Document Control

Rev	Date	By	Comments
A	Jun'16	J. Hoare	Technical Review Update
B	Oct' 17	J. Hoare	Technical Review Update
C	Dec 17	UoL	Sign off for release
D	July' 17	J. Hoare	Technical Review Update
E	Mar'20	J. Hoare	March 2020 Issue
F	April 20	A Singleton	General update to tracker and other minors.
G	June 20	A Singleton	Covid 19 Clauses added
H	Feb 21	A Singleton	Thermal Insulation Clauses added
I	Feb 2023	A Singleton	Frost and Fog Coil Information Update
J	April 23	A Singleton	LEV Fire Damper details added
K	Aug 23	A Singleton	Fire dampers must be to certified tested details
L	Jan 24	A Singleton	DW145 reference added
M	May 24	A Singleton	Fire and smoke damper requirements altered in refurb works

Design Guidance

1. This document shall be read in conjunction with the University Guidance Document "GD" series of guides which give greater information regarding the philosophies of passive design and the need to try to avoid mechanical ventilation where possible.
2. Reference should be made to the detailed University's mechanical technical specification. Where there are discrepancies between this document and the University standards clarification shall be obtained from the University before proceeding.
3. The University has declared a Climate Emergency and needs to reduce its carbon footprint. Buildings should be designed passively, where possible, with a view to negating or greatly reducing the need for mechanical ventilation for temperature control. Mechanical ventilation is required therefore where ventilation is a process necessity or where passive means cannot maintain the required levels of natural ventilation for occupancy fresh air or thermal comfort.
    a. Natural ventilation is the preferred option so long as there is no need for process ventilation and that the natural ventilation solution can maintain good indoor environmental control.
    b. Where natural ventilation is proposed the designers shall ensure that good fresh air movement is achieved by correct widow opening design and control of room shape and depth to optimise fresh air delivery. For example, deep rooms with one sided ventilation are to be avoided as are shallow height side hung windows.
    c. All design options should therefore be investigated in an attempt to negate the requirement to use mechanical ventilation methods for building overheating avoidance. This should be through passive building fabric solutions and night purging of the exposed thermal mass. Only when these measures have been exhausted should mechanical ventilation be considered.
    d. In the above regard summertime overheating shall be analysed in accordance with the CIBSE TM52 and TM59 publications.
    e. Refer to GD series of documents for thermal analysis considerations to determine ventilation needs.
    f. Consideration should also be given to external and adjacent noise sources as this will also impact upon the ventilation solutions that can be used.
    g. Where it is impractical to use natural ventilation alone the use of mixed mode systems should be developed.
4. Where mechanical ventilation is used, it shall be designed as follows

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a. To provide occupancy and process ventilation in such a manner that it does not need to be used out of hours for fabric heating and can therefore be de-energised when not required.
b. To provide building free cooling out of hours as needed in summertime.
c. There is to be a main entrance fire override panel for all building ventilation. Configuration is to be agreed during the building fire policy development but, as a minimum, the panel should allow a key fire override for normal/off and extract only running.
d. To meet the internal NR levels listed in the CIBSE Guide A Environmental Design Guide or project room data sheets.
e. To have external noise breakout levels that meet the requirements of the local planning department.
f. To include high efficiency heat recovery systems within all air handling units.
g. To include variable speed drives to aid commissioning and allow for minimum load/setback conditions to be achieved.
h. To have inherently low specific fan power ratings.
i. To include demand orientated systems where these make a sensible life cycle payback taking into account capital, maintenance and energy and carbon costs.
j. Where installed demand led systems shall employ room or zoned occupancy detection and/or carbon dioxide monitoring to achieve good indoor air quality i.e. IDA level 2 or better as defined in EN ISO 7730. The preferred method to achieve this is via Variable air volume boxes where there are multiple rooms served off a single system.
k. Where naturally or mixed mode ventilated, the occupied space comfort temperature should comply with the criteria set out in CIBSE TM52 for all University buildings and CIBSE TM59 for all student residences. This guidance benchmarks internal operative temperatures against maximum adaptive temperatures created in the CIBSE 'design summer year' weather data. This shall be undertaken at every RIBA stage.
l. In addition to the standard CIBSE compliance requirement noted above every RIBA stage report, including contractor submissions, shall also benchmark the number of hours a room exceeds 26°C throughout the year for illustrative purposes. This will provide the reader of the report a simple benchmark to measure the overheating of a particular room or building. It is generally expected that rooms should not exceed 26c for more than 100 occupied hours a year.
m. The CIBSE 'design summer year' should be used to bench test using modelling software and a report produced to predict (for each room) and highlight the internal periods liable to fail the requirements of CIBSE TM52 / 59. The overheating assessments shall be carried out at stage 2 and then onwards at every stage such that the University can be consulted and consideration can be given to potential mechanical cooling. The overheating reports shall detail all design assumptions used during the modelling process to ensure the University are informed of these assumptions i.e. night purge routines and how purging is achieved.
n. The ventilation standards should meet the CIBSE guidance, Building Regulations, HTM (where appropriate), ACDP and the indoor comfort standard described above.
o. The baseline fresh air requirement for typical teaching spaces, offices and general-purpose areas is 12 litres per second per person.
p. Where there are areas of high occupancy such as lecture theatres and seminar spaces, discussions shall take place, during early design stages, to understand if occupancy diversities can be applied to these areas. Typically, the following diversities may be adopted:
   - 20 to 100 Person Room – 90% diversity to be applied
   - 100 and above – 80% diversity to be applied

5. Fire considerations.
   a. The ventilation fire override controls shall be configured on a building-by-building basis to meet the agreed fire policy. There shall be a main entrance fireman's override panel as noted elsewhere.
   b. LEV operation needs to be also considered as above and as detailed later.

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c. Ductwork systems must maintain building fire compartmentation.
d. Building smoke compartments and all main fire compartments such as main compartment floors, escape stairwells, protected lobbies, escape corridors etc must be provided with mode 5 combination fire and smoke dampers in the ductwork penetrations interlinked to the fire alarm system cause and effect.
    - However, for refurbishment works only where altering/amending local ventilation, where undertaking a fire strategy review or where undertaking betterment on fire damper installations any fire dampers within stairwells and protected lobbies shall be replaced with combination fire/smoke mode 5 dampers.
e. Building sub fire compartments such as internal fire walls should be provided with fusible link fire dampers in the ductwork penetrations.
f. All fire dampers shall be complete with building in frames and include access doors on both sides of the fire compartment. Fire dampers MUST be installed fully compliant with the manufacturers certified details. Builder's work making good, again in full accordance with the manufacturers certified tested detail, shall be by a reputable fire compartment contractor.
g. All fire dampers shall have an asset code and be added to the University asset schedule in an agreed format.
h. Fire dampers should be installed to the highest standards including all recommendations within DW145 Installation of Fire and Smoke Dampers
i. Systems will generally be full fresh air but where any recirculation system is used smoke detectors must be installed with both the supply and extract AHUs.

6. LEV Extract systems. Where the extract ventilation system is Local Extract Ventilation (LEV) including Fume Cupboard extract, Safety Cabinet extract, Chemical Store extract and other local safety extract systems including cutting, welding and soldering fume extract then special considerations apply as follows.
    a. The operation of LEV systems in fire conditions is to be integrated with the overall building fire policy and main entrance fire override panel. The exact operation is to be determined on project-by-project basis.
    b. Fire dampers, with the exception of crush collars on suitably sized plastic ductwork, shall not be used.
    c. The ducted extracts shall be routed to generally avoid crossing fire compartments or where this is not feasible then ducts shall be either
        - Provided with intumescent fire crush collars which is the preferred option
        - fully fire rated by means of construction materials and thickness (and issued with a fire certificate which will likely be difficult to obtain)
        - shall be enclosed within suitably rated boxing either solution shall fully maintain the building compartment fire integrity (and issued with a fire certificate which will likely be difficult to obtain).
    d. LEV systems shall be installed in accordance with the University LEV policies.
    e. All LEV systems such as fume cupboards shall have battery backup on the controls panels provided as part of the system. In the event of the loss of power, the control panel shall provide audible and visual alarms advising the users of a loss of airflow to the fume cupboard.
    f. If the building has local power generation and essential circuits then consideration shall be given to powering LEV systems from essential supplies.
    g. All LEV systems shall have a remote lockable override switch in the corridor outside the laboratory or user space to turn off in an emergency.
    h. All new fume cupboards shall have self-closing sashes as standard.
    i. Standalone chemical store cupboards must be provided. The extract system from such chemical store rooms or cabinets shall be kept separate such that they can operate on a continual 24/7 basis allowing LEV systems to be turned off when not in use.
7. Air handling units. Packaged air handling units are to be designed and manufactured as follows

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a. All air handling units (AHUs) shall be fully compliant with European Union Ecodesign Regulations 1253/2014 which applies to Non-Residential Units and 1254/2014 which applies Residential Units for 2018 (not 2016) efficiency requirements. All AHUs tendered and supplied to the client shall be certified as 2018 efficiency compliant.
b. Air handling plant component configurations should suit the delivery application in terms of quality, level of cleanliness, level of resilience, low maintenance and energy efficient operation.
c. Indoor plant should be specified to achieve a life expectancy of approximately 20 to 25 years before major replacement.
d. Air handling units located externally shall be avoided and wherever practical these should be located internally. Where external air handling plant has been agreed with the university this should be weather proofed (minimise the number exposed perforations) so as to achieve a minimum life expectancy of approximately 15 years.
e. Modern insulated double skin good quality pentapost framed air handling units should be used. Galvanised steel plastisol coated frames and sandwich panels are to be used. Linings to cooling coils, cooling coil access sections and humidifier sections (where required) should be high grade stainless steel.
f. All air handling units shall be complete with tight shut off motorised dampers on their connections to the atmosphere side. These shall open when plant is required to run and close when not for energy saving and to avoid frost coil freezing. Dampers shall have monitoring end switches at both open and closed ends monitored by the BMS. These shall be linked to the fan enable sequences.
g. The design of frost coil provision on air handling units should be on a risk-based approach to the space(s) served. By default, frost protection should be provided as standard unless otherwise agreed with the University development and maintenance departments.
    - On full fresh air, air handling units <u>without heat recovery</u> frost coils shall be designed to raise the air from -5c to +5c and shall be controlled constant discharge at a temperature of +10c to negate any freezing risk.
    - On full fresh air, air handling units <u>with heat recovery</u> fog coils shall be installed in lieu of frost coils as per the latest hospital HTM. These shall be designed to raise the air from -5c to -3c (ie a 2 degree lift only) to “dry” the air and prevent the filters from blocking with frost. These shall be controlled constant discharge at a temperature of +3c to maximise heat recovery and negate any freezing risk.
h. Large frost coils above 1.5 square meters should be controlled with constant volume variable temperature water to avoid freezing when discharging at low temperatures to aid heat recovery.
i. Where cooling coils are utilised on air handling units these shall be positioned on the positive pressure side of the unit (i.e. blow through) which follows the requirements HTM 03-01 in terms of coil positioning. All drain tray and drainage arrangements shall also follow the requirements of the HTM detailed in Chapter 4.
j. Intermediate drain trays shall be installed on all cooling coils above 1200mm high.
k. All heating coil velocities shall not exceed 2.5m/s and all cooling coil velocities shall not exceed 2m/sec.
l. Coil construction and materials should match the application but generally copper tube with plastic coated aluminium finned types will suit most applications. But the designer must select the most appropriate combination for the application.
m. Unless there is a specific requirement for a high level of cleanliness all mechanically ventilated areas must have incoming fresh air filtered to a minimum standard of ‘G4’ for pre-filters and a minimum of ‘F7’ secondary filtration to BSEN 779. All secondary filers shall be positioned on the positive pressure side of the fan.

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n. All filters shall be mounted in specialist frames and held into the frame by the direction of airflow. Face withdrawal must be used, sliding out of filter banks will not be accepted. Note this will always require a suitably sized access section prior to the filter.

o. Fans should be high efficiency selected (min. 79%) using aerofoil blade backward curved centrifugal impeller plug fan type units located within the airstream (except kitchens, see later). These shall incorporate EC permanent magnet DC motors with inbuilt 0-10V signalling. On all but the smallest AHU's (circa 0.5m3/s) multiple plug fans within the air handling unit shall be provided to give full N+1 redundancy. Backdraught shutters will not be required where there are 4 or more fans but will be required on less in number.

p. Acoustic performance is important to consider in detail particularly casing radiated noise and vibration.

q. Heat recovery should be provided to all plants with exception of dedicated kitchen ventilation extract systems to suit the following. The University prefer plate heat exchangers to be used. Where heat recovery is used any frost coil should be designed for low discharge temperature and controlled constant discharge as detailed previously. The below efficiencies listed are from Regulation 1253/2014):
   - Plate heat exchanger – minimum of 73% sensible efficiency. The preferred default choice as zero cross contamination risk. Plantroom space to be configured to allow plates to be used on AHUs.
   - Thermal Wheel – minimum of 73% sensible efficiency. (only to be used in exceptional circumstances and then only after specific written agreement with the University, concerns regarding cross infection)
   - Run-around coil – minimum of 68% sensible efficiency.
   - All heat recovery systems shall be provided with fully modulating 0 to 100% bypass control.

r. Plate heat recovery is preferred such that the plate is before the supply fan and after the extract fan to recover most energy.

s. Fan energy consumption shall also comply with Regulation 1253/2014.

8. Laboratory Ventilation

a. Laboratory areas should be kept under negative pressure in relation to the surrounding areas with ventilation plant configured to draw contaminated air away from occupied areas. The recommendations of both CIBSE and HSE must be adopted in all areas where experimental or laboratory work is undertaken.

b. The University's Director of Safety Services, Public Health Department and Advisory Committee on Dangerous Pathogens may need to formally consulted with regards to the safe discharge of contaminated extract air from fume cupboards.

c. Fume cupboards should be designed to operate via variable volume as opposed to a constant volume wherever possible. Where variable volume is used then the system and controls should be interlinked to the general room extract system such that the overall extract room volume is kept constant no matter whether the LEV is operational or not.

d. Supply ventilation and supply air change rates shall generally be kept constant and be designed to make good total room extract whilst maintaining a negative room pressure and also to offset heat gains.

e. All other standards regarding fume cupboards should comply with the latest European Standards

f. General room supply and extract together with LEV extract should be demand based and reflect operational hours. Chemical store extract must be continual.

9. Toilet Extract

a. A negative pressure should be created within any toilet area to control the spread of odours. Toilet extract systems should be designed on the basis of 8 Ach–1 when occupied.

b. All toilet extract systems shall exhaust directly to the outside.

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c. The toilet extract fans should consist of duty and standby motors complete with motor fault indication on the BMS front end. Motor changeover shall be operated via the BMS 'front end'. Fault indication is paramount to avoid failure of both motors and fans.

d. Toilet extract systems may need to be demand driven with setback when unoccupied to save energy.

10. Plant Rooms
    a. Ventilation to all plant areas will be provided in accordance with the relevant design guidance and to meet the requirements of the equipment installed.
    b. Where possible air intakes should be located on the shaded north elevation of plant rooms.
11. Ventilation Ductwork Design
    a. Ductwork shall be designed in accordance with the University standard mechanical specification and the latest relevant B&ES specifications (e.g. DW143/144/151 and 172).
    b. Supply and extract velocities should not exceed:
        - 5 to 6 m/sec – main distribution routes and plant rooms
        - 5.5 to 4.5 m/sec – risers
        - 4.5 to 3 m/sec – spine/distribution ducts to floors (ceiling voids & exposed to view)
        - 3 to 2.5m/sec – branch duct
        - Less than 2.0 m/sec –final run outs to grilles and diffusers
    c. Maximum pressure drop per metre run should be limited to between 0.3 to 0.5 Pascal per metre (pa/m)
    d. Balancing dampers should be installed as required
    e. Velocities shall vary based on the areas it is serving. In certain cases, velocities stated above may need to reduced depending on acoustic criteria for the spaces served. If an acoustician is appointed on a project they shall be consulted to agree and finalise design velocities.
12. Duct and AHU Air Leakage Testing
    a. Allowance should be made for the air leakage testing of all air handling units and associated ventilation supply and extract ductwork. The ductwork needs to meet the specified standards and if it does not it will need to be replaced as necessary. Retrospective resealing of ductwork will not be allowed.
    b. The test should be carried out in accordance with the University standard mechanical specification or, if not stated in there, to B&ES ductwork leakage testing specifications DW143/144 to class B medium pressure standard as a minimum or better depending upon application.
    c. Where specialist installations require negative pressure operation of AHU's and associated ducting, those AHU's and ducts shall also be tested under negative pressure to class B as a minimum or better depending upon application.
13. Duct and AHU Cleaning and Access Hatches
    a. Allowance should be made for the correct minimum number of access hatches to be provided for regular inspection and cleaning of all air handling units and associated ventilation supply and extract ductwork. The installation contractor will be required to install as follows.
    b. Access hatches need to be installed as detailed within BESA TR19 and as a minimum in accordance with Table 3 "location of access hatches" and to the sizes recommended in table 4&5.
    c. For the avoidance of doubt all necessary access hatches are to be installed by the contractor during the works which will also include those additional hatches required for thorough cleaning and described within the table as "installed by the cleaning contractor". See also the clauses below in this regard.
    d. Additional hatches will be required at least every 6 metres run of duct over and above these requirements.
    e. Greater numbers of access hatches will be required on kitchen extract systems as specified within TR19 table 9.

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f. All ductwork shall be thoroughly cleaned internally following installation and prior to pressure testing. This shall be undertaken in accordance with the required standards in TR19 and minimum resulting cleanliness shall be as table 2 with the ductwork being classified as "medium cleanliness" except for all laboratory and specialist areas being required to be cleaned to "high cleanliness".
g. The installation contractor will be required to appoint a specialist ductwork cleaning contractor to undertake this cleaning work. The appointed cleaning contractor shall advise on the need for all additional hatches necessary to complete this work. Any further access doors needed for this work, and any needed over and above those specified above, shall be installed as necessary to allow the cleaning contractor to complete the cleaning works.
h. Access hatches shall be included within non demountable partitions and ceilings if needed to access all ductwork hatches.

14. Distribution Strategy
    a. Wherever possible avoid a passive extract philosophy whereby air is exhausted through one space and into another. This is to avoid possible cross infection risks. Used dedicated extracts within each room.
    b. Wherever possible all air handling plant should be located as close as possible to the areas it serves, with duct work runs being kept to a minimum all to ensure low pressure drop and low energy design.
    c. Where possible air intakes are to be positioned on north elevations to avoid solar gains.
    d. Intake and exhaust system louvres must be adequately spaced apart to avoid re–circulation issues.
15. Kitchen Ventilation installation
    a. All kitchen ventilation and ductwork installations shall be fully in accordance with the requirements of the B&ES DW172 guidance.
    b. Extract ductwork velocities in systems extracting from cooking areas shall be designed within the following velocities:
        - 6 to 9 m/sec – main runs
        - 5 to 7 m/sec – branch runs
        - 5 to 7 m/sec – spigots
        - 12 to 15m/sec – discharge efflux velocity
    c. All extract fans utilised for extracting directly from cooking or dishwashing areas shall have the motors located outside the airstream. The University preference is for a bifurcated fan system for all kitchen extract ventilation.
    d. Extract from cooking areas shall consist of a purpose made extract canopy system above each cooking range complete with a grease filter system. The filters shall be demountable and suitable for being cleaned within a dishwasher.
    e. Heat recovery should generally be avoided on kitchen extract systems as such systems are difficult to maintain and keep clean.
    f. Dishwasher extract shall be provided by means of a canopy above the appliance and all ductwork from the same shall be installed in solvent welded plastic and laid to falls with suitable trapped drains at low points.
16. Thermal Insulation. Thermal insulation shall be applied to ductwork in the following scenarios:
    a. All Ductwork carrying heated, cooled, tempered or conditioned supply air or extracted air for re-use by recirculation or for extracted air forming part of a heat recovery system shall be thermally insulated.
    b. Supply air handling plant including heater or cooler batteries and intake ductwork to plant, shall be insulated and then vapour sealed to prevent condensation.
    c. The insulation shall be mineral wool rigid sections correctly secured to the ductwork. The finish shall be class O aluminium foil face which shall be then aluminium sheet clad in plantrooms and in other locations liable to damage.

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d. An external vapour barrier must be used on all ductwork systems where the air within the system is cooled or operating at temperatures below the surrounding ambient air e.g. where there is a warm void and the air within the ductwork is cooler.
e. The vapour barrier should be applied such that it is continuous and gives protection to the whole surface of the insulation which it covers.
f. Air extract ducting to atmosphere where such ducting passes through occupied areas and contributes to the heat gain / loss of the occupied area shall also be thermally insulated.
g. All ductwork requiring insulation shall utilise full thickness insulated supports.

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Item	Manufacturer	Comments
Ductwork		Galvanised mild steel to DW144. LEV may need to use plastic ductwork systems to DW151. Kitchen ventilation systems to DW172. No flexible ductwork distribution systems shall be used. Final connections to grilles shall be limited to 500mm maximum for flexible connections. All ductwork that is located within a swimming pool, wet change area or that is in direct contact with the chemical rich environment shall be installed in either plastic ducting or galvanised ductwork that shall be coated in a fusion bonded epoxy coating to protect all metal elements from corrosion. All brackets and fittings which are susceptible to corrosion shall also be epoxy coated. The epoxy coating shall be applied to both the internal and external complete surface areas of the ductwork. The colour of the epoxy coating shall be different between the supply (green) and extract (red).
Ductwork Fittings		Galvanised mild steel to DW144. Plastic ductwork systems to DW154. Kitchen ventilation systems to DW172. No Self tapping screws or self-adhesive tape is permitted on galvanised steel ductwork installations.
Dampers (Volume Control)	Actionair Waterloo Lindab Trox	Galvanised framed opposed blade volume control dampers. Blades shall be low profile aerofoil, stainless steel with drive mechanism enclosed and outside of air stream. All dampers need to be lockable.

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Dampers (Fire/Smoke)	Actionair Fireshield or Smokeshield PTC (as appropriate) Waterloo Trox	All fire dampers MUST be installed to manufacturers fully certified and tested details. This includes the damper and surrounding builders works frame. Dampers should be fully supported and not supported by adjacent ductwork. The selection of the correct type of damper I.e. Fusible link or combination Fire Smoke Dampers shall follow the University of Leicester Fire damper Policy and be as noted earlier in this document. They shall also follow the requirement of Building Regulations Approved Document B (Section 10). Standard Fusible link Fire dampers are to be provided in all sub-compartment and in all locations where combination fire and smoke dampers are not required. Combination fire and smoke dampers shall be utilised in the following scenarios: • Needed in all smoke compartments such as underfloor or ceiling voids etc • Needed in all main compartments and in all ducts penetrating escape routes, protected corridors, escape corridors and stairwells. All linked to the fire alarm system. Any single knock fire alarm in a whole building shall shut all combination dampers in all areas. Combination fire and smoke dampers shall be mode 5 type with 24 volt connections and include full monitoring via a telemetry ring loop to cover a single cable failure. The dampers shall be provided with the manufacturers own control and monitoring panel and fully wired to the same. The panel shall be able to monitor damper condition position. This fire damper panel shall interface to the firemans panel as required. Fire dampers shall be avoided on ductwork serving fume cupboards. If the installation of them is unavoidable, either the use of fire rated ductwork or intumescent fire collars (crush collars) shall be utilised. Fire and smoke dampers shall be of a suitable rating to ensure the integrity of the fire compartment line is maintained. Where standard fire dampers are utilised, these shall have self-latching replaceable fusible links. Damper blades shall be stainless steel with stainless steel bearing. Damper cases/frames shall be 18-gauge galvanised steel. Dampers installation shall follow the requirements of DW 145. Access doors shall be provided either side of the damper installation.

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Access Doors	Actionair Access Shield Lindab Hotchkiss Air Supply	Access doors to be double insulated and provided in accordance with HVCA publication TR19, DW144 and DW172. Provision of access doors shall also follow the practical recommendations detailed in the 'ADCAS Guide to Ductwork Cleaning Requirements and Access Doors'.
Attenuators	TEK Ltd Trox Sound attenuators	Shall be galvanised mild steel complete with infill of rigid tissue faced Rockwool and treated to BS 476 Part 7. All Rockwool infill media within splitters shall be melinex lined and located behind perforated mesh.
Grilles and Diffusers	TEK Ltd Waterloo Krantz Gilberts	All Grilles and diffusers shall be supplied with opposed blade volume controls dampers, side entry plenum boxes and be power coated to suit the project architect's requirements. Grille pressure drops to be limited to an absolute minimum. Ductwork flexible connections to plenum boxes shall not exceed 500mm. Flexible ductworks shall be semi rigid insulated type. All plenum boxes shall be supported from structure utilising cleats. The grilles shall not be self-supporting off the ceiling installations. All grilles and diffusers shall be selected to ensure draughts do not occur and an even air distribution is achieved. Grilles and diffusers shall be selected to ensure design NR levels for the spaces they serve are not exceeded.
Weather Louvres	TEK Ltd Waterloo Gilberts Colt	All louvres shall be sized at a maximum face velocity of 1.5m/s to limit pressure drops. The louvres shall be to the following specification: • Be constructed from milled aluminium with mitred corners. • Be BSRIA HEVAC Class A Type • Be flanged or flangeless as agreed with the project architect. • Be fully weather proof. • Have 50% minimum free area. • Polyester powder coated to a colour agreed with the architect? •Be provided with secret fixings – drilled holes in the louvre flanges for fixing purposes are not acceptable. • Sized to a maximum face velocity of 1.5 m/s.
Frost Coil		Plain seamless copper tubes with no fins.

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Heating / Cooling Coil		Seamless copper tube with fins not exceeding 300 per metre. Heating coils to be aluminium finned and cooling coils shall either be copper electro-tinned or polyester coated to suit application. Coating of fins is not required for heating coils. Cooling coil face velocities shall not exceed those stated in HTM 03-01 (2m/s). The drain trays shall be fully HTM 03-01 compliant in accordance with best practice guidelines. Intermediate drain trays shall be included on all coils above 1200mm High.
Anti- Vibration Mountings	TEK Ltd Trox Sound attenuators	AV mountings shall be provided to all rotating equipment, fans, compressors etc. AV mounts shall achieve 98% efficiency as a minimum.

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AHU's / Fans	Larger AHUs Dalair Barkell Birmingham Air Con. Air Handling Systems Trox Smaller AHUs Nuaire Vent Axia Central Fans	Fans shall be suitable for required application. Wall fans – complete with remote switching. AHU fans – backward curved centrifugal impellers direct drive fans with EC permanent magnet DC motor with inbuilt 0-10 volt signalling for speed control. Multiple plug fans are referred. Curb fans – centrifugal type In-line fans – centrifugal type wherever practical. Dirty extract fans – shall be twin fans with automatic changeover facility. The fans shall be EC type and on larger systems shall utilise Plug Fans All fans shall be in compliance with latest Building Regulations (particularly the requirements of Part L2) Access panel to be hinged All dampers blades to be galvanised All AHU's to be internally lit Swimming Pool air handling units (AHU) shall be designed, procured and installed suitable for external environments and suitable for the high chemical rich air. Generally, the construction of the AHU's shall be as the general Air Handling Units but will include the following: • Hot dip galvanised or aluminium closed framework fixed with aluminium corners and internally insulated with mineral wool insulation. • Plastic faced or plain galvanized sandwich panels with 50 mm insulation (Thermal transmission T3 / Thermal bridging TB3 / Air leakage L3 according to EN 1886). • Internal partition wall is 30 mm thick and built from hot dip galvanised 1,25 mm sheet material insulated with mineral wool. • All internal steel components including fans and panels are powder painted before assembly with corrosion class C4 paint. • 70 µm powder paint finish on the outside panels for the installation of the air handling unit in external environments. • All fasteners, bolts and nuts are stainless steel and protected against the corrosive air with class C4 paint. • Highly efficient (double pass), epoxy-coated aluminium plate heat exchangers with high resistance to the corrosive swimming pool chemicals within the air stream. • •Damper motors IP 66 rated.

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