butt jointed and staggered where possible. Provision must be allowed for forming a minimum 100 mm lap seal between the vapour barrier and the waterproof membrane at the perimeter of the insulation.

8.4.78 On completion the Insulation boards must be in good condition, well-fitting and stable. Wet boards are unacceptable and must be replaced. Boards suffering mechanical damage must be replaced prior to waterproof layer applications.

8.4.79 Immediately prior to application of waterproofing membrane, ensure that all surfaces sound, clean, free from surface contaminants and are dry.

8.4.80 Prepare the glass fibre reinforcing matting by cutting it to size before commencing the application of the waterproof system.

8.4.81 The Waterproof Coating is moisture triggered polyurethane compound, site mixed and applied.

8.4.82 The catalyst shall be added to the primer at the rate indicated on the container and apply the catalysed primer using a synthetic deep pile roller to upstands and details first, before applying to the main area of the roof, at an application rate of 1L/m2.

8.4.83 Fibreglass reinforcing sheets, 110g/m2 is then laid on the wet layer as work proceeds and then a second layer application of 0.75L/m2 immediately following this such that there is a wet-on-wet bond.

8.4.84 Do not apply coatings in wet conditions or at temperatures below 5°C

8.4.85 Keep unfinished areas of roof dry between layers. If work is interrupted for more than 12 hours, use a proprietary cleaner to clean and reactivate the surface.

8.4.86 Monitor the thickness of the applied waterproof membrane by taking wet/ dry film thickness readings.

8.4.87 Maintain full thickness of coatings around angles, junctions and features.

8.4.88 Form with watertight joints around outlets. Do not allow liquid coatings to enter piped rainwater or foul systems.

8.4.89 Subsequent waterproofing layers must overlap by at least 100 mm, including the 110g/m2 fibre glass reinforcement.

8.4.90 For perimeter / detail work add catalyst to the product at the rate indicated on the container and apply the catalysed product (2.0 kg/m² min.) with a synthetic deep pile roller. Roll a strip of 110g glass fibre reinforcement into the wet resin, pressing trapped air free using the synthetic deep pile roller, ensuring a minimum 50mm overlap between adjacent sections. Apply a further coat of catalysed product at a rate of 1.0 L/m2, wet on wet to ensure full saturation of the 110g Fibre Glass Reinforcement.

8.4.91 All vertical edges of the liquid applied roof system must have a proprietary trim or flashing to protect against delamination of the waterproof membrane.

8.4.92 On completion check when cured that there are no pinholes and / or discontinuities in the system. If there are any found whatsoever then another coating shall be applied.

8.4.93 Ensure roof areas a clean and outlets are clear.

8.4.94 Do not store materials on the unprotected roof membrane. Use a proprietary matting or insulated paving to provide a base for plant and equipment.

8.4.95 Existing suppliers of high performance elastomeric roofing to the University include:

Sika Ltd (Liquid Plastics), Miller Street, Preston, PR1 1EA
Bauder Ltd, 70 Landseer Road, Ipswich, Suffolk, IP3 0DH
Icopol, Ltd, Barton Dock Road, Stretford, Manchester M32 0YL

8.4.96 In each case the final recommended supplier of the high performance elastomeric roofing shall be agreed with the Principal Building Surveyor.

8.4.97 The roof covering must be suitable for foot traffic, with a wet slip resistance of PTV 36 on the British pendulum test to BS 7976 Parts 1-3 2002. Where the base material cannot achieve this value, then adequate matting must be provided from the roof access point(s)

8.4.98 Roof surfaces must be easy to traverse – avoid the use of aggregate ballast which is unstable and heavy going and prone to weed growth. It is preferable to use paving with some form of protective layer over the waterproof membrane. The selection of inverted roofs is not preferred unless there is evidence to support that other options are unsuitable; green roof systems should preferably be laid on a structural waterproof membrane.

8.4.99 Consideration must be given to improving edge protection to existing roofs, where this is inadequate for close inspection or maintenance of the roof perimeter or work on the elevations from the roof. Where it is impractical to raise the external wall to form a parapet, then a proprietary guard rail must be provided as a permanent feature.

8.5 Architectural Specific Requirements – Doors

8.5.1 Solid core doors shall be made up of laminated timber and not chipboard infill to retain structural integrity of the hinge fixings and other door furniture.
In all circumstances an assessment must be prepared as to the most suitable operating mechanism or otherwise, including a brief justification supporting the chosen option/options.

8.5.2 The most energy efficient design shall be proposed for main entrance doors to a building. It is expected the design will consider heat loss calculations taking in to account pedestrian flows.
Where automatic swing doors are the preferred solution for main entrance doors a large internal lobby will be required.
Where revolving doors offer the most energy efficient solution for main entrance doors they shall be as large as possible, with the least number of internal partitions and fitted with presence detection and there shall also be adequate provision of swing entrance doors for fire escape and DDA purposes.

8.5.3 All new corridor and general circulation route doors shall be automated to maintain accessible routes with respect to the Equalities Act. The relevant British Standards to be complied with are:

- BS 8300:2009+A1:2010 Design of buildings and their approaches to meet the needs of disabled people.
- EN 16005 Power operated pedestrian door sets - Safety in use – Requirements and test methods
- BS 7036-2:1996 Code of practice for safety at powered doors for pedestrian use
- BS 5499 signage and fire-safety signage

8.5.4 Automatic doors shall be provided on all corridor routes except stair wells at ground floor level.

8.5.5 Hold open detent devices shall be provided on all corridor routes 1st floor and above with the exception of lift wells which should be automatic.

8.5.6 All Lecture Theatre doors shall be power assisted, with sufficient, adequately sized, and suitably placed push activation buttons.

8.5.7 Stair well doors should be manually operated and fitted with a self-closing device.

8.5.8 All Push Buttons shall be of the correct size, and fitted in a suitable location in terms of distance from door, and not obscured.

8.5.9 A common approach to the placing of Door Controls is to be adopted.

8.5.10 Colour highlighting/contrast is required between Door Controls and the walls.

8.5.11 All powered doors shall be fitted with finger guards.

8.5.12 Hold-open devices may be deemed to be desirable for a number of reasons, including:
Access improvement, fire safety, eases traffic flows, etc. However, Hold-open devices must not be used on doors separating heated from un-heated spaces, and consideration must be given to preventing heat loss and draughts**.**

8.5.13 In all circumstances an assessment must be prepared as to the most suitable operating mechanism including a brief justification supporting the chosen option**.**

8.5.14 Where automatic /power assisted doors are provided the following must be complied with:

- All doors must be capable of operating automatically when triggered by sensor or push button,
- Provide power assisted opening and manual override.
- Pull handles and push plates must be fitted.
- The door activation and safety features shall include intelligent electronic sensing devices to ensure the door responds as people approach without having to break stride.
- The use of threshold and side screen safety shall be incorporated to meet the requirements of BS 7036: 1996 or later version thereof.

8.5.15 BS7036:1996 or EN 16005 thereof provides guidance to manufacturers, suppliers, installers, specifiers, occupiers and property owners on the provision, installation, safe operation and maintenance of automatic door systems, with particular reference to safety and avoiding risk of accident.

8.5.16 Detection systems ensure the safe and effective use of each type of automatic door. There are two main types of system, motion and presence sensors, which are used in addition to other passive safety devices:

- Motion sensors These use radar technology to detect movement towards or away from the door, distinguishing pedestrians from vehicles and ignoring spurious movements, such as a falling leaf. They will not prevent a door from closing.
- Presence sensors also called safety sensors; these are based on active infrared technology so that, if the presence of an object or person is detected, the door is prevented from closing.
- Passive safety devices these include safety switches and pressure sensitive strips which prevent further movement of the door. Automatic revolving doors include safety contact strips on the posts at the drum side walls and on the bottom edges of the wings. In addition, an emergency stop push-button on the inside drum wall post can immediately shut down the door operator.
- Barriers and pocket screens these are needed to protect against traffic entering the path of a sliding door during its cycle of operation; to protect against traffic approaching from the side into the sweep area of a swing door; or to direct traffic towards a doorway opening, however the screen should not comprise an obstruction or hazard or restrict the width of an escape route below required widths.
- Means of escape if intended as escape doors, powered doors should be capable of manual break-out in the direction of escape. Alternatively, they should be linked to a fire detection system that opens the doors automatically. If doors are fitted with a break-out facility, it is essential that powered operation ceases immediately when break-out occurs - the resistance to break-out should not be greater than 20N.

8.5.17 Congestion in the vicinity of automatic door should be avoided through careful planning of the area. Obstructions, distractions, traffic flow and user characteristics shall all be taken into account by the designer.

8.5.18 Signs should be affixed to the powered door system at a height of between 1300 mm and 1600 mm.

8.5.19 The external approach to main entrance doors shall include either motion detector or push button with any necessary associated access controls suitably linked into the operation.

8.5.20 The internal approach to main entrance doors shall either include push button with any necessary access control release. Motion detection may cause the door to open when persons walk past the door internally and may not, therefore, be suitable, however, whenever possible motion detection is the preferred option.

8.5.21 The external approach to secondary entrance (lobby) doors shall include – either motion detector or push button with any necessary associated access controls suitably linked into the operation, however, whenever possible motion detection is the preferred option.

8.5.22 The internal approach to secondary entrance (lobby) doors shall include – push button with any necessary access control release. Motion detection may cause the door to open when persons walk past the door internally and may not, therefore, be suitable however, whenever possible motion detection is the preferred option.

8.5.23 Internal doors in circulation spaces shall include Push button with any necessary associated access controls suitably linked into the operation. Motion detection may cause the door to open when

persons walk past the door and may not, therefore, be suitable however, whenever possible motion detection is the preferred option.

8.5.24 Where any automatic door is specified an assessment must be prepared as to the most suitable operating mechanism including a brief justification supporting the chosen option.
Care must be taken to ensure that both external entrance doors and internal secondary doors are not opened simultaneously

8.5.25 Opening door gear manufacturer found to be satisfactory are Automatic Systems, Besam, Kone Record and Stanley or other equally approved. Each door application must be considered on an individual basis, utilising the most appropriate type for the particular location.

8.6 Architectural Specific Requirements – Windows / Glazing

8.6.1 The University require a minimum 10 year design guarantee on the design of any window system. This is in addition to separate installation and materials warranties.

8.6.2 Guarantee periods for individual window elements shall be as follows:

- Windows including gaskets to carry a minimum 25 year guarantee
- Powder coat paint finishes to carry a minimum of 15 years for gloss and 25 years for matt finishes
- Sealed insulated double glazed units to be guaranteed for a minimum of 10 years
- Windows ironmongery to be guaranteed for a minimum period of 5 years.

8.6.3 Insurance backed warranties are to be duly considered where entire window replacement – installation schemes are to be undertaken.

8.6.4 All opening windows shall have an opening restrictor to prevent the window from opening more than 100mm. It is imperative that heating and ventilation requirements are considered in the context of a no more than 100mm opening. In individual offices, laboratories, and teaching rooms this requirement can be relaxed to allow greater control of natural ventilation.

8.6.5 Within Common Areas, Offices & Teaching Spaces opening windows shall have folding cam openers.

8.6.6 Within Laboratory Space designated high level windows to have teleflex or similar remote winding gear.

8.6.7 Espagnolette type openers shall not be specified

8.6.8 All glass to be of the quality specified in BS 952 and BS EN 572; manufactured and processed in a factory where the Quality Control procedures comply with BS EN ISO 9000; and glazing carried out in accordance with the manufacturer's recommendations, and the requirements of BS 6262 Parts 1-7 Glazing for Buildings.

8.6.9 All new and replacement window glass must be treated for solar control and solar glare, where appropriate in accordance with the Building Regulations and subject to site conditions, extent of glazing and building orientation.

8.6.10 All proposed glazing should be risk assessed (see CIRIA Report C632) to determine the most appropriate specification and application of glass, for example: overhead or high level glazing or large glazing panels where breakage or spontaneous fracture due to Nickel Sulphide Inclusion may cause harm must comprise of laminated glass.

8.6.11 Where it is deemed acceptable to provide toughened glass then it must be heat soaked to reduce the risk of failure from Nickel Sulphide Inclusions.

8.6.12 All glass to be free from any visible blemishes / defects, including impurities which would detract in any way from the appearance or performance of the glazing system.

8.6.13 The colour or appearance of the glass must not be affected by variations in manufacture and performance. All glass is to be visually identical in appearance and colour at all times, regardless of the direction and angle of view.

8.6.14 Only glass with minimum distortions and no local defects (such as tong marks) producing irregular reflections is to be used.

8.6.15 The viewing area when viewed from any angle or direction glass with scratches and sleeks visible from 1800mm viewing distance, bubbles and inclusions greater than 1mm and less than 300mm apart will not be accepted.

8.6.16 Windows/ opening sizes and positions shall be designed to meet BREEAM 'View out' criteria for relevant building type.

8.6.17 No blemishes up to 0.5mm less than 250mm apart, will be acceptable in the middle 2/3 of any pane.

8.6.18 No glass or glazing combination to develop stresses that may lead to damage of glass, glazing materials, components and/or framing systems.

8.6.19 Distortion of the glass units shall be avoided through adequate manufacturing tolerances between the frame and glazed panels.

8.6.20 All glass is to be capable of easy replacement. Provide a method statement detailing the methodology of removing damaged glass and components and their subsequent replacement.

8.6.21 No part of glass or framing is to deflect more than +/- 15 mm under design loadings.

8.6.22 All glass and glazing to comply with BS 6206 and the requirements of the Building Regulations; where indicated in specification or drawings, eg at screens or doors to meet BS 6206-Specification for impact performance requirements for flat safety glass and safety plastics for use in buildings. A and Approved document N and CDM regulation design requirements.

8.6.23 There shall be no deliveries to site of any components that cannot be installed immediately or placed in clean, dry floored and covered storage. Where components are stored they shall be stacked vertically or near vertical on level bearers, separated with spacers to prevent damage by and to projecting ironmongery, beads, etc.

8.6.24 The specification for all window materials shall as a minimum comply with BRE 'Green Guide to Specification Online' rating: A.

8.6.25 Aluminium Windows shall comply with BS 4873.

8.6.26 All aluminium windows shall be manufactured using thermally broken high performance window sections with 'rolled in' polyamide; the opening vent to incorporate an external weather gasket and internal air seal gasket. The window profiles are to include a 20mm polyamide thermal break.

8.6.27 Extruded aluminium profiles are to be of aluminium alloy 6063 T5 or T6 to BS EN 12020 & BS EN 755 tempered to BS EN 515. Gaskets shall be extruded from EPDM to BS 4255-1 and PVC to BS7412.

8.6.28 The finish to aluminium windows shall be polyester powder coated to BS6496 (RAL Colour TBC by Architect), finished a minimum of 60 microns thick.

8.6.29 The window system shall comply with exposure categories to BS 6375-1/ Design wind load as below:

- 600Pa Air Permeability.
- 600Pa Water Penetration.
- 2400Pa Wind Resistance.

8.6.30 The window installation shall be completed into prepared openings.

8.6.31 Gap between frame edge and surrounding construction:

- Minimum: 6mm.
- Maximum: 10mm.
- Distortion: Install windows without twist or diagonal racking.

8.6.32 All window fixing details shall be fully designed to include for the structural transfer of all loading (wind etc.) to the frame. This should be certified by manufacturer and submitted prior to any works starting.

- Fasteners: Stainless Steel High Tech Fasteners.
- Spacing: When not predrilled or specified otherwise, position fasteners not more than 150mm from ends of each jamb, adjacent to each hanging point of opening lights, and at maximum 450mm centres.

8.6.33 All ironmongery shall be assembled and fixed carefully and accurately using fasteners with matching finish supplied by the ironmongery manufacturer

8.6.34 Final Checking/ Adjusting/ Lubricating of all ironmongery shall be carried out at Final Completion to ensure correct functioning.

8.6.35 Designers shall ensure at completion there is certified evidence that all incorporated components comply with specified performance requirements.

8.7 Architectural Specific Requirements – Floor Finishes

8.7.1 All offices shall have carpet tile floor finishes.

8.7.2 All floor finishes shall have a slip potential classification, based on pendulum test values (PTV) no less than 36 when wet or dry. Floor finishes within kitchen environments shall have floor resistance Strong Hold (30) or equivalent.

8.7.3 For any safety flooring the standard of floor required is typically of the Altro range or equivalent.

8.8 Toilets

8.8.1 Cubicle widths must be sufficient for a person and dispensers - particularly female washrooms where there are feminine hygiene products. Minimum size shall be 1640mm x 800mm

8.8.2 All toilets shall be fitted with mechanical ventilation controlled via air quality sensors.

8.9 Signage

8.9.1 All signage shall be designed and constructed to the Specification detailed in the University of Manchester Signage Design Guide (EPM GM13). For advice and/or clarification of the Signage Strategy contact the Principal Senior Building Surveyor.

8.10 Accessibility / Equality - The Equality Act and Disability Equality Duty

8.10.1 The University is expected to lead the way in carrying out its function with demonstrable respect for equality and human rights with legal duties relating to race, gender and disability. These obligations are set out in the Equality Act 2012 (the Act), the Race Equality Duty, the Gender Equality Duty and the Disability Equality Duty or later versions thereof.

8.10.2 The Act states that any person who accesses the University goods, facilities and services shall be protected from direct discrimination on the basis of a (seven) 'protected characteristic'. The relevant characteristics are:

- Disability
- Gender reassignment

- Pregnancy and maternity
- Race – this includes ethnic or national origins, colour and nationality
- Religion or belief
- Sex
- Sexual orientation.

8.10.3 Disability has a broad meaning. It is defined as a physical or mental impairment that has a substantial and long-term adverse effect on the ability to carry out normal day- to-day activities. 'Substantial' means more than minor or trivial. 'Impairment' covers, for example, long-term medical conditions such as asthma and diabetes, and fluctuating or progressive conditions such as rheumatoid arthritis or motor neurone disease. A mental impairment includes mental health conditions (such as bipolar disorder or depression), learning difficulties (such as dyslexia) and learning disabilities (such as autism and Down's syndrome). Some people, including those with cancer, multiple sclerosis and HIV/AIDS, are automatically protected as disabled people by the Act. People with severe disfigurement will be protected as disabled without needing to show that it has a substantial adverse effect on day-to-day activities.

8.10.4 The University is required to undertake reasonable adjustments to physical barriers that prevent access to education. These duties are also anticipatory which means that access improvements need to be considered in advance of a disabled student enrolling. This may include the provision of an auxiliary aid, such as an induction loop or, the installation of a lift to an educational building to address a physical feature.

8.10.5 Design Teams shall ensure access complies with the requirements of the University of Manchester document EPM PM14 – Disabled Access Guidelines (currently under review), the current version of BS 8300, Part M of the Building Regulations and Manchester City Council's, *Design for Access*.

8.10.6 In addition, for those characteristics and features not covered by this document, such as colour schemes, lighting and signage the following publications or later versions thereof are to be referred to:

- DETR (1999) 'Guidance on Use of Tactile Surfaces'
- BS 9999 / BS5588 - 8: 1999 Fire Precautions in the design, construction and use of buildings – Code of Practice for means of escape for disabled people
- ICI Paints (2002) 'A Design Guide for Use of Colour and Contrast to Improve the Built Environment for Visually Impaired People'
- Joint Mobility Unit: Buildings and Internal Environments Technical Bulletins
- Joint Mobility Unit: Streets and External Environments Technical Bulletins
- Centre for Accessible Environments: Designing for Accessibility
- Dept of Transport: Traffic Advisory Leaflet 5/95 'Parking for Disabled People'
- HSE: Workplace (Health, Safety and Welfare) Regulations 1992

8.10.7 The University routinely assesses all buildings in accordance with the best practice guidance. Further advice is available from the Principal Building Surveyor.

8.10.8 Design Teams must be aware that if improvements are made to access an existing building, i.e.: by improving a ramped approach, etc than the design strategy must consider the means of escape from the entire building. The assumption shall be that the building has an open door policy and has by virtue of the works been made more accessible. The University Fire Safety Officer shall be consulted regarding such matters.

8.10.9 Please see the elemental guide above relating to automatic doors (Clause 8.32- 8.37).

8.11 Recommended Approach to Accessible Design

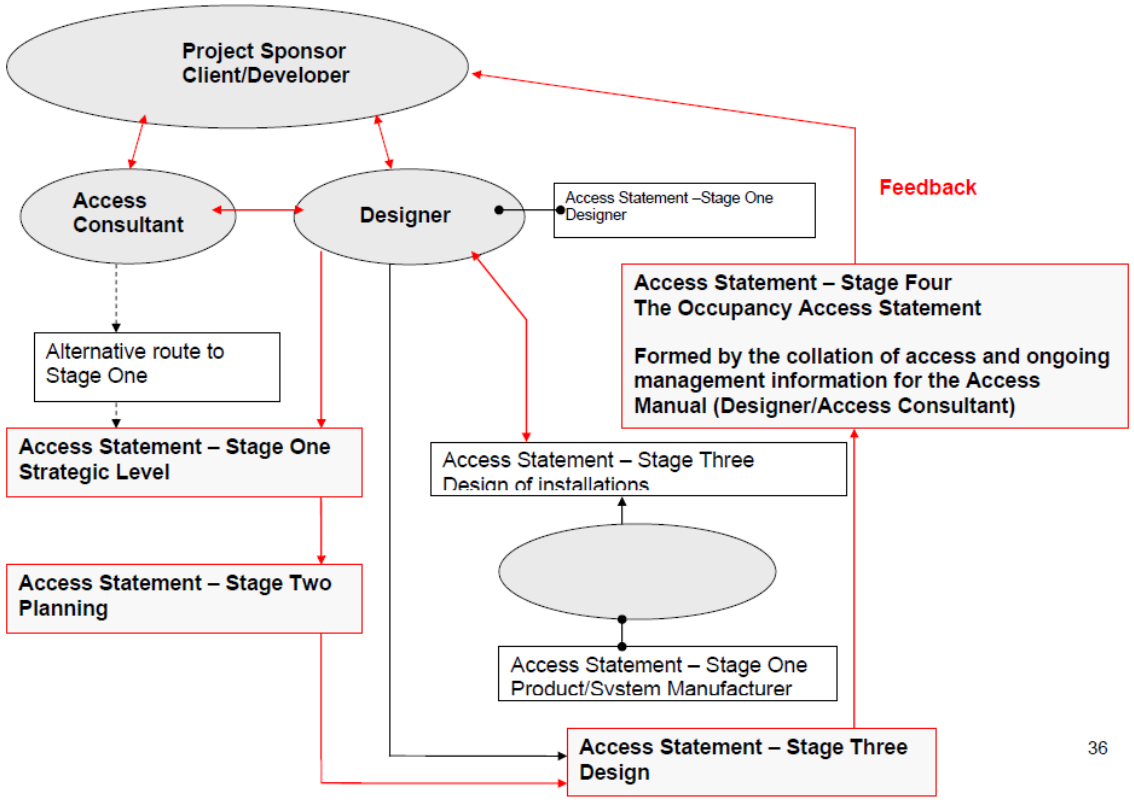
8.11.1 Function is one of the cornerstones of good design and accessibility is vital for a project to function well.

8.11.2 Where applicable an Access Statement offers an opportunity to improve the quality of buildings and spaces. By considering at the very earliest stages and throughout the project the proposed use of the building, who will use it and how it will be managed in terms of the needs of its users.

8.11.3 Increased consideration of the needs of those who will eventually be using the completed environment is essential. It will assist in providing a higher quality of learning experience.

8.11.4 For this reason access issues shall continue to be considered throughout the design process using the framework (stages) outlined below to ensure a fully inclusive design:

- Stage One The Strategic Access Statement.
- Stage Two The Access Statement at Planning.
- Stage Three The Access Statement at Design.
- Stage Four The Occupancy Access Statement.



(Taken from Disability Rights Commission, *Access Statements: Achieving an inclusive environment by ensuring continuity throughout the planning, design and management of buildings and spaces*)

8.11.5 The Occupancy Access Statement (Access Audit) shall be included within the project H&S File. This document will form an essential part of the University's continual review of estate wide assess audits and essential to the university's continual compliance with their legal and ethical responsibilities.

8.11.6 The Occupancy Access Statement will draw on all of the previous Statements and will demonstrate the commitment to the on-going suitability of the measures which have been introduced in the original design to enhance accessibility. Issues covered might include:

- Policies to ensure the appropriate maintenance of internal and external environments.
- An acknowledgement of those areas that were introduced into the original design to improve, or create, accessibility and for which on-going management and maintenance will be required. These might include, for example, the need to ensure on-going colour and luminance contrast in future changes in colour scheming, the need to maintain lighting levels, on-going appraisal of information to potential users, staff training etc.
- Details of a suitable management approach to the on-going maintenance of essential facilities such as lifts, induction loops etc., and evidence of the management practices and policies that have been put in place to ensure appropriate prioritisation of repairs and maintenance.

8.12 Acoustic Design

8.12.1 The Design Team shall consider all aspects of the proposals in respect of sound reduction. The design of buildings with regards to acoustic considerations must be in accordance with the following or later versions thereof:

1. Approved Document E, resistance to the passage of sound
2. PPG 24 Planning and Noise
3. BS 8233, 1999 - Sound insulation and noise reduction for buildings – code of practice
4. Building Bulletin 93 – Acoustic design of Schools and educational buildings
5. BREEAM standards as appropriate and directed by the University.

8.12.2 Where a specific acoustic standard is required than this must be demonstrated by suitable on-site testing prior to practical completion. Practical Completion must not be awarded without suitable testing certification.

8.13 Access for Maintenance and Cleaning

8.13.1 Please read in conjunction with Section 10: Guide to House Services.

8.13.2 Appropriate consideration of health and/or safety implications during the design stage for those who build and maintain the structure will make a significant contribution to reducing its whole life cost, and will assist in delivery to time, cost and quality.

8.13.3 All design development stage reports must contain a statement from the Design Team and CDM-C regarding access for maintenance and cleaning. Please see Section 5.4: The Design Risk Management process.

8.13.4 The hierarchy of priority for access is stairs, companionway ladders, and vertical ladders as a last resort.

8.13.5 When discussing usability and maintainability, involving the client or those who will be responsible for operating the building or structure will mean that proper consideration can be given to the health and safety of those who will maintain / use the structure once it has been completed.

8.13.6 Safe access is paramount; the use of fall arrest and/or restraint systems to roof/high level areas shall be avoided. A 1100mm high parapet wall or permanent handrail must be provided, see BS 6037:2004 Code of Practice or later version thereof for the planning, design, installation and use of permanently installed access equipment.

8.13.7 Design Teams shall ensure adequate, safe cost effective access is provided to window cleaning both internally and externally. The methodology for completing window cleaning shall be clearly defined and relevant information in relation to Health and Safety clearly documented in the Operation and Maintenance Manuals.

8.13.8 Safe access and egress is essential for vertical cleaning and maintenance purposes.

8.13.9 High-level ledges shall be avoided as they are difficult to access and clean.

8.13.10 Crawl ways and safe ceiling void access is preferred to mobile access scaffolds in high level installations.

8.13.11 Underground ducts should allow for adequate access to carry out maintenance and always offer alternative means of escape for emergency situations.

8.13.12 The requirement for temporary access platforms or Mobile Elevated Working Platforms (MEWPs) shall be avoided or declared in the derogation report detailed in Section 1.6 and Section 12.

8.13.13 A Roof Access document highlighting residual hazards on roofs shall be compiled and included in the Health and Safety Files.

8.14 Fire

8.14.1 During building alterations and the installation of building services the integrity of fire compartmentation shall be preserved at all times and where necessary improved.

8.14.2 The University have prepared a Fire Risk Assessment for every University building. Design Teams must ensure that they consult with the Fire Officers to review the fire risk assessment. Any recommendations identified as being required within the vicinity of the subject works must be considered and as far as reasonably practicable must be included within the subject scope of works.

8.14.3 It should always be borne in mind that building alterations are likely to materially affect the Fire strategy and in all cases an updated Fire Strategy document shall be produced.

8.14.4 Any apertures in a separating element can cause the anticipated or required level of fire separation to be compromised either slightly or drastically. The IFSA Code of Practice is designed to provide the designer with an understanding of the problems and give recommendations as to the best way of maintaining the separating function of the elements making up the modern building.

8.14.5 The use of intumescent products such as pipe collars, mastics, foams and pillows shall take into account future maintenance requirements. The application of intumescent paints and coatings as an alternative to structural improvement should be restricted to areas where damage is unlikely to be sustained to the surface. Design Teams must consult with the University Fire Officer in all cases.

8.14.6 Where it is difficult to achieve the statutory requirements imposed by the Building Regulations in respect of fire resistance of elements of structure (i.e. half an hour or one hour protection) consideration may be given to the introduction of compensatory features into the scheme such as improved levels of fire detection. Such proposal must always be referred to the University Fire Officer before proceeding.

8.14.7 It is anticipated that much of the work carried out in buildings will need to be undertaken whilst the staff or students are present. If it becomes apparent during the design phase of the project that the scheduled alterations will have an impact on the existing fire precautions the advice of the University Fire Officer should be sought at an early stage of the design phase.

8.14.8 For further advice and/or clarification contact the University Fire Officer.

8.14.9 Design Teams should ensure that the University Fire Officer has been provided with all necessary information to carry out a Fire Risk Assessment prior to the occupation of the premises a minimum of 4 weeks before handover, including sufficient time to assess the requirement for fixed and portable fire extinguishers.

8.15 Security

8.15.1 All designers should make contact with the University Head of Security for guidance on designing for security to ensure continuity of security design and consideration in line with the methodology of crime prevention through Environmental Design.

8.16 Locking Systems

8.16.1 The specification and type of new locks shall be considered in the context of existing suiting systems within the building and shall be agreed with the Principal Building Surveyor.
See also Section 7.9 - Access Control Systems. In principle the University does not wish to add keyed locks to its buildings and would advise Design Teams to consider electronic access to all where possible.

8.16.2 Ironmongery must comply with the requirements of BS 8300.

8.16.3 Where appropriate digital door access systems shall be used particularly to external doors. Advice shall be sought prior to the use of any such system.

8.16.4 Additional security measures shall be incorporated / extended, such as alarms, CCTV and access control for the building envelope and controlled environments.

8.16.5 Key records shall be provided as part of the Health and Safety file.

8.16.6 Emergency Exit hardware shall be compatible with existing systems and be to the satisfaction of the University Fire Officer.

8.16.7 For specific advice on locking issues contact the Principal Building Surveyor.

8.17 Paint Systems

8.17.1 Consideration should be given when specifying finishes to solid wall construction, allowance must be made for adequate moisture permeability throughout the structure.

8.17.2 Paint shall be Eggshell for walls and ceilings and Gloss for woodwork and metalwork.

8.17.3 For life safety and property protection purposes, the surface linings of walls and ceilings shall conform with “Class O Surface Spread of Flame” requirements. Generally this applies to escape route protected stairs, corridors and other room circulation spaces. If in doubt consultation with University Fire Officers will clarify minimum requirements.

8.17.4 For circulation areas and escape routes, existing coatings are to be checked for overpainting and adhesion as described elsewhere in this section. Paint systems to these area are to be designed to maintain or upgrade the fire rating to Class “0” Surface Spread of Flame.

8.17.5 Exterior woodwork paint systems are to be designed for the long term protection of timber with maximum resistance to cracking and flaking. Exterior metalwork paint systems are to be designed for improved resistance to UV damage and to be rust inhibiting.

8.17.6 Suitable paint products would include the following (or other equal and approved systems).

- Class “0” Spread of Flame; Crown Trade Timonox Bonding Prime and Vinyl Matt Emulsion
- External woodwork; Sandtex Trade Flexible Primer/Undercoat and Flexigloss X-tra.
- External metalwork; Sandtex Trade Rust Inhibiting Primer and Metalgloss X-tra.

8.17.7 Paint systems to existing external retained painted surfaces should comprise at least spot priming plus 1 full undercoat and two Finishing coats coat with an additional stripe coat to damaged edges and all arises.

8.17.8 Preparation is to be specified in detail to suit the condition of the substrate and in accordance with BS 6150. Where substrates are degraded, complete removal of existing coatings may be required.

8.17.9 Where hazardous products have been used for a specific purpose, the future maintenance implications of such a product need to be included in the Health and Safety File.

8.17.10 Consideration should be given when designing Colour Schemes to achieve good colour contrast throughout the building to highlight key features i.e. doorways. This should be done in accordance with the requirements of BS8300 and guidance given by the Joint Mobility Unit and the Centre for accessible Environments

8.17.11 Emulsion paints shall be water based and not acrylic.

8.17.12 Low VOC paint shall be used where possible.

8.17.13 Where it is considered that fumes from oil based paints are likely to cause a nuisance to building occupiers than water based paint must be used. The contractor shall distribute an information leaflet about the effects to building users.

8.17.14 All paint products proposed must be approved by the Principal Building Surveyor prior to completion of tender documents.

8.18 Extensive Over-painting

8.18.1 Inherently non-combustible surfaces such as plaster- board and brick can become a potential fire hazard due to repeated redecoration with conventional paints.

8.18.2 Different paint types from a variety of manufacturers have generally been used over many years with less than thorough preparation. In a fire thick layers of old paint tend to delaminate rapidly catching and spreading fire around a building. In extreme cases a lethal "flash- over" fireball effect is created.

8.18.3 Extensive over-painting in communal areas has been responsible for several fire deaths in UK including Southwark (1991), Lambeth (1993), Birmingham (1995) and Glasgow (2002). A failure of the paint in an escalator shaft was also implicated in the fire at Kings Cross underground station in 1987.

8.18.4 In previous times the solution was to strip off all the old paint and redecorate. This process was impractical and expensive and consequently, the paint industry developed a solution which involved testing paint on a very poorly performing surface representing extensive over-painting.

8.18.5 The Design Team shall undertake an assessment to determine whether a competent person should be appointed to assess the quality of the adhesion of any existing paint layers.

8.18.6 The assessor should look for excessive over-painting and in particular poor adhesion of the paint to the surfaces of escape routes. If this is apparent, then the risk assessment should recommend stripping back and redecorating or redecorating with a paint that has been shown to work on highly overpainted surfaces.

8.19 Asbestos

8.19.1 For all asbestos issues refer to the University Asbestos Management Policy EPM HS25 and the University Asbestos Manager for guidance.

8.20 Conservation

8.20.1 The University has a number of buildings; monuments and sites of particular historical and architectural interest. Prior to undertaking any design work on buildings; monuments and sites that may fall in to this category, please contact the Principal Building Surveyor for guidance.

8.20.2 Projects and works planned to listed buildings must be progressed with full consultation with the local authority, English Heritage and any other legislation and guidance on the historic environment.

8.20.3 Refer to the ‘Historic Register’ for a list of all buildings; monuments and sites that are listed or of particular historical and architectural interest. This is available from the Principal Building Surveyor.

8.20.4 All projects shall allow for the protection and conservation of all trees in the curtailage of the site and immediately adjacent areas, which are likely to be affected by the works, deliveries etc.

8.21 First Aid and Rest Rooms

8.21.1 The Health and Safety (First Aid) Regulations 1981 and Workplace (Health, Safety and Welfare) Regulations 1992 require the University to assess the risks of work in certain areas in order to determine the necessity for the provision of a First Aid Room. In addition there is a requirement to assess where employees or students may be new or expectant mothers and where required shall make provision of suitable Rest Rooms for their use. The overall location spread of provision should be considered.

8.21.2 Where deemed necessary the first-aid room(s) should contain essential first-aid facilities and equipment, be easily accessible to stretchers and be clearly signposted and identified. If possible, the room(s) should be reserved exclusively for giving first aid.

8.21.3 The requirements for First-aid rooms are as detailed below:

- be large enough to hold an examination/medical couch, with enough space at each side for people to work, a chair and any necessary additional equipment;
- have washable surfaces and adequate heating, ventilation, and lighting;
- be kept clean, tidy, accessible and available for use at all times when employees are at work;
- be positioned as near as possible to a point of access for transport to hospital;
- display a notice on the door advising of the names, locations, and if appropriate, telephone extensions of first-aiders and how to contact them,
- a sink with hot and cold running water;
- drinking water with disposable cups;
- soap and paper towels;
- store for first-aid materials;
- foot-operated refuse containers, lined with disposable yellow clinical waste bags or a container suitable for the safe disposal of clinical waste;
- fan examination/medical couch with waterproof protection and clean pillows and blankets (a paper couch roll may be used that is changed between casualties);
- a chair;
- a telephone or other communication equipment;
- a record book for recording incidents attended by a first-aider or appointed person

8.21.4 Consideration shall also be given to provide suitable rest facilities for workers who are pregnant or breastfeeding. The facilities should be suitably located (e.g. near to toilets) and where necessary include facilities for the new or expectant mother to lie down, and provide a private, healthy & safe environment for nursing mothers to express and store milk (lockable fridge). NB Toilets are not suitable for this purpose.

8.21.5 The requirements for Rest Rooms are as detailed below:

- a sink with hot and cold running water;
- drinking water a store for first-aid materials;
- space for an examination/medical couch with waterproof protection and clean pillows and blankets;
- a chair;
- telephone or other communication equipment;
- disposable cups;
- soap and paper towels;
- first-aid materials;
- foot-operated refuse containers, lined with yellow, disposable clinical waste bags or a container suitable for the safe disposal of clinical waste;
- an examination/medical couch with waterproof protection and clean pillows and blankets;
- lockable fridge
- record book for recording incidents attended by a first-aider or appointed person.

8.22 Balustrading

8.22.1 Balustrades whether solid or composed of units should be designed as to minimize the risk of persons falling, sliding or slipping through any gaps within the barrier. More specifically they must be designed to prevent the passage of a 100mm diameter ball from passing through any opening within the barrier.

8.22.2 The finished barrier should have no sharp edges or projections that could cause injury to persons or damage to clothing.

8.22.3 The designer should be aware of the need to provide maintenance of the barrier to sustain levels of performance and appearance specific to a particular material. Consideration should also be given in the design of the barrier to the possibility of vandalism and in terms of its prevention and removal.

8.22.4 Balustrades should be designed to resist the most unfavourable likely imposed and wind loads separately without unacceptable deflections or distortions. Minimum horizontal imposed loads appropriate to the design of parapets, barriers and balustrades should be determined in accordance with BS 6180:2011, or the latest interpretation of this standard.

8.22.5 The strength of fixings, attachments and anchorage securing the barrier to a substrate should be adequate to sustain a loading greater than that to which the barrier will be subjected. All joints should be designed to provide the full strength of the members being joined. To that end, where any uncertainty exists with regard to the strength of any component in the fixing, the design loading factors should be increased by 50%.

8.22.6 The installation of a barrier should be supervised by a suitably qualified person or persons, who should ensure that the design assumptions have been effectively implemented. Inspections and investigations should be carried out as necessary to establish the integrity of the materials and the elements of the construction used.

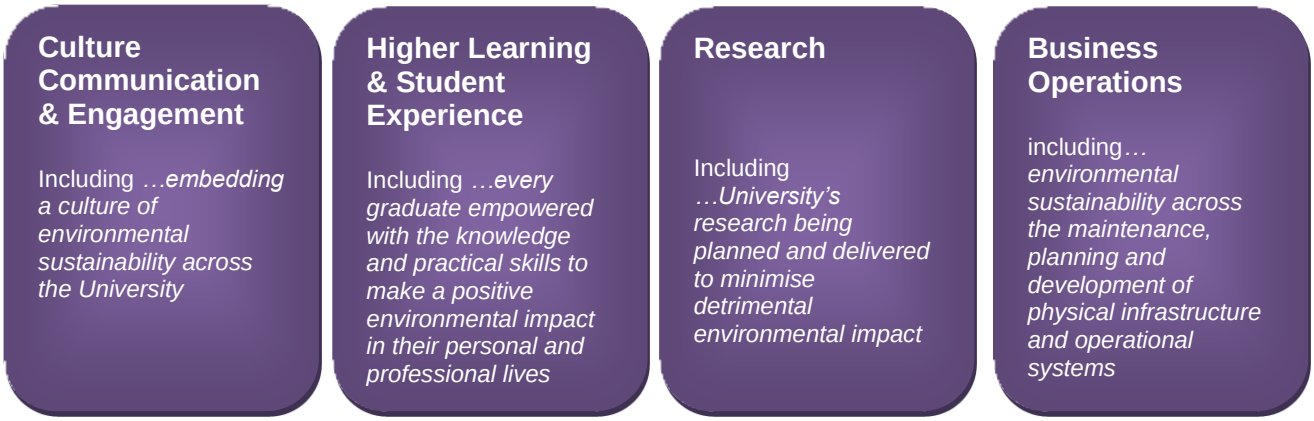
8.22.7 Suitable materials for balustrades are as detailed below:

- Concrete - All concrete used in the construction of barriers should be in accordance with the recommendations of BS EN 1992
- Glass - There are certain situations, particularly under some lighting conditions, where the presence of transparent glass is not readily evident and a suitable indicator should be provided in accordance with BS 6262 Glazing for buildings
- Masonry - All masonry used in the construction of barriers, both separately and in conjunction with other materials, should be designed and constructed in accordance with BS EN 1996-1-1:2007
- Metals – BS 6180:2011 provides recommendations for most common metals which may be used as barriers or balustrades, including guidance on: surface finishes, fabrication, assembly/fixing and maintenance.
- Plastics - BS 6180:2011 provides recommendations for most plastics which may be used as barriers or balustrades.
- Timber - BS 6180:2011 provides recommendations for most common timbers which may be used as barriers or balustrades

9.0 Sustainability

9.1 General

9.1.1 The University has a vision *to embed environmental sustainability as a key priority across the full range of our activities*. This vision is underpinned by four priorities:-



9.1.2 All new builds and refurbishments must take account of these priorities. The following are seen as a means to address priorities:-

- To support behavioural change and to provide opportunity for students and staff to learn (such as providing information screens and real-time displays for example)
- To ensure resource efficiency in design (through passive design for example), in construction (reusing demolition waste on site for example) and in operation (through specification of robust materials for example).
- To optimise the opportunities an urban compact campus presents as well as to establish sustainable principles for those goods, materials and people coming into and out of the campus during design, construction and operation.

9.1.3 Any project in excess of £100,000 in value or of an environmental nature require the completion and sign off of EPM tES, the University's bespoke environmental sustainability project tracker.

9.1.4 Any project of £100,000 in value or less requires the completion and sign off of the University Tracker Lite document.

9.1.5 All reports shall contain a section headed 'Sustainability' which pulls together all sustainability sections as a minimum. This shall be in addition to the BREEAM report.

9.1.6 All new builds and refurbishments will be required to submit a carbon reduction plan.

9.1.7 All new builds to achieve 10 or more BREEAM Ene 01 credits.

9.1.8 All new builds shall meet a minimum BREEAM Excellent, with an aspiration for Outstanding presented as part of the BREEAM Excellent Design stage strategy; all refurbishments shall meet a minimum Very Good.

9.1.9 A minimum of 20% of energy demand to be provided by on-site low and zero carbon technologies.

9.1.10 Produce a project-specific *Energy Efficient IT Strategy* that demonstrates carbon savings, compared to standard/baseline specifications.

9.1.11 Aim to reduce water consumption (litres/person/day) by a minimum of 40% against a notional baseline performance.

9.1.12 Implement sustainable waste management practices (see Section 11 for specific details).

9.1.13 Targets must be set, monitored and reported during construction for CO_2 emissions and energy and water consumption.

9.1.14 Considerate Constructors score of at least 32.

9.1.15 Provision of landscaping that will enhance local biodiversity.

9.1.16 Specify Sustainable Urban Drainage systems to drain surface water and minimise pollution.

9.1.17 Ensure buildings are designed to be adaptable to the predicted impacts of climate change.

9.1.18 Implement measures that provide support building user feedback and post-occupancy evaluation

9.1.19 Production of a *Building User Guide* that details building design and features to facilitate the sustainable operation of the building by building users.

9.1.20 Provision of environmental sustainability information, such as an interactive display for example.

9.1.21 Further information on the Tracker documents and target setting is available from the University Environmental Sustainability Project Officer.

9.2 Transport - General

9.2.1 The University is committed to sustainability and reducing its carbon footprint. With regard to travel, the guiding document is the Sustainable Travel Plan. The plan sets out a clear way forward for increasing the numbers of staff, students and visitors that use walking, cycling, public transport, car sharing and video conferencing. Many new Estates and Facilities capital projects, schemes and works, from small to large, present an opportunity to do just this.

9.2.2 Further information and guidance is available from the University Sustainable Travel Guide (http://www.sustainability.manchester.ac.uk/campus/travel), or the University Sustainable Travel Planner who is part of the Environmental Sustainability Team.

9.3 Cycle parking - New Building Criteria (BREEAM compliant)

9.3.1 For new buildings, the following criteria shall be adopted:

- All cycle parking shall be BREEAM compliant as a minimum.
- Quality cycle parking shall be installed in appropriate areas. More detailed guidance is available in Greater Manchester Police's Design Guidance which is an acceptable standard. (www.designforsafety.org/uploads/files/DFS_cycles.pdf)
- All cycle parking shall be covered and in close proximity to entrance/s (as close as possible but not more than 30m)
- Subject to change of current arrangements, 50% of provision to be in the form of a secure shelter/s to be provided for staff and Post Graduate use (extending current shelters or a new shared use shelter for more than 1 building may be appropriate)

9.4 Sheffield 'hoop' stands

9.4.1 Sheffield 'hoop' stands are the most common form of cycle parking. Any planned installation of them shall comply with the following requirements.

9.4.2 Stands should be 0.8m tall, 1m in length, with at least 1metre between stands and at least 0.5m of clear space surrounding them.

9.4.3 Stands should be ‘n’ shaped and stainless steel comprising:

- 48.3 OD x 2 tube
- Grade AISI316 stainless steel
- Finished in a 320 grit finish satin polished
- Core drilled and embedded within the ground: level, plumb and in line and level with minimum 400mm root..
- Use fast set postfix, or similar approved, pre-blended dry cementitious material to BS 5838 Part 1 containing Portland Cement, High Alumina Cement, sharp sand and gravel. Protect finished work against frost and rain by using hessian or polythene sheeting. In dry or windy conditions, do not allow finished work to dry out too quickly. Allow concrete to dry sufficiently prior to proceeding with further works.

9.4.4 Stands shall be as close to building entrances as possible and in the most desirable areas of public realm areas; otherwise cyclists will use other more convenient forms of street furniture.

9.4.5 Numbers of stands are variable but should at the very least replace any current provision and, usually, increase capacity. New locations should be actively sought.

9.4.6 Provision should be overlooked by the public or staff and/or by CCTV cameras, to maximise the actual and perceived level of security.

9.4.7 Opportunities for placing stands undercover (such as new or existing building canopies) should be taken, where feasible.

9.4.8 Stands should be easily reached from access routes.

9.4.9 Multiple examples can be seen on the University campus particularly in the vicinity of the Alan Gilbert Building.

9.5 Shelters

9.5.1 The University has a number of cycle shelters across campus, with access currently given to staff and postgraduates.

9.5.2 Any new shelters shall be in-keeping with the current design of existing ones on south campus.

9.5.3 Location and size of shelters shall be based on the current coverage of facilities and potential demand. In the case of new buildings the criteria above shall be adhered to.

9.5.4 Particular consideration shall be given to security design features, particularly entry and exit procedures.

9.5.5 CCTV shall be installed both internally and externally to each shelter.

9.5.6 Advice and consultation based on any issues with current provision shall be sought, for example, drainage issues.

9.5.7 Internal Sheffield stand specifications shall be in accordance with the guidance above (9.5 – 9.13).

9.5.8 Signage shall replicate current provision (ensuring wording is up to date).

9.5.9 Shelters shall be easily reached from access routes.

9.6 Temporary Cycle Parking During Works

9.6.1 When works take place which mean existing cycle provision is not accessible for a set period of time, it is important that the capacity of these facilities is replicated as close as possible to the original

location. Temporary Sheffield stands which can be moved easily shall be used and be in place for the whole period of the works.

9.7 Shower, Changing and Drying Facilities – new build criteria (BREEAM compliant)

9.7.1 For new buildings, the following criteria shall be adopted:

- A minimum of 1 shower per 10 cycle spaces.
- Areas of appropriate size provided for changing and lockers (lockers to be provided equal to the number of cycle spaces), as part of shower facilities.
- A specifically designed area (not a plant room, for example) for the drying of wet clothes to be provided as part of, or in close proximity to, shower and changing facilities.

9.7.2 For refurbishment projects new shower facilities must be considered if none currently exist

9.7.3 The design teams emphasis for all such facilities should be placed on quality and excellent user experience in order to generate and encourage as much usage as possible.

9.7.4 Consultation should take place on the appropriate number of showers and types of additional facilities required (changing, drying, minor functional improvements etc), based on space available. Provision in new builds should meet the criteria above.

9.7.5 If only one shower is to be installed it shall be unisex with appropriate access provided.

9.7.6 Dedicated spaces shall be provided for showers.

9.7.7 Shower facilities located within disabled toilets shall be avoided.

9.7.8 A coded lock entry system shall be installed unless there are particular local access issues.

9.7.9 Consideration and provision of storage and changing facilities should take place wherever possible, including individual lockers, clothes hooks, a seating area and hair dryers.

9.7.10 New facility locations shall be agreed and provided to the Sustainable Travel Planner to add to the list of available showers across campus.

9.8 Cycle and Pedestrian Access Routes

9.8.1 With the construction of a new building and/or public realm area, the access and routing of cyclists and pedestrians (many arriving by public transport) shall be given priority in order to provide an attractive option that highlights the importance placed on encouraging such travel behaviour.

9.8.2 All cycle access routes shall provide direct access to any current or new cycle parking facilities.

9.8.3 All pedestrian routes shall provide clear and consistent facilities to a building's entrance/s.

9.8.4 Any new pedestrian and cycle routes shall be linked up to any current or future provision (both University and 'on highway')

9.8.5 Routes shall also consider the access from public transport facilities, such as bus stops and interchanges/stations.

9.8.6 Investigate whether new bus stops could be installed and/or existing ones moved (agreement would need to be sought from the appropriate public bodies) to enable easier access.

9.8.7 Designers shall consider how access from an interchange/station be improved by the design of the new building (e.g. entrance locations) and/or public realm facilities.

9.8.8 Signage and/or markings shall be provided in order to clearly designate routes and inform users (potentially, with regard to distance and time).

9.8.9 Facilities shall be in-keeping with current provision but, where feasible, should look to further increase the attractiveness of public transport, walking and cycling.

9.9 Sustainable Travel Information Provision

9.9.1 A prominent area shall be provided which allows for the provision of sustainable travel information (possibly in conjunction with an overall Environmental Sustainability information area)

9.10 Electric vehicle charging points

9.10.1 As a minimum, a feasibility study should be conducted to establish the demand for the installation of at least one dual electric car charging point in a prominent parking area. It should be noted that such facilities can be installed for use by University fleet vehicles and / or staff / public vehicles. In all cases the installation shall be discussed with the University Sustainable Travel Planner.

9.11 Video Conferencing Facilities

9.11.1 As a minimum, a feasibility study shall be conducted to establish the demand for the provision of at least one suite with a minimum capacity of 12 participants. The decision to increase the number of suites should depend on the intended buildings users' and their activities. Technological specification advice and agreement should be sought from Media Services incorporating building users' technical requirements.

9.11.2 In addition, the ability to carry out 1:1 video conferencing shall be considered in terms of general IT facility provision, in consultation with IT Services.

9.11.3 Where more than one option exists, location and room capacity should be based on consultation with building users and local senior management. Technological specification advice and agreement should be sought from Media Services incorporating building users' technical requirements.

9.11.4 The Sustainable Travel Planner should be made aware of the location of additional Video Conferencing facilities.

10.0 Guide to House Services

10.1 Cleaning

10.1.1 Covered entrances shall have exterior barrier matting supplemented with primary and secondary internal barrier matting.
Matting shall extend a minimum of 3 meters in all directions from the doorway.

10.1.2 Floor coverings shall allow ease of cleaning and low maintenance.
Particular attention shall be paid to entrance areas and the need to specify flooring capable of withstanding delivery trolleys.

10.1.3 All vinyl flooring products specified and the associated cleaning requirements shall be brought to the attention of and agreed with the House Services Manager.

10.1.4 Cleaners hoppers shall be a minimum size of 4 square metres, and shall be installed on every floor of a building.

10.1.5 Each hopper shall incorporate a low level Belfast sink with hot and cold running water; shelving shall also be installed in all hoppers in agreement with the House Services Manager.

10.1.6 To enable a safe cleaning regime electrical mains power socket outlets shall be provided as detailed below:

- Laboratories – dedicated cleaners sockets at low level, clearly labelled
- No sockets to be located between doorways or on blind corners.
- Sockets require for cleaning in washrooms
- Sockets outlets to be located in the centre of large theatres so that machinery can be used
- Sockets outlets required needed on stairs (at intermediate points as required)
- An adequate numbers of sockets shall be installed to negate the need for trailing leads. The Maximum working lead length is 15m.

10.2 Accommodation

10.2.1 Storage areas for cleaning materials shall be installed on every floor. There shall be sufficient provision for storage of 3 – 4 cleaning machines, assorted chemicals and consumables such as toilet tissue, paper towels, soap, plastic bags. The storage area shall have adequate lighting and a lockable door.

10.2.2 Designs shall also incorporate adequate changing and mess facilities for House Services Staff. This shall include sufficient room for a table and chairs and an area set aside as a kitchen area. The kitchen area shall be complete with cupboard space and sink with hot and cold running water and power for items such as toaster, microwave, kettle and fridge. The area shall have heating, ventilation, lighting and space for lockers

10.2.3 Building Reception areas shall not be incorporated into designs where there is little likelihood of the reception being staffed.

10.2.4 Where receptions are incorporated into the design particular consideration shall be given to the issue of cold draughts where automatic doors are installed.

10.2.5 Designs shall also incorporate an area for Postal functions. The area shall be of sufficient size to accommodate a weighing machine, computer, printer and a sorting area complete with pigeon-holes. The room shall be complete with adequate lighting, power, telephone and data provision.

10.2.6 Office accommodation for House Services supervisors to be incorporated within the designs. These are to be agreed with the House Services Manager.

10.2.7 The University purchase standard washroom dispensers for paper and soap. These shall be used on all projects. Details are available from the House Services Manager.

10.3 General Design Issues

10.3.1 The designers shall design out high-level ledges as they are difficult to access and clean.

10.3.2 Designers shall ensure adequate and safe access be given to window cleaning both internally and externally.

10.3.3 Glass doors on circulation routes shall not be installed.

10.3.4 The contractor shall complete a post contract clean, to the specification and satisfaction of the House Services Manager.

11.0 Guide to Landscaping / Campus Cleaning

11.1 Hard and Soft Landscape Areas

11.1.1 Designers shall consult with the Environmental Services Manager and Principal Building Surveyor regarding specification and future maintainability. Reference shall also be sought from the Landscape Master Plan document number M4993 available on the Estates website.

11.1.2 Detailed information including specification, as fitted drawings on Public Realm projects is available, the index for which can be located on the University intranet at address:

G:\Estates\psu\Unit wide\Bldg Database\Campus_Info\Public Realm\Volume 2 - Architect\PDF Dwgs\Electronic dwgs on CD - JMP Construction Issue from A Ash 18..07\1170-L0000.pdf

If assistance is needed to access the documents contact the Principal Building Surveyor.

11.1.3 Any works which are likely to impinge upon the hard or soft landscape areas of the University shall be undertaken so as to retain or enhance as far as is possible, the amenity value of the University's external environment and its use as a teaching and research resource.

11.1.4 Consideration should be given to the subsequent maintenance of the site taking into account access arrangements for vehicles and machinery engaged in grounds and other maintenance and delivery or despatch activities.

11.1.5 Any reinstatement of existing grounds shall be approved by the Environmental Services Manager, as should the preparation and construction of new soft landscape areas.

11.1.6 Extra heavy standard or semi-mature trees shall be specified to have a 30 Month 'Fail to Thrive' period,

11.1.7 Shrubs shall be specified to have a 12 month 'Fail to Thrive' period.

11.2 Campus cleansing/refuse collection

11.2.1 All projects shall make adequate provision for the maintenance of the cleanliness of the site in accordance with The Environmental Protection Act 1990 or later version thereof and its regulations applicable to litter and refuse.

11.2.2 It is imperative that sufficient access is provided for waste collection vehicles around any new buildings or new/amended waste storage areas. Specific advice on the dimensions and weight of waste collection vehicles being used by contractors working for the University should be obtained from the University Waste Co-ordinator to ensure access for waste collections is adequate. Further guidance is given in App. D of the document produced by Manchester City Council (9.11 below).

During the construction phase, where site works/compounds may impede the collection of any waste receptacles, advice should also be sought from the University Waste Co-ordinator, in conjunction with the Campus Cleansing Unit, to ensure alternative collection/access arrangements can be put in place.

11.2.3 Where required by building function, clinical waste areas, both internally and externally shall be provided.

11.2.4 Further advice on Campus Cleansing issues is available from The Environmental Services Manager.

11.3 Planning Applications

11.3.1 Manchester City Council expects that planning applications for new developments should include a waste management strategy. The Council has produced "Waste Storage and Collection Guidance for New Developments" at http://www.manchester.gov.uk/site/scripts/download_info.php?downloadID=1580&fileID=5814 and a

strategy template is available on the Councils website at http://www.manchester.gov.uk/site/scripts/download_info.php?downloadID=1582

11.4 Waste storage areas

11.4.1 In consultation with the University's Waste Co-ordinator, adequate waste storage areas shall be incorporated into the design of any new building for the storage of appropriate waste containers.

11.4.2 General (non-recyclable) waste is collected in 1100 litre eurobins, so an assessment needs to be made of the volume of waste that is likely to be produced in any new building/area so that there is sufficient provision to accommodate the number of eurobins required to service the building.

11.4.3 Provision shall also be made for the storage of recycled materials within/close to the building for the following recyclates:

- plastic bottles
- cans
- paper
- cardboard

Appropriate signage shall be provided to identify the location and types of waste/recyclates to be stored prior to collection using the WRAP iconography available from http://www.recyclenowpartners.org.uk/index.html . This should be agreed with the University Waste Co-ordinator.

11.4.4 Designers shall consult with the University's Waste Co-ordinator to determine the most appropriate storage facilities for these materials prior to collection by the University's Campus Cleansing Unit.

11.4.5 General advice on waste storage is also available in the above guide produced by Manchester City Council. This is a practical guide for use by planners, developers, architects, building managers and others to enable them to design and implement successful waste management strategies for buildings in Manchester. Detailed information is given about the physical design of buildings, including the sizes of bin stores, through to the practical management of waste once a building is occupied. The document expands on the guidance given in Part H (Drainage and waste Disposal) of the Building Regulations 2002 to give a Manchester specific focus about waste management in the City.

11.5 Internal recycling facilities/provision

11.5.1 As well as designing buildings with appropriate waste storage areas, buildings shall be designed in a way that encourages occupants to recycle waste in their work areas, as is already happening in other University buildings.

11.5.2 Internal space shall be designed into appropriate areas of new developments to accommodate waste/recycling bins of an appropriate size to allow for the segregation of the following 4 waste streams:

- plastic bottles
- cans
- paper
- general (non recyclable) waste

11.5.3 In line with the University's Carbon Management Plan, it is the policy of the DOEF that new buildings are not provided with individual waste/office bins, but instead provided with recycling points so that they operate in the same manner as existing "bin the bin" schemes. Therefore, the advice of the University Waste Co-ordinator shall be sought as early as possible in the project to identify suitable locations for waste/recycling points in areas such as kitchens, breakout and communal areas.

11.5.4 The University uses a number of different waste/recycling bins for the collection of different materials and these will depend on the location/space that is available. However, in the majority of instances, waste collection will be by means of receptacles that are of 55 litre capacity (dimensions H:660mm,

D:525mm, and W:305mm), with taller versions of the same bin at H:870mm (87 litre capacity). In other areas where slimmer bins are required, bins of the following size are used: H:1000mm, D:320 Width:1060 (equivalent to 4 bins side by side).

11.6 Waste produced during construction projects

11.6.1 The University signed up to the Halving Waste to Landfill Construction Commitment with WRAP (Waste and Resources Action Programme) which is a voluntary agreement through which the University has developed measures and set targets to reduce the amount of construction, demolition and excavation waste sent to landfill as a result of construction activities.
As such, the University has a "Code of Practice relating to Construction Waste[1]" which all contractors are required to comply with, and in particular, the following objectives/targets:

- That during the demolition of existing buildings that a Demolition Recovery Index (DRI) of at least 80% is adopted, with the aim of exceeding 90%[2].
- That new buildings/refurbishments are designed in such a way that wastage during the construction process is minimised and resources are used efficiently, and that wherever feasible, best practice design is employed as detailed in the relevant WRAP guidance.
- That any construction waste is managed as sustainably and achieves a construction waste recovery/recycling rate of at least 75% by weight as a minimum, with the aim of exceeding a rate of 80% recovery/recycling.
- That at least 15% of the total value of construction materials used should derive from recycled and reused content in the products and materials selected.

11.6.2 The University requires the completion of a Site Waste Management Plan for construction projects. Site Waste Management Plans shall be sent to the University Environmental Sustainability Project Officer.

11.7 Public realm works/external areas

11.7.1 The University Waste Co-ordinator shall be contacted as early as possible in a project to discuss what facilities need to incorporated into the design of public realm works.

11.7.2 The University no longer installs external waste bins in any new public realm areas. Existing waste/litter bins have been replaced over the majority of the main campus by recycling bins that allow the segregation of waste into the following 4 streams:

- plastic bottles
- cans
- paper
- general (non recyclable) waste

11.7.3 Future schemes on the main campus shall provide for the appropriate numbers of external recycling bins to match the existing recycling bins in place. The dimensions of these are as follows: H:1100mm, D:575mm, W:1100mm.

11.7.4 There are different requirements for the provision of external recycling facilities in residential parts of the campus – the Fallowfield, Victoria Park and the City Campuses. In such instances, the Environment Officer in the Directorate of Student Experience should be contacted as early as possible in a project to discuss what facilities are required, but in general they should match the existing recycling bins in place that allow the segregation of the following waste streams:

- paper
- cardboard & cartons
- glass, plastic bottles, cans, tins, aerosols
- general waste

The dimensions of these tend to be as follows: H:1100mm, D:492mm, W:2040mm (combined width of

[1] See http://www.sustainability.manchester.ac.uk/campus/recycling/construction

[2] This target should be applied after all asbestos/asbestos contaminated material has been removed from the existing building.

2 units together).

11.7.5 Residential Services have 'kerbit' recycling scheme in place in all university owned Halls of Residence, so in any new residential developments, external space must be designed which allow for 3x 1100l bins per 40 students to be in placed outside each main entrance of a hall block for the following waste streams:

- paper, cardboard & cartons
- glass, plastic bottles, cans, tins, aerosols
- general waste

11.7.6 Internally, Halls of Residence will require recycling bags/ bins inside student kitchens to allow them to separate waste. Therefore space must be made available for these, as well as a general waste bin, as follows:

- paper, cardboard & cartons (recycling bag)
- glass, plastic bottles, cans, tins, aerosols (recycling bag)
- general waste (bin of approx 60 litres)

Dimensions should be agreed with the Environmental & Sustainability team.

11.7.7 Sport facilities operate a twin bin system for waste/recycling. These units consist of:

- Plastic Bottles, cans, mixed glass (in an orange WRAP signage scheme)
- General Waste (conventional WRAP white and black signage)

This can be ordered through the Environmental Officer for DSE.

12.0 Project Sign off

12.1 General

12.1.1 For projects in excess of £100,000 in value or of a particularly complex nature Design Teams shall obtain formal acceptance of technical design proposals at each of the RIBA stages from the following key University personnel:

- Head of Professional Services
- Principal Mechanical & Energy Engineer
- Principal Electrical Engineer
- Principal Building Surveyor
- Head of Maintenance Services
- Asbestos Manager
- University Fire Officer
- Head of Environmental Sustainability
- House Services Manager
- Environmental Services Manager
- Waste Coordinator

12.1.2 Appendix 5 details the sign off form which shall be used to formally record acceptance from key University staff at the various design stages.

12.1.3 Any non-compliance with this document or other University standards shall be formally recorded in the form of a derogation report and brought to the attention of the appropriate University representative. Agreement and sign off at each RIBA stage is needed before the project shall proceed.

12.1.4 At each of the RIBA stages the CDM-C shall prepare and issue a statement confirming compliance with the requirements of the CDM regulations, and that the principal of 'eliminating risk' has been adopted by the designers with regard to future maintenance. They shall also document work methodologies for overcoming future 'high risk' maintenance activities such as window cleaning etc.

12.1.5 At least two weeks prior to completion of a project the CDM-C must deliver a draft O&M manual and Health & Safety file to the University Project Manager (Client Representative) in electronic format for initial review and comment, in accordance with the requirements detailed in EPM HS14b the CDM Procedures. The O&M and H&S file must be comprehensive including product data sheets, maintenance recommendations etc. however excessive information such as product brochures are not required.

12.1.6 Details of any plant installed should be brought to the attention of the Principal and Assistant Mechanical Engineer in order that asset numbering can be carried out in accordance with the Universities protocol. This information should be collated prior to any tendering or stage 4 activities. Please also refer to section 6.10.9.

12.1.7 An Asset List of all plant shall be provided in Microsoft Excel format. This should include any planned maintenance requirements, detailing frequency and a brief description of the maintenance activity to comply with manufacturer's recommendations and legislative obligations.

12.1.8 A full and complete copy of the O&M and H&S file shall be delivered to the University Project Manager at completion of the project. The files shall be in electronic format for adding to the University database, and be produced in accordance with standard University formats.

12.1.9 The lead designer must deliver all updated as built drawings in both DWG and PDF format on completion of the project.

12.1.10 All RIBA Stage reports shall be formally submitted to the UoM PSU Administrator. Each report should be accompanied with completed template which summarises key project details (refer to EPM PM7, Appendix 7 for a copy of the template). The reports shall be logged & filed with all Estates

Stakeholders being notified of receipt. All projects information shall be submitted in PDF format as a minimum. For larger projects where file sizes can be excessive, all submissions shall be broken down into manageable file sizes. Any stakeholder comments/requirements shall be formally issued to the Client Representative via the UoM PSU Administrator within a suitable time period. Please refer to EPM PM7, Appendix 6 for more information on this procedure.

12.1.11 It is not permissible for the formal issue of project information via online platforms (i.e. Conject).