Worcestershire County Council
Corporate Services Directorate - Property Services

GUIDANCE NOTES FOR DESIGNERS - MECHANICAL & ELECTRICAL SERVICES (Version 2010.01)

INDEX

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Issued by P. N. Harris CEng CEnv CMgr FCIBSE MIEE MEI MCMI MBIFM Chief Engineer
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PHILOSOPHY AND PURPOSE OF DOCUMENT

The purpose of this document is to inform external Consulting Engineers and in-house Design Engineers of the common standards to which mechanical and electrical building services engineering installations shall be designed. These Guidance Notes shall be used as the basis of the review of all designs, and shall be taken into account by designers when submitting fee bids. The document does not seek to replace industry-standard design guidance and practice, but is issued to inform designers of specific County Council requirements, many of which have been adopted in the interests of standardisation and simplification of maintenance across a large and diverse property estate.

Worcestershire County Council is also committed to a more sustainable future and therefore wishes to achieve a substantial reduction in energy consumption and the release of CO_2 and other greenhouse gases to the atmosphere. It aims to meet and exceed wherever possible the reductions set out in the Climate Change agreements made at Kyoto and all subsequent Government carbon management and environmental protection initiatives. The design of building services installations will therefore be expected to incorporate best practice and all applicable and affordable techniques to minimise the environmental impacts of energy consumption due to public building operation.

The Council has since 2005 developed a Carbon Management Action Plan, which currently incorporates BREEAM assessment methodology for all applicable new schools projects. High School projects exceeding £2m in total value, Middle/Primary School projects over £1m, and First/Infant school projects over £500,000 may be subject to a full BREEAM assessment and will generally be expected to achieve a 'very good' rating. The consulting engineer or engineering designer shall design the engineering installations in conjunction with the Design Team in order to achieve this outcome.

The County Council operates an effective planned preventative maintenance programme and requires straightforward maintainable systems without over-sophistication that will "stand the test of time". In addition, the Officers in Charge of the County Councils' buildings are not required to have any specialist knowledge of building services, and thus all user controls are required to be simple and intuitive in operation.

Designers and Consulting Engineers are expected to familiarise themselves with the above and the following specific requirements when preparing schemes.

In the event that the designer proposes to incorporate an alternative design strategy, accept the inclusion of alternative materials or manufactured components, or wishes to depart from this guidance for other reasons, the Council will normally expect the

designer to be able to demonstrate that his/her proposals will result in an equivalent or better performance in use over the design life of the installation, at equal or lower cost. In such instances, designers are requested to contact the Chief Engineer or his representative and seek approval to the alternative proposals.

Comments, suggestions and updates to this document are welcomed.

Phil Harris

P N Harris CEng CEnv CMgr FCIBSE MIEE MEI MCMI MBIFM
Chief Engineer
Worcestershire County Council

Property Services
County Hall
Spetchley Road
Worcester
WR5 2NP
Tel: 01905 763763
Fax: 01905 766498
e-mail: pnharris@worcestershire.gov.uk

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GENERAL REQUIREMENTS

1. The engineering installations shall incorporate full building services including mechanical, electrical and other specialist services as required by the Client's brief. The Designer should prepare a preliminary design concept report and submit this to the Chief Engineer for comment before proceeding to detailed design. This is an important stage in the Designer's relationship with the Council on any project, and should not be overlooked. Forwarding a copy of the tender documents when they are sent out to Contractors at the same time as tenders are invited is **not** an acceptable alternative.

2. The County Council is particularly keen to comply with or exceed the guidance set out in DfES Building Bulletins and other guidance applicable to Local Authority premises. This will involve the Engineers, Architects and other Designers working in close collaboration and advising each other accordingly.

3. During the course of the design work the Designer will be expected to undertake risk assessments regarding such things as safe surface temperatures, safe water temperatures, etc. If he is unsure or has doubt about a particular aspect of this he should seek clarification from the Chief Engineer.

4. Where extensions or a new block are to be built on an existing site, a survey of the existing services is to be made and a report provided on the implications to the existing services and controls, and cost of the project. Some records of existing services may be available but this is not guaranteed. It may be necessary under certain circumstances to widen the brief to encompass alterations/upgrading of the existing services, utilising alternative funds in order to service the new build satisfactorily. Any extension to the scope of works to be agreed.

5. Any extension of an existing service/system must be compatible with the existing, and preferably incorporate equipment of the same or similar manufacture.

6. On any existing site a check should be made with the Property Services Department as to the presence of Asbestos. A Permit to Work system is in existence and shall be used to instigate the appropriate Level 2 or Level 3 asbestos survey. The Council's records are not definitive, and if asbestos in any form is suspected during any survey work, contact must be made with Property Services to establish the facts. The County Council's Analyst provides this service on instructions from the Property Services Department (see Asbestos 'Contracts' and 'Disposal' procedures.)

7. The Designer will be required to carry out all negotiations with the appropriate Statutory Authority, or the County Council's current supplier, for water, gas and electrical supplies to the site. All new and modified gas, electricity and water supplies are currently procured through the Council's procurement organisation, West Mercia Supplies, Holsworth Park, Oxon Business Park, Bicton Heath, Shrewsbury SY3 5HJ, telephone 01743 241130 or www.westmerciasupplies.co.uk. All new meters shall be of a type

which provides an electrical pulsed output and compatible with the Council's AMR strategy. The designer is also responsible for checking the capacity of existing services where the building is on an existing site, and for negotiating any upgrading required. Attention is drawn to the extended delays which are frequently encountered when dealing with gas, electricity and water undertakings and their sub-contractors, and designers are reminded of the need to initiate the process as soon as possible after the instruction to proceed is confirmed. Payments are normally forwarded direct to the supply undertaking by the County Council, but the Designer in collaboration with West Mercia Supplies shall forward the supplier's quotation to the Chief Engineer with a request to issue payment. This normally takes no more than seven days.

8. On existing sites, some record drawings may be available for use by the Designer. Arrangements can be made with the Property Services Department to view those that exist, and copies of any selected can be made available. No guarantee can be given that a drawing exists for any particular site, or that if they do exist that the information is correct. The Designer must be responsible for obtaining any information required for the project from his own site survey.

9. Commissioning certificates must be provided for all plant and controls by the manufacturer of the equipment.

10. Certificates of Electrical Completion to be issued to Worcestershire County Council's Principal Electrical Engineer. Fire Alarm Installation and Commissioning Certificate and Emergency Lighting Inspection, Testing and Commissioning Certificate shall also be provided. The Design Section of the Form of Completion and Inspection, as detailed in Appendix 6 of BS7671 I.E.E. Wiring Regulation must be signed by the Designers and forwarded to Property Services. All certificates shall be as supplied by the NICEIC.

    Full operating and maintenance instructions/manuals (one for site, one to be kept by Property Services) are to be provided on completion of each project. Particulars of any extended warranties (where these exceed 12 months, such as for underfloor heating pipework) shall be provided to the Supervising Officer.

11. All equipment shall be selected, and installed to permit ease of maintenance with safe access provided to all maintainable items.

12. The Designer must arrange to hand the services within the building, over to the Property Services Maintenance Engineers on completion of the works, and formally agree completion of all the works at the end of the defects liability period. The operation of any controls installed shall be demonstrated to the Energy Officers at practical completion.

13. The Designer is required to adhere to the Council's preferred list of manufacturers for all mechanical and electrical equipment.

14. All works shall generally comply with the current edition of Worcestershire County Council's Trade Preambles for Mechanical and Electrical Works, published on the County Council's website.

15. All installations shall comply with the current editions of:

    CDM Regulations
    Building Regulations
    Relevant Codes of Practice
    Applicable British Standards
    Water Regulations 1999
    Gas Safety Regulations
    BS7671 I.E.E. Regulations
    DCSF/PfS design guides/Building Bulletins
    CIBSE Guides
    Fire Officer/Risk Manager's recommendations
    All HSE Publications and in particular:
    HS(R)25 Electricity at Work Act
    GS23 Electrical Safety in Schools
    L8 Approved Code of Practice - Legionella

16. The Designer will be required to comply with the County Council's Standing Orders. Guidance will be provided by the Council as necessary.

17. The Designer is required to provide adequate site supervision of the installations during the Contract, including attending site meetings when requested to do so. To define 'adequate', the Authority would expect that all works are carried out to the full requirements of any drawing or specification prepared for the Contract.

18. A schedule of personnel is attached to this document indicating the name and function of those members of Property Services Department with whom the Designer is likely to need to liaise during the design process.

19. It is the designers' responsibility to ensure that all relevant standards, current at the time completion of the design, are complied with.

DESIGN SUBMISSIONS

1. Property Services Division is responsible for the operation and maintenance of all engineering services throughout Worcestershire County Council and for providing advice and guidance on building related matters.

2. It is essential that the Designer liaises with the Chief Engineer or his representative in the first instance on any new projects. All new projects should have had a feasibility study undertaken which will provide information and guidance on the propsed engineering strategy for the scheme. This is also to establish the appropriate communication between various parties with an interest in the project's engineering solutions. All communication should generally be through the Project Manager.

3. The following stages of a project should be covered by a review of information and the design intent to date:

   3.1 Pre-Design
   Define and evaluate alternative ways of satisfying the define need and assess long term strategies for utilities and infrastructure use.

   3.2 Outline Design
   Prepare alternative outline proposals and select the preferred alternative. Develop the preferred design sufficiently to enable appropriate engineering assessment.

   3.3 Final Sketch Design
   Develop the approved outline design into a design solution, fully integrated with constructional, structural and services requirements. Validate the solution against the brief, budget and other constraints and obtain any necessary third party approvals.

   3.4 Detailed Design
   Prepare for approval all design drawings, specifications and Schedules suitable for tender.

TESTING AND COMMISSIONING

1. Worcestershire County Council expects and is prepared to pay for a high standard of test, commissioning and hand-over procedures. It is essential that contractors are made aware of this at the tender stage.

2. By whatever method testing and commissioning is undertaken the following general comments apply:

   - All testing and commissioning, including off-site inspections, must be witnessed by the Engineer responsible for the service design, or his appointed representative such as the Engineering Clerk of Works.

   - If the competence of the installing contractor's ability to undertake commissioning is in doubt then the use is to be made of specialist commissioning contractors. The decision must be made before the issue of the tender documents and provision made for any additional costs.

- All on-site tests and commissioning must have the design engineer in attendance or be represented by a third party such as the Engineering Clerk of Works.

- If for testing and commissioning purposes an imposition of dummy loads is required, this is to be allowed for in the tender documentation costing and programming of the project.

3. If it is required that a system, complete building test, or commissioning procedure requires to be witnessed by the representative of the County Council, this should be made known at the tender stage and a minimum of five working days notice given by the Consulting Engineer to the WCC representative. Particular attention will be paid to systems which are to be buried or permanently concealed. Where applicable, access points shall be installed to permit inspection of concealed joints and fittings as required by the Water Regulations.

4. Systems offered for witnessing must be complete, fully operational and commissioned. WCC representatives will abandon witnessing of any system found to be not complete in any respect, and reserve the right to recover abortive costs.

MECHANICAL SERVICES – HEATING, PLANT AND CONTROLS

1. Locate boiler rooms at ground floor level, preferably with vehicular access. Provide a minimum of two heating boilers each capable of 66% maximum demand, and connected on a 'reverse return' hydraulic circuit. Where biomass and gas boilers are fitted in a dual-fuel installation, the gas boiler should be sized to meet at least 75% of maximum demand. Schools in particular can be extended or altered periodically; the Designer shall therefore make an allowance for any known future extensions, and bear in mind the flexibility for extending the plant when planning boiler room sizes etc. The choice of fuel now includes renewables including wood chip, wood pellets, bio-oil etc and should be evaluated and the options presented to and agreed with the Chief Engineer. Where oil tanks are to be specified, these shall be steel self-bunded and comply with the detailed requirements of the Mechanical Trade Preambles. Oil installations are generally for 28sec oil (Kerosene) but should be suitable for future conversion to a 35sec bio-oil type. Where an existing boilerhouse containing gas-fired plant is located in a basement, wholly or partly below ground, in residential accommodation or in an internal room, an automatic gas detection system and magnetic gas solenoid valve will be required. New heating installations shall be designed for a 20K temperature differential, i.e. 80/60^{o}C flow and return temperatures. Alterations and extensions to existing heating systems shall be designed in accordance with the existing temperature regime, typically 11K temperature differential, 82/71^{o}C.

2. Use boilers with fully automatic controls, including gas safety equipment such that plant will always restart after power failure, (i.e. NOT permanent pilot ignition, nor manually-reset gas valves). Fit all boilers having a combined control/limit stat with a third terminal for remote indication of overheat condition on the control panel or for BEMS digital input. Consider the use of condensing boilers when this can be justified, i.e. with radiator or underfloor heating circuits where advantage can be taken of the lower return temperature, although in such cases a primary boiler circuit may not be required. Boilers shall not incorporate manufacturers' proprietary electronic or sequencing controls unless suitable volt-free contacts can be provided enabling full BEMS control and monitoring functions as for traditional boiler controls. Radio controlled thermostats/time clocks etc shall not be utilised.

3. Provide domestic hot water independently from the heating system. For larger installations use either direct gas fired appliances, combination boilers, separate boilers and high output calorifiers, or plate heat exchangers designed for DHWS use. For smaller installations, electric point-of-use water heaters may be more appropriate, to be decided on capital/running cost considerations. Control hot water systems independently from any heating system. All cleaner's sinks to be fitted with independent electric water heater, with time switch or BMS control. Take into account all the latest recommendations for the prevention of Legionnaires' disease in hot and cold water systems particularly the HSE Guidance Notes and Approved Code of Practice L8. Storage quantities for both hot and cold water system are to be kept to an

absolute minimum. It is generally unnecessary to provide a secondary circulation on an electrically heated HWS system, so long as the pipework is sized to limit the length and capacity of dead-legs in order to meet compliance with HSE AcoP L8. It has been found that trace heating is inappropriate, and shall not be specified. On larger circulation HWS systems, a single circulation pump is to be situated on the return pipe and take offs from the top of the main to assist with removal of air.

4. All critical use pump sets should be run and standby with automatic changeover and status monitoring provided in the control panel. Obtain the agreement of the Chief Engineer or his representative if it is proposed to use programmable pumps having integral controls and/or inverter drives. Avoid the use of canned rotor pumps except on small installations. Where canned rotor pumps are to be specified, ensure that they are fitted such that the pump can at no time air lock. Fit a single circulating pump on domestic hot water systems in the return pipe, and supply a spare pump, complete with plug-and-socket electrical connections. Spare pump to be bagged and sealed against dirt and mounted on a fixed bracket in the boiler house.

   The electrical load of the Mechanical installation, and pumps and fans in particular, can form a significant part of the total electrical consumption on any site. Consequently it is important not to oversize the pumps selected. They are to be selected to suit the load when running on intermediate speed. Alternatively, integrally speed-controlled constant head pumps may be considered for appropriate applications.

   Consider, but obtain prior agreement to the use of, inverter control for pumps with motors rated greater than 1.5kW on sites with Building Energy Management Systems and ensure that, where pumps with integral differential pressure control are being considered, the functionality of the BEMS is not compromised in terms of recognition of pump alarm and status conditions by incorporating motor running current sensing.

5. Consider the use of mains pressurised services rather than open-vented whenever possible, but exercise caution when selecting system operating pressures on existing pipework systems where its condition is unknown. If necessary, an over-sized expansion vessel should be selected, designed to prevent the system pressure exceeding the value that would have been applied by a feed and expansion cistern. Avoid specifying automatic pressurisation sets of the “break tank and pump” design unless the system capacity is too great for a direct-mains fed system of the ‘Mikrofill’ type. If an F&E tank is to be installed, fit a water meter on the mains water make-up in an accessible position at ground level.

6. Design all heating systems to provide group/zone control to individual areas/blocks to limit energy wastage during periods of out of hours use. It is important to zone buildings on areas of potential use, rather than on orientation, e.g. at a primary school, zone the system to provide separate zones for (1) after-school clubs, (2) extended service areas, e.g. dining, kitchen, hall and WCs, (3) school office accommodation and (4) classrooms and the remainder of the building. Zone a High School with individual

blocks/areas of activity (sports, craft, science, home economics etc.) Zone Homes for Older People or other residential accommodation into areas of daytime occupation, night-time occupation, and 24 hour occupation. Fit all zoned circuits with a 3 port motorised valve for either compensation control on a variable temperature circuit, or on/off control on a constant temperature circuit, operated from the control panel. This will ensure that the circuits will only operate when required, even under optimum off and first stage frost protection conditions when other zones/groups are in operation, and will also provide the opportunity for applying a small degree of weather compensation to constant temperature circuits to maximise energy savings. Fit non-return valves to each return circuit to prevent unwanted circulation occurring during extensions, hold-off or frost conditions.

7. All design temperatures are to comply with the Client's design brief for the particular use of the area, the appropriate DCSF design guide or CIBSE design guidance. Advice must be given to the Design Team to modify the design solution where the predicted summer time peak space temperature exceeds the criteria set for the building type, with particular reference to BB101 overheating criteria for teaching spaces, which requires the calculation to assume year-round occupancy. Prediction of overheating in classrooms must be undertaken using software utilising an approved Test Reference Year.

8. Design all systems wherever possible for automatically-controlled natural ventilation (controlled by CO2 level), except where mechanical ventilation is specifically required by the Client, where deep plan areas necessitate tempered fresh air to be introduced, or where the occupation or equipment levels are such that natural ventilation is inappropriate, i.e. Theatres and Lecture Areas etc. Any ventilation plant is to be located in purpose constructed, accessible plant rooms. If any plant is located in loft spaces a permanent loft ladder must be provided for access, together with a safe walkway and lighting. Roof-mounted plant must be provided with safe means of access, working platforms, guardrails and external lighting if appropriate. Advise the design team on all aspects of natural ventilation particularly window types, positions etc. In general all naturally ventilated spaces such as classrooms must have cross ventilation. Where theatres and lecture areas are provided a background heating system for low occupancy periods is appropriate, with time-limited manual over-ride controls for full occupancy use. (i.e. to operate the ventilation plant). Ensure that any plant installed is appropriate for the application, and that excessive noise levels are not generated. The levels are to comply with DfES Building Bulletin 93 ‘Acoustics’.

9. Provide all toilets, changing and shower areas with mechanical extract ventilation with automatic control. This to be linked to the lighting switch in rooms without windows via the BEMS if appropriate, or preferably locally controlled by PIR sensors with 15 minute run-on timer.

10. Fan convectors should be full height models with lockable access doors, and fitted with filters, adjustable low temperature cut out thermostats, integral high/low speed control

thermostat, and floor plinth. Ensure that any pipework in the cabinet of the heater is thermally insulated if it could affect the operation of the high/low thermostat. Fan convectors shall not be ceiling mounted unless of a type where access is via a hinged bottom cover on the unit, and not installed in woodwork, engineering, pottery areas or other dusty environments. Avoid the use of fan convectors where access is difficult, e.g. behind extensive builders work casings. Radiators and fan convectors should not as a general rule be fed from the same piped heating circuit, but if they are, the radiators should be fitted with Thermostatic Radiator Valves as in Paragraph 11. Fan convectors within rooms should in general have hand adjustable on/off control thermostats located in the room. Those in corridors, etc. to have in-built on/off thermostats. Allen Martin ET room thermostats are to be used in lieu of the above at any location where there is an internal air temperature sensor associated with the Building Energy Management System. All fan convectors shall be supplied by a key-operated switched FCU with neon indicator. Motor speed settings shall be chosen for acceptable noise levels in operation, and fan convectors shall preferably be sized to give the correct heat output at 'low' speed.

11. Radiator heating tends to be preferred by building users, have lower maintenance costs, and should be used wherever practical. Aluminium radiators shall not be specified. Radiators should preferably be controlled using a central weather-compensating controller, and the use of thermostatic radiator valves should be kept to a minimum for local limit control in areas having heat gain, or where limited numbers of radiators are incorporated into heating systems where the majority of the heating system comprises fan convectors. Do not exceed the limit of 43°C on safe surface temperatures in Homes for Older People, areas used by nursery school children (the under-fives), handicapped children in schools, disabled person's toilets, Autism bases, bathroom management areas (BMAs) and in first aid areas. In such locations LST radiators, with remote-sensing TRVs if applicable, shall be specified. Reference should be made to the appropriate design guides, or the specific Client's requirements. See paragraph 19 for requirements for underfloor heating.

12. The County Council operates two Building Energy Management Systems. Most sites report to either Trend 945/963 or TAC Continuum BEMS central stations, and in total some 270 buildings are now under energy management control.

    New buildings of 100kW heat rating (or extended buildings which reach this figure) must be connected to either the TAC Continuum or Trend 963 system and the Designer is expected to obtain competitive tenders from these firms. Mechanical works associated with alterations and extensions must be under the control of the building energy management system (if one exists at the site). In all cases fully detailed discussions must take place with the Chief Engineer, Principal Engineer Energy or their representatives to ensure full compatibility with the existing system and the central station.

It must be appreciated that with 270 sites already connected to the Council's central stations it is very important that common standards, systems and protocols are maintained throughout. Again WCC will advise on this. Refer to the "Automatic Controls" design notes elsewhere within this document, and to Section 8 of the Mechanical Engineering Trade Preambles which include technical clauses, lists of approved panel builders and electrical Contractors who specialise in controls wiring. These or equivalent clauses shall be included within the Designer's particular specification which shall also include a 'points schedule' of digital and analogue input and outputs.

The Council's requirements for automatic controls are set out elsewhere in this document.

13. On smaller projects where BEMS is not involved, controls shall be simple. Rather than utilising individual time switches, compensators, external thermostats for first stage frost, internal thermostats for high limit and second stage frost, extension timers and holiday switches for both heating and HWS, a PLC-based approach is recommended. WCC has developed standard control system designs based on Trend microcontrollers. Details are given in the Mechanical Engineering Trade Preambles and advice is available from the Chief Engineer or Principal Engineer Energy at WCC Property Services. On certain small installations, a domestic-type control system or the boiler manufacturer's own controls may be sufficient, so long as the user is given the additional facility to select a 'holiday' period with frost protection.

14. Provide a boiler house control panel on all projects, the operation of which should as far as possible be self explanatory with the use of appropriate labels etc. Specific requirements apply to the design of control panels, and this is covered in the Council's "Automatic Controls design notes incorporated elsewhere within this document. However, it is important to note that control panels shall be fitted with MCB's, not fuses. Switches on BEMS control panels shall be fully monitored, shall have "OFF" and "AUTO" positions only (no "hand" position) and that a single monitored manual group override key switch is required. Internally, all 'live' conductive parts shall be insulated and/or shrouded. Provide fully monitored rotary local isolators on equipment in the boiler room, in order that unauthorised operation of remote unattended plant can be logged and action taken. Do not link the boiler house control panel to the building fire alarm system; locate a heat or smoke detector, linked to the building fire alarm system, within the boiler house. This shall be separate from the fire detection and fuel shut-off system associated with the boiler plant itself

15. All domestic hot and cold water services installed must be sterilised in accordance with BS6700 under the Contract, and tested on completion by a NAMAS-accredited Analyst. Mains fed drinking water must be provided where required by the Client, or at suitable locations. Spray taps shall not be used.

16. Special areas, i.e. laboratories, workshops, etc. shall be provided with special means of isolation in accordance with the Client's brief or design guide. In general, this means a single control panel in each classroom allowing individual or group isolation of gas, water and electrical outlets in the room. Gas proving shall be incorporated, and the electrical isolation shall extend via a contactor to any Blakley safety isolating transformers. Domestic hot water circulation systems shall not be isolated, similarly the teacher's workstation may require a dedicated permanent water supply for safety purposes. Prep rooms serving laboratories are not normally served via isolating systems. All water installations serving laboratories shall comply with the Water Supply (Water Fittings) Regulations 1999 and non-potable water supplies to laboratory taps shall be from derived from gravity or pumped storage. Alternatively, approved laboratory taps suitable for direct connection may be used by installing Brownall XL or other approved pipe interrupters on each laboratory tap outlet to provide a permanent Type A air gap.

17. Safe access for maintenance of all engineering equipment is of paramount importance and must be provided. It is not acceptable to have maintainable items situated above false ceilings unless purpose-designed access panels are provided and the requirements of the Work at Height Regulations are incorporated.

18. Commissioning/orifice or double regulating valves may not be justified on simple conventional heating systems in schools, and are frequently found in the fully-open position. Contractors should be capable of balancing heating systems by traditional means. On more complex systems e.g. a sports hall with several air-handling units, double-regulating valves would normally be expected to be provided. The Designer shall verify at commissioning stage that the readings achieved are within acceptable tolerance from those intended within his design. It is of great assistance to subsequent Maintenance Contractors if a chart is fixed in the plant room showing the settings of all valves ‘as commissioned’. Alternatively specify Taconova SD bypass type direct reading commissioning valves together with a double regulating valve.

19. The use of underfloor heating systems is not encouraged, due to poor controllability and reduced BREEAM credits, and should only be considered an option where it is linked to a ground source heat pump. Where underfloor heating is proposed it must be carefully considered and integrated with the existing boiler plant and distribution systems on site. Ideally, underfloor heating systems should have their own low carbon heat pump or similar boiler plant which can be programmed to operate at times and temperatures to suit the system. Where an extension or new building is being erected on a site predominantly heated by radiators or fan convectors, underfloor heating for the extension will only be accepted where a new primary low carbon heat source is being provided.

    The manufacturer is to provide a 25 year warranty backed by an insurance company. The water flow temperature should be controlled from a separate 3 port zone valve situated in the boiler house under control from the Building Energy Management

System, with separate mechanical over-temperature protection where required. Preference will be given to concentric underfloor pipe systems.

20. Ground source heat pumps shall always be of the borehole type unless there are valid reasons for a trench type system. Ground source heat pump installations shall be backed up by a second heat pump or another type of equipment such as a gas boiler. Air source heat pumps are a less preferred alternative to ground source. For schools, the Council's preferred solution is for heat pumps to serve low-temperature fan convectors or radiators operating at around 45ºC flow temperature. These systems should always be directly weather-compensated at the heat pump to maintain a high seasonal COP.

MECHANICAL SERVICES – WATER, VENTILATION AND SPECIALIST SERVICES

Domestic Hot and Cold Water

A summary of the Council's design guidance on domestic hot and cold water systems is provided in Appendix 8 of the Water Quality Policy and reproduced below:

Cold Water

Storage temperature: 20°C (maximum)
Storage capacity: Avoid installing cisterns if at all possible: 4 hours (where absolutely necessary), 24 hours (maximum).
Distribution temperature: 20°C (maximum)
Mains powered Ultrasonic or infra-red occupancy-sensing flow controls shall be fitted to all wet urinal systems

Harvested Rain Water

To be used for WC and urinal flushing only
System to collect rainwater from roof areas only, no connection to gulleys or SUDS
All pipework to be in ABS, and not copper
Valved sampling points to be provided
Cisterns with rainwater and mains water inlets to have Severn Trent approval
Warning notices to be fixed adjacent to all appliances served by RWH systems to read:
"CAUTION – HARVESTED RAINWATER – CATEGORY 4 FLUID"
System water to be sampled and analysed annually

Domestic Hot Water

Storage temperature: 60°C (minimum), 65°C (maximum)
Distribution temperature: 50°C (minimum)
Avoid the use of calorifiers
Plate heat exchangers designed for DHWS use are acceptable
Thermostatic mixing valves shall be to TMV3 specification and fitted to all outlets accessible by pupils, clients or the public
Warning notices for unblended outlets and shower installations shall be provided as described in the trade preambles. Unblended hot water shall be available at cleaners' sinks, catering and washing-up facilities and food technology classrooms

DHWS Distribution Pipework

Maximum length of:

- Spur – 5 metres
- Dead leg / blind end – 5 pipe diameters
- Blended pipework – 2 metres

Distances are measured from the circulating main to the point of draw-off, and INCLUDE any length of blended pipework, shower hose, etc. Single-pipe (non-circulating) distribution is permitted from small electric point-of-use water heaters or combi boilers, provided that hot water at 50^{o}C (minimum) is available from the most distant tap within one minute of running to waste. Secondary HWS circulation must have a pump on the return and re-enter the cylinder via a designated return connection, not the cold water inlet. Electrical trace-heating of non-circulating HWS pipework shall not be permitted.

On sites where the majority of hot water outlets are blended, sampling points should be provided in the form of an unblended hot outlet to act as the 'sentinel tap'. Such taps should be located in a safe place whilst being representative of the hot water within the installation.

DHWS Pumps

Secondary circulation: single pump, in return leg. Provide 'dry' standby adjacent; use electrical plug and socket

Anti-stratification: shall run for one hour per 24 hours, and must only run in times of low or no demand. Primary heat source to be 'on' during pump run period

Distribution System Layout

Design temperature drop: 5K (maximum)
Hydraulic balancing: avoid multiple parallel loops; aim for 'single pipe' with short return leg
Thermal insulation to be fitted to CWS and circulating HWS pipework only, not HWS deadlegs

Bulk shower installations

Include electronic group shower controls such as "Rada Pulse 129" with remote key-operated group flushing over-ride. Thermostatic mixing valves to individual shower cubicles should be provided in preference to central blender.

All work on water systems in WCC premises to be undertaken by Severn Trent 'Watermark' approved Contractors, Sub-Contractors and operatives and shall comply with the Water Supply (Water Fittings) Regulations 1999 or as amended

Avoid tank-fed systems if possible; use mains pressure
Select direct gas-fired water heaters in preference to calorifiers
Select electric mains-fed unvented point-of-use water heaters for small systems, but control to limit electrical maximum demand
Avoid concealed pipework, cisterns and components and observe the requirements of the Water Regulations, particularly in laboratory water systems
Spray taps or rubber-lined braided flexible hoses shall **not** be specified

Thermometers and Temperature Sensor Positions on New/Refurbished Projects

Include BEMS temperature sensors (or 100mm dial thermometers where no BEMS) in:

- Incoming mains CWS downstream of stop valve
- Cold water feed into calorifiers or water heaters
- Cold water storage tanks
- HWS stored water in calorifiers or direct-fired water heaters
- HWS flow from calorifier, water heater or plate heat exchanger
- HWS return to calorifier, water heater or plate heat exchanger

Install dial-pattern thermometer in storage cisterns and on HWS system flow and return at the source.

Flexible hoses

Flexible hoses will **not** be permitted on any domestic hot and cold potable water system, unless the flexible hose forms an integral part of a WRAS-approved tap or water fitting. Final connections to taps, cisterns and appliances shall be made using rigid pipework by site-made sets and bends and approved pipe fittings or, if a flexible connection is specified, all-metal flexible fittings shall be used. Under no circumstances will EPDM-lined flexible braided hoses be accepted for final connections without the prior approval of the Water Quality Manager, Chief Engineer or their representative.

Air Handling Plant - General

The design of the plant and selection of equipment within an air-conditioning or supply ventilation system should aim to minimise the distribution of excess moisture within the ductwork. The installation, and in particular the plant room layout, should provide adequate access to items of plant for inspection and, when necessary, for affecting a cleansing regimen as part of the plant maintenance programme.

All materials used in the construction of cooling coils / chiller batteries and humidifiers should withstand bio-degradation; this applies in particular to surface finishes, mastics, gaskets, insulation, etc. Natural fibrous material should not be used.

Fresh Air Inlet

The fresh air supply inlet(s) must be located to avoid the possibility of air being carried over from evaporative cooling towers or being discharged from other extract systems and drawn into the system.

Cooling / Chillers Coils

The cooling coils / batteries and their components should be designed to allow regular cleaning.

Humidifiers

The cleanliness of the water supply is essential for the safe operation of humidifiers. Provision should be made for draining down supply pipework and break tanks for periodic disinfection and for periods when they are not required in service. Water supply should be potable quality from a rising main.

The addition of treatment chemicals for continuous control of water quality for humidifier / air handling units should be avoided. Consideration could be given to installing a UV system to control microbiological growth. Given the limitations of UV systems, however, this will require filtration to high quality to ensure the effectiveness of exposure of organisms to the UV irradiation. As with all water treatment systems the unit should be of proved efficacy and incorporate UV monitors so that any loss of transmission can be detected.

Overriding controls separate from the normal plant humidistat should be installed. Their purpose is to prevent excessive condensation when starting up. A time delay should be incorporated into the humidifier control system such that the humidifier does bit start until 30 minutes after the ventilation / plant start-up. In addition, a high limit humidistat should be installed to switch off the humidifier when the saturation reaches 70%. This humidistat is to control added moisture, it is not necessary to install a dehumidifier to reduce the humidity of the incoming air if it already exceeds 70%. The normal humidifier control system should ensure that the humidifier is switched off when the fan is not running.

Steam Humidifiers (Electric or Gas Fired)

The humidifier lance design should prevent steam impinging onto the side(s) of the duct, condensing and generating excess moisture. Water supply should be taken from a rising main with short pipe runs to minimise stagnation.

System Drainage

It is essential that cooling coils / humidifiers, fan scrolls (when necessary), eliminators and heat recovery systems are at a sufficient height from the floor or ceiling to permit the installation of the correct drainage pipework systems with access for maintenance.

Each device should have its own drainage trap.

A drainage / drip tray should be provided, to collect condensation on cooling coils (including the return bends and headers), and for humidifiers, eliminators and, if necessary, heat recovery devices. The drainage /drip tray should be constructed of a non-corrodible material and be so arranged that it will completely drain. To prevent ‘ponding’ it is essential that the drain outlet should not have an upstand. The tray should be large enough to trap all the water produced by the device. Provision should be made for easy inspection of the tray. Any jointing material used to seal the tray to the duct must not be of a type that will support microbial growth, (the

Water Fittings Directory lists suitable materials). A slope of approximately 1 in 20 in all directions should be incorporated to the drain outlet position.

Drainage / drip trays should be connected to a drainage trap assembly that should discharge via a Type A air gap as laid down in BS 6281 : Part 1 : 1988. The depth of any trap should be at least twice the static pressure head generated by the fan so that the water seal is not 'blown out' during plant start-up. (See Figure 5, typical air-conditioning plant drain).

A trap need not be directly under the drainage tray if the pipework connecting the two has a continuous fall. Each trap must be of the transparent type to show (visibly the integrity of the water seal, and should be provided with a means for filling. Permanent markers on each trap should be provided to show the water seal levels when the system fan is running at its design duty. Each installation should incorporate quick release couplings to simplify removal of the traps for cleaning and maintenance.

If trace heating of drainage traps is necessary to provide frost protection, insulation should not be fitted, otherwise the trap will be obscured from view.

The pipework should have a minimum fall of 1 in 60 in the direction of flow. (Transparent pipework is not necessary). Water from each trap should discharge over either an open tundish connected to a drainage stack via second trap, or a floor gully (or channel). Where the drainage pipework from the tundish outlet, which should be ventilated, discharges into a surface water drainage stack or a dedicated plant drainage stack, the connection must be via an easy swept tee.

It will be necessary to disinfect humidifiers / cooling coils etc; thus it is preferable to discharge plant drains into the foul drainage system. The surface water drainage system may be used, for example when a plant is installed on the roof, but if chemicals are used during cleaning operations it will be necessary to discharge the effluent to the foul drainage system, for example by use of a hose.

The drainage system should be constructed of a corrosion resistant material. It should be capable of removing all the moisture produced, for example during periods of maximum dehumidification load and in the event of full discharge from the humidifier during fan failure, and provide a means of safely disposing of the water via an independent drain. Drainage / drip trays for coils should be provided with a means to prevent air by-passing the coil (for example by the inclusion of suitable baffle arrangements).

<u>Fume Cupboards</u>

The designer shall ensure that the fume cupboard design meets the requirements of the COSHH Regulations in respect of all chemicals and substances the use of which is reasonably foreseeable within the fume cupboard.

Fume cupboard extract fans shall be mounted on the roof or external wall. In-line fans shall be avoided. Fume cupboard installations shall follow BB88 best practice.
Listed below are the specific requirements for new fume cupboard installations which, in the absence of any alternative design integrated with laboratory furniture by a specific manufacturer or supplier, shall be as below.

1. All fume cupboards shall fully comply with BS 7258 : Parts 1 – 4 1994.

2. All Fume Cupboard sashes shall be fitted with mechanical sash locks set at a sash height of 500mm.

3. Each Fume Cupboard shall have a double skin construction with external epoxy powder steel, coloured to match the underbench units.

4. Each Fume Cupboard sash shall be made with 6mm toughed glass. The sash shall be suspended on stainless steel cables running over ball-raced nylon pulleys with counterbalance weights all arranged on a fail-safe principle in the event of cable failure.

5. All fume cupboards shall be complete with 1 no. cold water hand operated spray.

6. Ductwork shall be manufactured and installed to the Heating and Ventilating Contractors' Association (HVCA) 'Specification for Plastics Ductwork – Unplasticised Polyvinyl Chloride (uPVC) and Polypropylene (PP), DW 151'.

7. All internal PVC ducting shall be reinforced with Scott Bader' Crytic Fireguard 75 PA' flame retardant coating finish (white)

8. Design criteria i.e transport/efflux velocities shall be in accordance with BS 7258.

9. Fume Cupboards shall be supplied c/w 1 metre flexible tails to rear for plumbing services e.g gases, water etc.

10. The types of chemicals/solvents that are to be used within the cupboard shall determine the materials used for the fume cupboard worktop and inner linings/baffles. The decision should be taken after consultation with the users.

11. Where the intention is to designate the fume for the use of radio-active materials the worktop/linings shall be formed by a one piece stainless steel section.

12. Each fume cupboard shall be complete with a stainless steel cill.

13. Each fume cupboard shall be complete with a glazed light cowl and light tube with internal wiring to a switch and junction box.

14. Each fume cupboard shall be fitted with an electronic continuous visual/audible airflow/sash alarm panel.

15. Fume cupboard extract fans shall have castings and impellers manufactured from polypropylene. Manufacturer to be approved by the County Council.

16. Extract fan motors to be IP55 rated with protective covers.

17. Extract fans shall be sized to achieve the following face velocities at a sash-height of 500mm:- General Purpose Fume Cupboards: 0.55m/s

Commercial Kitchens

Cookers are appliances requiring an adequate air supply for combustion, and extract to remove the products of combustion. GSIUR 27(4) requires that there be an interlock to ensure that in the event of failure of any mechanical fans the gas will be shut down.

Kitchen canopies shall be served via ducted supply and extract systems, speed-controllable to minimize energy use, or preferably provided by a kitchen-specific heat recovery air handling unit.

The Council will expect to see Designer's designs incorporating the HSE's requirements in this regard. For further information and interpretation on kitchens see the downloadable pdf files on the HSE website www.hse.gov.uk/pubns/cais10.pdf and www.hse.gov.uk/pubns/cais23.pdf

Fire Fighting Sprinkler Installations

The Building Regulations, the Regulatory Reform orders and Insurers are increasingly calling for active fire suppression systems such as sprinklers as part of the design of new schools and major extensions. DCSF BB100 sets out a risk assessment methodology which dictates the use of sprinklers in the majority of new-built schools. The Designer shall undertake the design of sprinkler systems in collaboration with a specialist supplier/installer, who shall be a Loss Prevention Certification Board-approved member of the British Automatic Sprinkler Association and accredited to LPS 1048-1. The Designer shall be responsible for selecting and recommending to the Council the most appropriate specialist supplier/installer in terms of a whole-life costing analysis.

Sprinkler installations should, in general, be based on full capacity above-ground water storage and pumping systems rather than being reliant on the water supply authority's mains supply, and shall incorporate concealed or vandal-resistant sprinkler heads. Sprinkler tanks shall preferably be of GRP manufacture.

Specialist Dust Extraction Systems

Local exhaust ventilation and dust extraction systems shall be provided in compliance with the COSHH Regulations in areas such as workshops, school woodworking and Craft Design and Technology rooms. The performance of such systems is critical in providing a safe and healthy working environment for staff and pupils alike. The design of such systems is regarded as specialist, and the Designer shall undertake the design of LEV and dust extraction systems in collaboration with a specialist supplier/installer, who shall be responsible for the selection of central and local extract fan/filter units as well as the detailed design of the extract ductwork. LEV systems shall be interlocked with the workshop machines to prevent operation unless an adequate dust extract airflow is present. System design should take into account the pattern of use of adjoining workshops and CDT rooms in order to avoid unwanted noise nuisance from the LEV system when quiet teaching is in progress.

The Designer shall be responsible for selecting and recommending to the Council the most appropriate specialist supplier/installer in terms of a whole-life costing analysis. The design shall ensure lowest noise, electricity consumption and maintenance costs commensurate with adequate performance and reliability. The performance of the complete system, when connected to the proposed workshop machinery, will be assessed and a capture velocity at the workpiece of not less than 1.0m/s at every machine will be expected under normal running conditions.

Renewable Energy Systems and Low Carbon Technologies

The County Council's carbon management policy reflects central Government policy on the incorporation of low- and zero-carbon technologies within public sector projects. Designers shall consider and evaluate the cost-effectiveness of such systems and, in conjunction with the Design Team and BREEAM assessor as appropriate, incorporate specific technologies into the project. Guidance on the cost-effectiveness of LZC technologies is available on request.

The designer shall evaluate the following at feasibility stage:

Biomass (solid fuel, woodfuel etc)
Bio fuels (liquid fuels, bio-diesel etc)
Ground-source and air-source heat pumps
Solar thermal heat source
Photovoltaic power generation
Wind power generation
Rainwater harvesting

ELECTRICAL SERVICES

1) GENERAL

The electrical installations shall incorporate full building services including lighting, power, fire alarm with class change facility, call systems, H & V control, security and intruder alarms, T.V. telephone, and computer systems, all as required by the Client's brief or other specific design guide. The main switchgear must be located in a purpose built area preferably where it cannot be obstructed by other material, i.e. not in a Caretakers store. An ideal location is a cupboard of minimum depth with fully accessible doors from a corridor. Under no circumstances is the main intake to be located in the boiler room. All distribution boards again are to be located for future ease of access, i.e. not behind or above shelving in stores.

A system of Energy Metering shall be installed to comply with Building Regulations Part L2. The metering system to be installed will depend on the type of the project i.e. whether the project is a new school, a major extension or refurbishment works. Independent AMR primary metering is required - further guidance shall be obtained from the Chief Engineer.

All electrical installation work shall be carried out in accordance with the latest edition of the Institution of Electrical Engineers Wiring Regulations BS7671 for Buildings with particular reference to earth bonding.

The wiring system shall be suitable for the building type and construction and will comprise LSF-insulated single cables within some form of rewireable system, concealed where possible, preferably using metal trunking and conduits, or otherwise heavy duty pvc conduits. Mini trunking may also be considered for certain surface applications. All routes of surface trunking and conduit are to be agreed on site with the relevant bodies before installation. Where site conditions dictate, acceptable alternatives will be Prysmian Afumex LSX or equal and approved LSF insulated cables having copper CPC, integral copper or aluminium screen and LSOH thermoplastic oversheath, fixed to cable tray or basket. Where fire rated cables are required, Pirelli FP200 or Firetuf shall be used.

Domestic grade LSF/LSF insulated and sheathed non-armoured TWE cables otherwise known as “twin-and-earth”, clipped direct or on cable trays or baskets or contained within trunking or conduits, may be permitted only under exceptional circumstances and with the prior agreement of the County Council.

MOUNTING HEIGHTS

The Council has adopted specific standards for mounting heights of electrical accessories. The following shall take preference over the Consultant’s own standards unless specifically agreed in writing by the Council. Where new wiring is being installed adjacent to existing installations and the mounting heights of existing accessories differ from those listed below,

and in all circumstances to maintain an acceptable visual appearance, the Architect's advice must be sought before setting-out is commenced.

Unless otherwise noted, the dimension stated shall be to the bottom edge of the accessory:

Socket outlets	450mm from FFL
(where above benching)	150mm from the top of the bench
Light switches	1100mm from FFL to the centre of switch
Cooker control units	1550mm from FFL
Room thermostat	1500mm from FFL
CO_2 Sensors	1500mm from FFL
Clocks	2350mm from FFL
Distribution boards	1500mm from FFL to the bottom in a Secure Area
Distribution boards	Mounted below ceiling level in a Non-secure Area
Data/Telephone outlets	450mm from FFL
Fire alarm call points	1100mm from FFL
Fire alarm bells	2350mm from FFL
Fire alarm panel	1500mm from FFL
Intruder alarm panel	1500mm from FFL

A system of a main distribution panel comprising MCCB and MCBs is preferred, all being clearly marked and labelled for ease of operation and maintenance. All distribution boards shall be equipped with MCB's of the correct type and rating, i.e. type B or C for normal duty. Equipment to be able to withstand the appropriate fault level conditions.

Sub-main cables to be either XLPE/LSF/SWA/LSF where run above ground, or PVC/SWA/PVC where buried, and shall be BASEC approved and run concealed where possible.

All 13 amp power sockets and hand driers should be controlled by RCD units with 30mA sensitivity tripping current throughout. The socket outlets shall preferably be twin, and wired using ring main circuits.

Special areas, i.e. laboratories, workshops, etc., shall be provided with electrical requirements in accordance with the Client's brief or design guide, and as follows :-

(a) All socket outlets in laboratories to be double pole switched and controlled by a purpose-designed 1:1 isolation transformer, 5kVA rating, complete with RCD units, 5 milliamp sensitivity, as manufactured by D. W. Blakley. Installation to be tested using a Blakley tester on completion and a certificate of test provided.

(b) Workshops to have all power services supplied throughout from a contactor controlled MCB distribution board operated via emergency stop buttons and a master key switch start control. The coil circuit shall be supplied from a phase

conductor within the contactor and sub-fused by a slide lock or equal fuse within the unit. Each contactor shall have a key start and stop button circuit, only one circuit to be used on any one area. The function of the circuit is to be as follows: Key start makes contact to coil circuit, the auxiliary contacts within the contactor hold the circuit in series with the n/c stop buttons. The key may then be removed with the circuit held. Operation of any stop button will interrupt the coil supply and isolate the outgoing service. All machines must be provided with no volt release starters, or RCD plugs on small single phase machines.

(c) All sockets for I.T. equipment to have high integrity dual earth facilities, to comply with the latest edition of BS7671.

2) LIGHTING

Lighting should generally be fluorescent, LED or other low energy source, especially in areas where natural daylight is unavailable, and should be integrated with the architectural requirements. Luminous efficiency shall equal or exceed Building Regulations AD-L2 requirements.

The system shall comply with Part L2 of Building Regulations and preference shall be given to energy efficient fittings.

High frequency control gear shall be utilized in all areas.

Outside lighting to be provided as required with photo electric cells to bring the lights on and time switch to switch off. An override key switch facility shall be provided for testing purposes.

Lighting levels shall comply with the CIBSE lighting code, Client's brief, or other specific design guide.

Fittings generally shall run parallel to windows and switched in rows.

Generally lighting controls in classrooms shall use the DEMAND principle, i.e. the lighting is switched ON manually and switched OFF automatically utilizing the PIR and daylight sensors. The system shall comprise of a Retractive switch, a controller, a PIR and a daylight sensor as manufactured by Setsquare Controls Ltd., contact number 01732 851888.

Lighting in classrooms with two rows of luminaires shall be controlled via SetSquare PODCU2 controller using the retractive switch to switch ON the inner row of luminaires first and the row of luminaires by the window second. The PIR and daylight sensor to be connected to the controller to provide the necessary inputs as required. The PIR detectors shall switch off the lights after a predetermined time when there is no occupancy in the room.

Wiring detail of a typical classroom can be provided on request.

Lighting controls elsewhere shall be preferably by PIR's with an override key switch facility.

3) EMERGENCY LIGHTING

Emergency lighting to be provided as required by legislation. All premises shall be provided with full emergency lighting; no relaxation or reduction in provision should be made for areas deemed not to be occupied during the hours of darkness, as the Council has no managerial control over the patterns of usage to which many buildings will be subjected by the occupiers. Emergency Lighting shall be provided in WC's where natural light is not available.

Individual battery-powered emergency luminaries shall be installed. Where more than three emergency luminaries are required, emergency luminaries having integral self-test facilities or connected to a centralised automated testing facility shall be provided. Where the number of emergency light fittings exceeds 25 points in a new building, the Designer shall consider and evaluate the installation of a central battery system. The system shall be 230/230V inverter type as Cooper Lighting or equal and approved.
The Designer shall produce a 'life cost' plan for 30 years to determine whether a self contained or a central battery system is to be used.

However where existing lighting circuits are to be retained (such as in extensions or refurbishment projects) local monitoring of existing final lighting sub-circuits may be impracticable. In such cases, individual battery-powered luminaries, having integral self-test facilities or connected to a centralised automated testing facility, shall be provided.

4) FIRE ALARM SERVICES

Fire detection systems and fire alarm systems shall be installed in accordance with the latest edition of BS 5839, County Council's standard and Fire Authority's recommendations. If being linked to an existing system, the Designer is to notify the Chief Engineer if the existing system does not comply with the latest edition of BS 5839 Part 1.

Generally, analogue addressable systems are currently only considered to be justified in larger premises, subject to the requirements of the Building Regulations and the Fire Risk Assessment.

For schools, automatic detection shall be installed to the Fire Risk Assessment requirements in high risk areas, IT rooms and main fire escape routes e.g., kitchens, boiler houses, electrical switch rooms etc. or either side of automatic self closing fire doors (unless specifically requested). Designers shall be responsible for ensuring that

their proposals meet the requirements of DfES Building Bulletin 100 and also incorporate the Council's Fire Risk Manager's current requirements in the light of fire and arson risk and insurance cost. Further guidance is available on request.

Equipment shall be manufactured by a Worcestershire County Council approved company only, and shall comply with the latest edition of the appropriate British Standard. It is essential that open-protocol systems are used such that the Council is not tied-in to a single supplier for subsequent extensions, modifications, maintenance and operation.

Class change facility to be incorporated where required and time delay to be provided for magnetic door holders during the operation of class change periods.

All 'standard' fire alarm wiring shall generally be in 'Firetuf' cable with appropriately coloured LSF oversheath, unless the Regulations dictate the use of 'enhanced' MICC cable in the building in question. Single runs shall be above false ceilings clipped to the building structure, multiple runs shall be supported on the cable tray.

The costs shall include for 12 months maintenance by the fire alarm specialist contractor.
Note: this is a particular WCC requirement for fire alarm installations, and the responsibility for the first year's routine servicing and maintenance at the Contractor's expense – not just defects and breakdowns – shall be included within Designers' tender documentation and specifications.

The fire alarm shall be interlinked with any door entry system such that upon receipt of a fire signal the panel will allow access through the doors controlled by the door access system

5) INTRUDER ALARM SERVICES

5.1 General

Intruder alarm security systems shall be in accordance with EN 50131-1 enhanced with NSI PD 6662 and ACPO DD 243. The designer shall undertake a Risk assessment of the premises and the system shall be designed to the following classification.

2X- Low risk –Audible only
2X – Low risk (enhanced) - Audible only with key holder response via a digitcom or speech dialer.
2B – Medium Risk – Audible system with Classic Red Care and sequential detection - Police response.
3B – High Risk – Dual Signalling with Red Care plus GSM sequential detection - Police response.

In a project involving work on any existing system, the Designer shall include the requirement within the project budget to make the existing systems fully compliant with the 2005 EN 50131-1 Grade “2” standard.

The installation and operation shall comply with the intruder alarm policy of the West Mercia and West Midlands Police Force.

5.2 DESCRIPTION OF THE INTRUDER ALARM SYSTEM

The equipment shall be suitable for operation on 230V 50 Hz mains supply, and shall incorporate battery back-up to maintain the system in an operating condition in the event of a mains power failure.

All circuits shall be monitored and shall generate an alarm condition on the panel in the event of cables being cut or shorted out.

The intruder alarm system shall comprise of the following pieces of equipment:

All Equipment to be Grade 3 classification

l No. Main Intruder Alarm End Station (Control Panel)

Requisite No. of Sub Main Panels (if required) linked to Main Panel.

Lockable document box located by the End Station

l No. Self-contained Weather-Proof Outside Bell, Dummy Bell boxes to be fitted on each elevation of the buildings.

Requisite No. Dual Technology Detectors complete with anti mask

Named Entry and Exit door Contracts or Detectors having Timed Circuitry.

Internal sounds to be audible throughout the building.

The Contractor is to ascertain from the user the nominated Entry/Exit doors for the buildings.

Remote power supplies as required.
Separate power supply unit for the Red Care unit.

Mains fused spur unit Surge suppressors must be fitted to the main control.

Shunt lock eg Chubb 5 lever lock ref. 3G 114 if required to outbuildings ie Mobile Classrooms, etc

5.3 AREAS OF PROTECTION

As a general guide adequate protection shall be provided to the following areas using the dual technology detectors.

Intruder Alarm Panel location
Head/Principal's Room
Secretaries Offices
Computer Rooms
Video/T.V. equipment room
Exam Result room
Photocopying Rooms
Music Rooms
Needlework Rooms
Corridors
Workshops

Ground Floor Laboratories and Prep. Room and lst Floor Laboratories where there is easy access of flat roofs etc.
Libraries
Any further rooms/offices where expensive equipment, money or School/college records are stored.

This is not an exhaustive list and the designer shall provide protection to other areas as identified in the Risk Assessment report

5.4 SYSTEM OF WIRING

The Intruder alarm system shall be installed by an NSI Registered Contractor carrying ‘GOLD’ accreditation.

The intruder alarm wiring system shall be completely segregated from all other wiring systems to avoid spurious signals and in accordance with the I.E.E. Regulations (Extra low voltage category 2 circuits).

Wherever possible, cabling shall be installed within roof spaces and routed such that the possibility of any mechanical damage to the cables is eliminated.

Cables in roof spaces shall be installed parallel to walls, and any change in direction shall be by means of right angle bends, no cable should be routed diagonally across any roof space.

All cables with the exception of cables run in plastic trunking shall be clipped to the fabric of the building. The plastic trunking shall be screw fixed to the fabric of the building; self adhesive trunking shall not be used.

In roof spaces containing steel work only, cables should be fixed with the aid of plastic tie wraps.

Cables passing through fire stop blockwork/partitioning in ceiling voids shall be protected by 25mm bushed galvanised conduit, (provided by the Contractor), packed with glass fibre material, and the cable tied at either end of the conduit with incombustible string for a distance of 75mm form the end of the conduit.

All holes around the conduit shall be made good to the thickness of the original blockwork/partitioning.

Surface run cables shall be concealed within Egatube Limited compact mini-trunking, YT2 or equal and approved.

Catenary wires between buildings, as a general rule shall not exceed 15m length, and they are to be run as high as possible. Before installation details of catenary wires runs shall be agreed with the Engineer.

If the distance of the catenary exceeds 15m, or if stated otherwise or catenaries are impracticable, intruder alarm cabling must be installed underground between buildings.

Underground cables shall be PVC SWA PVC armoured type cables or a suitable size, trenched to a depth of 450mm and covered with yellow identification tapes.

The Contractor shall allow for full excavation and permanent reinstatement to the trench to the Engineer's satisfaction.

If it is necessary to install alarm cabling in heating ducts it shall be enclosed in black plastic conduit manufactured by Egatube Limited, type H.I.P. or equal and approved, as for the miniature trunking all accessories and adhesives shall be used in its installation and the contractor shall take note of the installation recommendations made by the manufacturer.

Under no circumstances shall low voltage intruder alarm cables be installed in lift shafts or adjacent to mains cables carrying 230V.

Where ceiling tiles are removed and replaced, the Contractor shall ensure that no damage is caused to the ceiling grid or tiles.

In the event of damage, the Contractor shall be held responsible for replacement.

5.5 CONTROL PANEL (DIGITAL COMMUNICATOR - IF REQUIRED)

Multi zone control panels, as manufactured by Menvier Ltd M800 and M2000 series and matching Digital Communicator shall be positioned adjacent in the most appropriate and convenient locations.

The Installer shall advise the local Police Authority in writing immediately upon connection of the system and forward full details of two nominated keyholders.

It is the Contractor's responsibility to obtain the grid reference and forward the details to the Police Inspectorate. The Council's approved central station is

Security Express (Custodian)
Crocus Street,
Nottingham NG2 3EJ.
Tel no 08448 791704

The central station monitoring charge (the first year may be included in the contract) will be paid for by the Authority but it will be the responsibility of the installer after an initial test period to inform Security Express that the system is ready to go on line and be commissioned on completion.

The units shall be wall mounted at a height of approximately l,800mm above finished floor level. The final positioning of the Panels is to be agreed on site with the Engineer.

The Unit shall be fault and tamper-proof and incorporate warning lamps and/or liquid crystal display.

On type 2B and 3B the Intruder alarm system's final set to be carried out via a proximity reader or in the case of mobile classrooms with the use of a shunt lock.

An audible warning sounder shall be incorporated in the system to give indication when the entry/exit circuit is operating.

The Control Panels shall be supplied with a mains/battery unit with float charge stand-by facility, capable of operating the unit in the event of mains failure.

The system shall be zoned and circuited to take into consideration evening lettings in certain areas of the building.

It will be a design requirement of the system that during a specific sub-letting, all other areas can be protected.

5.6 SUB MAIN CONTROL PANELS

It may be necessary where a number of separate blocks exist on the site to have individual sub-main control panels for each block (or a number of blocks) which will then be connected to the main control panel in the Main Building.

This will enable the individual blocks to be used independently without affecting the system in the main or other buildings.

5.7 MAINTENANCE CONTRACT

The Contractor shall include in his tender summary the cost of a fully comprehensive maintenance contract for 12 months and to include two service visits (5month and 10 month).

The contract will be for a period of one year only from date of hand-over of an operational system and shall run concurrently with the defects liability period detailed within this contract.

At the end of this period the Contractor shall hand over the installation complete to the nominated Intruder Alarm Contractor named by Worcestershire County Council. During the hand-over the Installing Contractor will demonstrate the system and provide the Maintenance Contractor with a Schedule of Protection, copy of the specification and 'As Fitted' drawings, and shall programme a neutral code into the system.

6) DATA SERVICES

The data services shall be installed as per the clients requirements. The data installations in all buildings extensions shall be provided by the buildings data maintenance contractor. For new buildings the data services shall be provided by CIS or other approved contractor.

Where dado trunking is installed around the perimeter of the room, the dado trunking at each end shall rise to the ceiling void and link to cable basket. Drops to single outlets shall be run in UPVC conduit.

All major data cables runs shall be installed on a cable basket and any minor data cables shall be clipped to structure in ceiling void.

7) TELEPHONE SERVICES

The telephone equipment and wiring shall be supplied and installed by a specialist contractor under a separate contract from the client.
The designer shall indicate the telephone points as per the clients requirements and shall liaise with the client, specialist contractor etc as necessary.

8) DISABLED WC CALL SYSTEM

A disabled toilet alarm call system shall be installed. The system shall comprise a call push or call pull switch, reassurance light, sounder and re-set push.

9) ENERGY MANAGEMENT SYSTEM

The County Council has a Building Energy Management System (BEMS) for controlling and monitoring boiler equipment and therefore wiring should be in accordance with any existing or new system controls as required, and the electrical requirements of the mechanical wiring installation specification. Fan Convectors shall be fitted with non-switched fused spur units.

10) INCOMING SUPPLIES

Selection of the appropriate Electricity Suppliers tariff must be such that the most economical one is supplied, bearing in mind load, annual usage, and potential for off-peak use. Electricity is purchased via West Mercia Supplies, who run the contract on behalf of Worcestershire County Council. http://www.westmerciasupplies.co.uk

Designers shall be responsible for assessing the adequacy of existing incoming mains supplies to support any planned increase in electrical load for the proposed development. This should be undertaken as part of the initial feasibility or outline design in order to permit uprated supplies to be procured in good time if necessary. Designers should commission a load measurement exercise where necessary to establish the existing load, the cost of this exercise being identified and incorporated within the Designer's fee bid or project cost plan whichever is the more appropriate.

11) It has been found on many projects that the electrical installations have pierced the vapour barrier provided in the roofs. All designs for electrical works must ensure that conduits and other fittings are positioned such that the vapour barrier in any building construction is not pierced, other than for fixings, and where these fixings occur their exact arrangement must be agreed with the Project Architect.

LIFT INSTALLATIONS

1. Lifts shall be provided in accordance with a specific designer's brief which will be provided by Worcestershire County Council for the particular project, and be in full accordance with all current and relevant British and European standards, including BSEN81/1 1998 for electric lifts, and for hydraulic lifts BSEN81/2 1998. The requirements of the SAFED guidelines and the Provision and Use of Work Equipment Regulations 1998 shall also be complied with. Lifts shall be selected from the ranges of the preferred manufacturers listed elsewhere in this document.

2. Durability is essential in all components and finishes, with ease of maintenance, and a life expectancy of twenty-five years is required before major reconstruction becomes necessary.

3. Full maintenance should be included during the twelve-month guarantee period, with twenty-four hour attendance in the case of residential accommodation. **Note: this is a particular WCC requirement for lift installations, and the responsibility for the first year's routine servicing and maintenance at the Contractor's expense – not just defects and breakdowns – shall be included within Designers' tender documentation and specifications.**

4. Digital communicators shall be open protocol made by MENCO or Wing Crest. At the end of the twelve month warranty period the codes shall be changed to a neutral number to be agreed with the engineer.

5. A full set of O&M manuals to be left in the lift motor room

AUTOMATIC CONTROLS

Standard requirements for Design Engineers and Consulting Engineers

Design concepts

Provide a comprehensive automatic controls specification for procuring a Building Energy Management System as part of the Mechanical Engineering sub-contract package.

The automatic controls specification will include:

- The motor control panel or panels (MCP);
- The specialist electronic control equipment, manufactured by either of the Council's approved suppliers Schneider TAC (Tour Andover Controls) or Trend Services;
- The writing and loading of software to site-based controllers and central station located at County Hall, including graphics, by the control system manufacturer;
- All proprietary and non-proprietary control equipment intended for field installation, such as valves, actuators, sensors, pressure switches, pockets etc whether supplied under the contract or 'free issue';
- All site electrical wiring and containment associated with the mechanical services plant;
- Comprehensive testing, commissioning and handover of the entire mechanical and automatic controls system and its associated electrical wiring;
- Integration with elements supplied by others, such as window actuators, natural ventilation dampers etc.
- Control equipment such as valves, dampers etc shall generally suitable for 24 VAC power, 0-10 V DC signals.

The Designer shall consult and agree with the County Council a definitive points schedule for each project and the specific control equipment manufacturer to be used. This will be one of the following two approved companies with whom the Council has partnering arrangements:

TAC.UK
Midlands Division (EUP5)
Smisby Road
Ashby-de-la-Zouch
Leicestershire
LE65 2UG
Tel No. 01530 417733

Trend Services (Novar Systems Ltd)
Central Division
PO Box 34
Horsham
West Sussex
RH12 2YF
Tel No. 01403 226931

BEMS Control 'Points'

The Building Energy Management System will control and monitor all items of plant, as detailed on the HVAC schematic diagram for the project, together with any other existing systems within the building(s) that may be specified to be under the control of the BEMS. The Designer shall ensure that all existing time clocks or independent controls are removed, and control incorporated within the new BEMS. This may include domestic hot water heating whether centralised or distributed, ventilation plant, air conditioning and other similar systems, but shall exclude internal and external security lighting which shall not be included as part of the Building Energy Management System. The principle is to centralise time schedules and environmental control of the whole building into the BEMS and thus to optimise energy consumption reductions.

The use of 'stand alone' controls at a BEMS-controlled site is normally limited to self-acting thermostatic radiator valves in selected locations, local thermostats for fan convectors, and temperature controllers for localised comfort cooling or 'air conditioning' split systems. However, in the latter case a link to the BEMS shall be provided comprising a 'start-stop' signal and, where possible, a common fault alarm input. This is to prevent wasteful operation out of hours, and to enable cooling systems to be held-off while space heating is running.

BEMS Monitoring

The Building Energy Management System shall provide both environmental performance and status monitoring of the plant to enable remote control and operation of the installations. The principle is to provide comprehensive monitoring to include remote indication of unauthorised operation, as well as plant alarm and failure, to reduce the risk of building closure and lost availability. For this reason, the range of parameters monitored is more comprehensive than would normally be encountered in general commercial engineering practice.

Control panels are also not provided with 'HAND/AUTO/OFF' switches. Switches shall have 'AUTO' and 'OFF' positions only. Hand operation shall be by a monitored single manual plant over-ride keyswitch.

The following conditions shall be monitored:

General

Boiler house fire safety circuit operated
Control panel opened or isolated

Mechanical plant including HWS generation and AHUs

Boiler or burner isolated
Burner lockout
Pilot failure (existing plant only – no new permanent pilot gas fired plant to be specified)
Boiler high temperature
Boiler MCB tripped
Boiler held off due to interlocking with pumps
AHU motor fault
AHU frost call
AHU flow failure

Pumps

Pump MCB tripped
Pump overload tripped
Pump running current normal ('flow established' condition)
Dual pump set changeover
Pump isolated

Pressurisation sets

Set isolated
Set MCB tripped
Pump overload tripped (where installed)
Direct mains fed system alarm (where installed)
System high/low pressure alarm

Control valve actuators

Actuator isolated

MCBs in control panel

MCB 'off' condition

Temperature monitoring

Common hot water flow and return temperature
Incoming cold water mains temperature
Heating zone sensors for trimming

Automatic Ventilation, Natural or Mechanical systems

CO2 and temperature monitoring (CO2 control takes precedence over temperature control)

System over-ride

Manual operation of plant over-ride keyswitch

Plant run time extension

Manual operation of plant extension switch
All alarms to be monitored during extension period

INTERPRETATION AND POINTS OF CONTACT

The following is a list of post holders with whom Designers are invited to liaise and who can provide technical advice or interpretation of these guidance notes, if required, during the design process:

- Chief Engineer
  Tel. no. (01905 766406)
- Principal Engineer (Electrical)
  Tel. no. (01905 766428)
- Principal Engineer (Mechanical)
  Tel. no. (01905 766424)
- Principal Engineer (Energy)
  Tel. no. (01905 766436)
- Property Risk Management Officer
  Tel. no. (01905 766131)
- Energy Analyst
  Tel. no. (01905 766448)

Enquiries are invited by e-mail to pnharris@worcestershire.gov.uk

PREFERRED MANUFACTURERS (deviations from this list are subject to prior approval)

MECHANICAL SERVICES

1	**Boilers**	**2**	**Burners**
	Both cast iron sectional and steel		Nuway (preferred)
	Viessmann		Weishaupt
	Ideal		Reillo
	Clyde Combustion		
	Hamworthy	**2a**	**Biomass Boilers**
	Hoval		
	Broag		KWB
	Strebel		Talbotts
	MHS		Frohling
	Worcester Bosch		Nu-way (domestic size only)
	Buderus		Hoval
2b	**Ground Source Heat pumps**	**2c**	**Air Source Heat pumps**
	Viessmann		Viessmann
	Dimplex		Mitsubishi
	Worcester Bosch		(To be agreed with WCC)
3	**Gas Water Heaters**	**4**	**Electric Water Heaters**
	Andrews		Zip
	Hamworthy		Heatrae Sadia
	Hoval		Santon
	Vaillant		Stiebel Eltron
	Lochinvar		
5	**Metal Flues/Chimneys**	**6**	**Circulating Pumps**
	A I Bridge		Armstrong Holden Brooke Pullen
	Midtherm		Wilo
	Hamworthy		Grundfos
	Selkirk		Biral
7	**Sump Pumps**	**8**	**Control Systems (Stand Alone)**
	Flygt		Trend
	Grundfos		Schneider TAC
	Holden Brooke Pullen		Refer to Automatic Controls section

Preferred Manufacturers – Mechanical Services cont'd

9	**Control Accessories**	**10**	**Energy Management System**
	Valves: Sauter Room thermostats: Sunvic Pipe thermostats: Sontay Electronic thermostats: Allen Martin Clocks (with back up): Sangamo Grasslyn		TAC 'Continuum' Trend '963' Refer to Automatic Controls section
11	**Valves**	**12**	**Air Vents**
	Crane Hattersley Taconova direct reading commissioning valves (preferred)		Spirax Sarco Winns
13	**Steel Radiators**	**14**	**Cast Iron Radiators**
	MHS Hudevad Myson Runtalrad Sensotherm Caradon Plumbing Solutions (Stelrad)		Clyde PMP MHS
15	**LST Radiators** - all to have smooth edges MHS Myson Stelrad Sensotherm	**16**	**Natural Convectors** Biddle Dunham Bush S & P Coils
17	**Fan Convectors**	**18**	**Unit Heaters**
	Biddle Dunham Bush S & P Coils		Biddle Dunham Bush S & P Coils

Preferred Manufacturers – Mechanical Services cont'd

19	**Gas Space Heaters**	**20**	**Radiant Panels – Water**
	Benson Drugasar ITT Reznor Powermatic Tempcana Vulcana		Comyn Ching (Solray) Dunham Bush Frenger
21	**Underfloor Heating**	**22**	**Gas Radiant Panels**
	(Only to be specified after approval by WCC) Wirsbo Rotex Warmafloor		Ambi-Rad Hoval
23	**Control Panels – EMS**	**24**	**Control Panels – General**
	IPA Chapter Controls Isis Controls Brunel Controls Concord Controls		IPA Chapter Controls Isis Controls Brunel Controls Concord Controls
25	**Insulation**	**26**	**Fan Dilution Systems**
	Refer to Trade Pre-ambles		Air Flow Developments Hamworthy
27	**Air Handling Units**	**28**	**Roof Extract Units**
	Roof Units VES Andover Senior Moducel Nuaire Dunham Bush		Myson Nuaire Roof Units Woods Vent Axia
29	**Wall / Window Fans**	**30**	**Air Conditioning Units**
	Roof Units Vent-Axia Xpelair Greenwood Airvac Nuaire		Mitsubishi Daikin Hard-wired remote controls only

Preferred Manufacturers – Mechanical Services cont'd

31 **Fans**

Myson
Roof Units
Woods
Vent Axia

32 **Silencers**

TEK Ltd
Or by fan or AHU supplier

33 **Cold Water Tanks**

Decca
AC Plastics
Dewey Waters
Nicholson Plastics
Polytank

Note: All tanks to comply with current Water Regulations

34 **Feed and Expansion Tanks**

Decca
AC Plastics
Dewey Waters
Nicholson Plastics
Polytank

35 **Showers (TMV3)**

Caradon Plumbing Services (MIRA)
Reliance Water Controls

36 **Blenders**

Reliance Water Controls (RWC)

37 **Showers (Electric)**

Mira Advance ATL
Triton Millenium Care

38 **Gas Safety Valves**

Black Teknigas
TCW Services Ltd
Landon Kingsway
Johnson (Maclaren)

39 **Pressurisation Units**

Mikrofill (Bromsgrove)

40 **Urinal Control Valves**

Cistermiser (passive infra-red)

41 **Water Treatment**

To be agreed with WCC

42 **Gas Proving Panels**

TWC Services (Controls)
Duomo
Medem

43 **Gas detection**

Electronic Devices

Worcestershire County Council
Corporate Services Directorate - Property Services

Preferred Manufacturers – Electrical Services (deviations from this list are subject to prior approval)

1	**Distribution Board and MCBs**	**2**	**Wiring Accessories**
	MEM Eaton Crabtree Dorman Smith Hager MK Square D Wylex Merlin Gerin		Ashley Crabtree Delta MK MEM Eaton Legrand
3	**Call Systems**	**4**	**Fire Alarm / Class Change**
	Quantec C-tec Static Systems Wandsworth		Morley - IAS Gent C-tec
5	**Lightning Protection**	**6**	**Standby Generators**
	Crown House Furse A W Elliott BICC Best Omega		Dale Lister Petbow F G Wilson
7	**Contactors**	**8**	**Safety Cut-Outs**
	E N Bray MEM Eaton Square D		Blakley FDB
9	**Security Alarms**	**10**	**Off Peak Heaters**
	As Approved List of Contractors Panels: Cooper Menvier M-series Detectors: Honeywell		Creda Dimplex Stiebel Eltron
11	**Emergency Lighting**	**12**	**Purpose Made Distribution Boards**
	Emergency Power systems Whitecroft Menvier Bradley Lomas		Switchgear Specialist Ferrofort Engineering

13	**Lifts**	**14**	**Cables**
	Thyssen Express Pickerings Schindler		BICC Crompton Delta Enfield Pirelli
15	**Metal Trunking and Conduits**	**16**	**Plastic Trunking & Conduits**
	Marshall Tufflex Centaur Walsall Legrand		Egatube Marshall Tufflex Centaur Walsall
17	**Lighting Fittings**	**18**	**Outside Lighting**
	Low energy sources are required, and the following manufacturers would be accepted: Coughtrie, Crompton, Lumitron, Marlin, Osram, Phillips, Thorn, Design Plan, Concord, Linolite, Whitecroft or M&S Lighting. Others to be agreed with the Principal Engineer (Electrical Design).		
19	**Stage Lighting**	**20**	**Flameproof Equipment**
	CCT Stage Lighting Ltd		Simplex GEC Walsall