UWE Estates Design Specification

Chapter 6: Mechanical Engineering

UWE Bristol | University of the West of England

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6.1 Change Control

Version Number	Date of Issue	Chapter Ref	Brief Description of Change(s)

1.4	01/05/19		Numerous updates throughout.
1.5	Nov2019		Numerous updates throughout.
2021	Jan 2021		Various updates throughout as detailed in 2021 Version
2022	JAN2022		Various updates throughout as detailed in 2022 Version
2023	JAN2023		Various updates throughout as detailed in 2023 Version
2024	FEB2024		All sections updated and reworded to Design Specification

General Mechanical Design Principles

This Design Specification sets out the minimum standards of engineering services to be applied. It is not intended to stifle innovation or technical advances.

UWE adopt low carbon principles in line with UWE target to be net-zero carbon by 2030. A fundamental requirement is to design out avoidable energy requirements, particularly fossil fuels. Demand reduction takes priority over covering energy requirements through low carbon or renewable sources. The design should apply the principles of Low Carbon Design:

- Understand energy use in the building type
- Use the form & fabric of the building to minimise energy demand
- Focus on thorough insulation and air tightness
- Use high efficiency building services with low carbon fuel
- Manage energy within the building
- Use low carbon and renewable energy systems
- Ensure all systems are operating at peak efficiency

The design shall follow the principles of the energy efficiency hierarchy:-

- Reduce demand by using passive measures
- Use energy efficient equipment and controls
- Use low carbon and renewable technologies

The design shall consider implications of a changing climate. UWE use their buildings throughout the year and therefore all buildings shall be thermally modelled considering extremes of heat and cold, and future-proofed for flash floods as well as temperature.

Mechanical Design

All designers shall consult with a range of stakeholders including end-users, Estates, and the Facilities departments.
A4ll designers shall survey existing services to ascertain implications of any works. A condition survey may be required.
The designer is responsible for checking the suitability of all existing services and supplies, capacities, etc. at inception.

Design Co-ordination

- Analysis of the building's façade in conjunction with the building designer and structural engineer to assess thermal performance and ultimately to increase energy efficiency.
- Liaise with all members of the design team including the building designer and structural engineer to provide an integrated building/ structural / services installation. This must include coordination of mechanical builders work requirements, plant space and significant apertures within the structure.
- Coordination is also required with the electrical services designer regarding the power and control requirements for the mechanical services.
- When trenching, coordination is expected to provide suitable and sufficient excavations to accommodate mechanical, electrical, and data requirements. A minimum 50mm data duct at 350mm depth should be provided in any trenching work.
- External Shading should be considered in conjunction with the building designer to consider the full implications including minimising the effects of unwanted heat gain to occupied space. This should be done from project inception.

Plant, System Selection and Location

- Selected to maximize operational efficiency and availability.
- To suit ambient conditions (thermal & noise) during all seasons, incorporating future-proof for climate change.
- Continuity with existing plant and manufacturers where appropriate, particularly any district heating network on site.
- Business Continuity and resilience with regard failure of main services and / or utilities.
- Consideration of maintainability and the minimisation of impact within occupied spaces
- Major plant should be located at Ground Level. If this is not achievable then approval will be required from UWE Estates Operations, along with a fully detailed Access and Maintenance Strategy.

Schedule of Statutory Notifiable Plant.

Certificates for the factory pressure testing of boilers, calorifiers and other pressure vessels must be specified at tender and provided at handover.

All Safety Pressure Relief Valves must be pre-certified and pre-tested before installation, physically tagged with all relevant and required information on site, and certification provided at handover.

Fume Cupboards will be of fire resisting construction, provided with smoke / fire detection and consideration for their own suppression system subject to fire risk assessment. In the event of a temporary loss of power the Fume Cupboards shall be capable of automatic restart

Any statutory notifiable plant under the requirements of PSSR, must be included on the register of relevant statutory equipment examined by the University's competent engineers appointed by the University's insurer.

Pumped Water and Air Circuits

Water pumped circuits should have at least 100% standby (excluding HWS secondary, where a spare pump shall be provided).
+10% to be added to all pump duties (head & flow) to make allowance for commissioning tolerances.

In every instance variable volume pumps/fans with static pressure control via the BMS shall be considered. This is important when future expansion of the installation is envisaged.
Variable speed drives should be utilised where appropriate and have differential pressure sensors rather than switches.

Local visual indication via temperature and pressure gauges should be provided in addition to BMS sensors (BMS sensors alone are insufficient).

Metering

Refer to chapter 12: Controls & Metering Standards.

General Drainage

Drainage pipework must not be routed in locations where a leak could cause a hazard, such as above electrical equipment / electrical panels, data cabinets, etc.
External drains, gutters and downpipes shall be sized to consider climate changes regarding heavy rainfall.
HDPE or Stainless Steel shall be used for drainage.

UWE prefer gravity drainage. Sewage pumping, including of condensate, must be avoided. If a pumped solution is deemed unavoidable then approval for its use must be obtained from the UWE Estates team. UWE will need detailed justification and assurances that the system offers adequate reliability and resiliency (e.g., through provision of back up pumps).

Laboratory/Industrial Waste Drainage

Vulcathene pipework shall be used for chemical drainage including laboratories and workshops.
All drain runs which will carry hazardous or radioactive substances, must be labelled accordingly.

Waste traps/catch pots must be labelled with appropriate warning signage and contained in labelled cupboards.

This list of substances cannot be put down the drain without notifying the sewerage provider, who then needs to notify the Environment Agency:

Mercury and its compounds	Dieldrin	Tributyltin compounds
Cadmium and its compounds	Endrin	Triphenyltin compounds
Gamma-hexachlorocyclohexane	Carbon tetrachloride	Trifluralin
Pentachlorophenol and its compounds	Polychlorinated biphenyls	Fenitrothion
	Dichlorvos	Azinphos-methyl
DDT	1,2-dichloroethane	Malathion
Hexachlorobenzene	Trichlorobenzene	Endosulfan
Hexachlorobutadiene	Atrazine	Trichloroethylene (above 30kg/year)
Aldrin	Simazine	Perchloroethylene (above 30kg/year)

The use of these substances shall be avoided where possible. Where the use of one of these substances is proposed by a School or College, the designer shall inform and review the full implications with the design team and UWE School / College.

Piped Supply Systems

Distribution pipework should generally be to match the existing installation.
The use of plastic pipework is generally not accepted (excluding overflows and warning pipes etc.).

Water services pipework must not be routed in locations where a leak could cause a hazard, such as above electrical equipment / electrical panels, data cabinets, etc.

Low level copper pipework to radiators is prohibited without prior agreement with Estates.

System expansion allowance shall be made in pipework design, and not expansion bellows.

Services for open plan accommodations should be designed on a grid basis.

Heating Pipework

All heating pipework up to and including 125mm shall be installed using mild steel pipes to BS1387, heavy grade, black varnished finish.
All heating pipework 150mm and over shall be installed using carbon steel grade 430 pipes to BS3601 ERW, dimensions to BS3600 table 1, standard mill protective coating finish.

All heating cold feed and open vent pipework, and safety valve or vent cock discharge pipes, shall be installed using mild steel pipes to BS1387, heavy grade galvanised finish.
All pipework off air bottles or AAV's shall be copper to BS2871, part 1, table X or Y.

All black steel pipework up to and including 50mm shall have screwed joints to BS21 taper thread.
All black steel pipework 65mm and over shall have welded joints or flanged joints throughout.

Joints shall not be permitted within any part of the building fabric.

Screwed fittings on black mild steel pipework, other than sockets, shall be malleable cast iron to BS6681, having ends to BS143 or BS1256, black finish manufactured by Crane Ltd.

Fittings on welded pipework shall be carbon steel grade 430 seamless, to BS1965, part 1, heavy, having bevelled ends, varnished finish.

Joints shall be provided as necessary to enable all pipework to be dismantled without cutting.
All heating pipework throughout shall be adequately thermally insulated everywhere.

Hot & Cold-Water Services

The designer is responsible for checking the suitability of all existing supplies at project inception. If record information is not available, the designer shall either survey or request and provide a brief for any surveys required. The designer if required shall contact the relevant statutory supplier to establish suitability of supply capacity.

The Designer shall formally notify the statutory supplier (Bristol Water) of new installations and alterations as per the Water Regulations. Formal approval from Bristol Water must be received prior to works starting on site and included in all handover documentation.

All water services must be designed to eliminate or minimise aerosol production and water retention. They must also be designed to be readily drained, internally inspected, and cleaned.

Prior to working on any domestic water service all tools must be suitably cleaned and chlorinated. All new fittings shall be suitably clean and chlorinated. All new pipework must be chlorinated by a competent Contractor within a 7-day period prior to use. Chlorination certificates must be provided prior to use.
All components must be cleaned and disinfected prior to installation, or the entire system completely cleaned and disinfected prior to re-instatement to service. Sampling of sentinel and representative outlets shall be taken no sooner than 48 hours later to prove efficacy of the disinfection.

All hot and cold distribution pipework, cold mains and cold tank down feeds, and hot pipes shall be located to minimise heat gains to and from their environment. Pipework shall not be routed through hot ducts or run adjacent to heat sources, such as radiators.
Ensure the hot water pipework is installed above the cold water pipework.

All hot and cold-water pipes throughout shall be adequately thermally insulated everywhere.
All plant and distribution pipework shall be clearly labelled throughout.
No rubber fittings nor any flexible hoses are to be installed in any domestic water system.

All above ground Water Services pipework up to and including 133mm shall be installed using copper tubes Table X, uncoated or current equivalent. Flexible connections are prohibited.
Above ground Water Services pipework 159mm to 219mm shall be installed using copper tubes to temper annealed, Table 5 up to 7 bar working pressure, and Table 6 up to 17 bar working pressure.

Infrared Sensor Taps and Infrared toilet flushes are not to be fitted.

The Designer must consider the possibility of loss of the mains water supply and must include injection points if required. UWE has a Water Resilience Policy which identifies injection points for maintenance of water supply via the provision of bowsers.

Temperatures shall be recorded at all outlets and storage to prove that the system can deliver the correct temperature water within the correct time period. Disinfection, sampling, and temperature certificates shall be provided.

Where substantial modifications or new systems have been installed, an independent review of the Water Safety Plan and Risk Assessment incorporating the Legionella Risk Assessment shall be carried out and funded by the Project. The Risk Assessment shall be carried out before commissioning or sampling, and a follow-up review of the Risk Assessment shall be carried out after a short period of occupation.
Where substantial modifications or new systems have been installed, a sampling plan shall be prepared in line with BS7592 and BS8554 and submitted to the Water Safety Group and Responsible Person for approval and funded by the Project.

Water Conditioning

Water Conditioning or water softening must be considered and installed in all hot and cold water services as Bristol is a very hard water area.
UWE prefers the use of electronic water conditioners that are fitted externally to the water pipe, providing protection against limescale. See section below for preferred suppliers.

Electronic water conditioners are designed to make the scale clump together and then drop out in the bottom of the cylinder, thus making it easy to remove the scale during the cylinder annual inspection. However, many new water heaters only provide small inspection hatches which are not adequate for physically removing scale or vacuuming out deposits from all of the bottom of the cylinders. In these instances only, water softeners must be considered.

Cold Water

A mains water service with no tanked supplies should be utilised wherever possible.
If cold water storage is required it should have a minimum of two independent, fully hydraulically balanced tanks to minimise down time during times of maintenance.
To minimise the risk of water stagnation or bacteriological growth, storage capacity shall be minimised to ensure sufficient turnover.

Sectional Cold Water Storage tanks shall be designed with external assembly flanges and self-draining profiles, since this arrangement facilitates easy cleaning of internal surfaces.
Externally located cold water storage tanks shall be suitably protected from environmental conditions.
Cold water storage tanks shall be protected from the ingress of light, insects, vermin, birds, etc.
Delayed-action ball valves shall be fitted wherever possible to avoid stagnation of water.
The feed to each tank shall be fitted with a water meter to allow for confirmation of equal and uniform usage from all tanks in any configuration.

Where booster pumps are to be installed, a break cistern will be required between the mains supply pipe and the pumps, to comply with the Water Supply (Water Fittings) Regulations 1999

for backflow protection.
Control of the pump(s) should be fully automatic in operation and controlled by pressure sensors. Where two or more pumps are installed, the design flow should be achieved with one pump for resilience. Automatic control shall be provided to cyclically and sequentially control all pumps to ensure that each is regularly brought into service.

Communal drinking water should be dispensed via proprietary "Hydration Station" refrigerated units with carbon filters, bottle filling as a well as drinking facilities and gravity drains.

Combined boiling / ambient / chilled water taps shall not be installed unless agreed with Estates.

To prevent any confusion between Cat 5 and domestic pipework, Cat 5 pipework shall be clearly labelled and insulated with Isogenopac throughout.

Domestic washing machines and dishwashers must have appropriate back flow protection to current Water Regulations (nominally Cat 3).

External taps for irrigation / washdown purposes, or for window cleaning, are prohibited without prior discussion with Estates. Where unavoidable, appropriate back flow protection to current water regulations must be installed.
All outside taps and bib taps shall have Fluid Category 5 backflow protection.

RPZ non-return valves shall not be used without the approval of UWE Estates Engineer.

Scald Risk Assessment

Thermostatic Mixing Valves Type 3 (TMV's) and Taps (TMT's) are not to be fitted. Only high risk areas such as Doc M Accessible Facilities, Childcare facilities, open public Sports Facilities supported by the completion of a scald risk assessment, shall have Type 3 TMV's or TMT's fitted.
Thermostatic devices that are integral to the body of the tap/shower are preferred as it reduces the length of blended water and ensures the cold water is drawn through every time the outlet is used. A TMT is preferred to a TMV in terms of bacterial risk.

These must be fitted to be fully accessible for routine maintenance. Populations that are most vulnerable to scald risks include children, older people, people with reduced mental capacity, mobility or temperature sensitivity, and people who cannot react appropriately or quickly enough to prevent injury. All other public facing areas can have separate hot & cold taps, or mixer/blender taps installed with no integral thermostatic mixer.
No remote TMVs shall be used on water systems.

Hot Water

Where a Hot Water Return is installed, a single inline circulator pump should be installed on the return. For reasons of reliability, two pumps shall be proposed, with one pump fitted in the pipe with the second pump provided as an immediate spare within the plant room. They must not be installed in parallel as this introduces areas of stagnant water.

Central water generators should have a minimum of two generators for continuation of supply during times of maintenance. Where more than one generator is used, they shall be connected in

parallel, taking care to ensure that the cold feed, the hot flow and the hot return are all fully hydraulically balanced to ensure equal flow through each.

The combined storage capacity and heater output must be sufficient to ensure that the flow temperature, at continuous design flow of at least 20 minutes from calorifiers or other heaters, shall not be less than 60°C. This applies to both circulating and non-circulating hot water systems. The positioning of the control and high limit thermostats, cold feed and return water connections must ensure that these temperatures are achieved.

All HWS shall be stored at 60°C and warning labels provided at all outlets where there is a risk of scalding.
Storage calorifiers should be selected and designed to be capable of raising cold water from 10°C to 65°C, within a two hour recovery period.

Temperature gauges / temperature indication are to be provided to hot water flow and hot water return to all calorifiers. Immersion sensors are to be used in preference to strap-on sensors.
Vents shall be arranged to discharge over a separate tundish with visible Type A air gap, sited at a level that takes account of the hydrostatic head of the system.

Cathodic protection from galvanic action by means of sacrificial anodes shall be provided.

Hot water return shall be routed to the base of the calorifier to ensure the full contents of the calorifier are moved. Where the return is not at the base of the calorifier then all Calorifiers shall have anti-stratification pump circuits.

All Calorifiers are to have fully accessible drain points, directly off the lowest point of each Calorifier, with minimal dead-leg, to take samples and assure full drain down.

A check valve shall be provided in the cold feed, as close to the calorifier as practicable, to prevent warm water affecting the cold water feed. The installation of such a check valve shall not be carried out in systems that use the cold feed for expansion, and a U-bend or S-bend shall be installed in the cold-feed, sufficient distance from the connection to the calorifier, so that water which is warm is not displaced (on heating up) beyond the bend and the vertical pipe rise.

Expansion vessels used on potable water supplies shall be of a flow-through type. Where pressurisation vessels are of the single-entry type, they must be fitted with appropriate flow-through valves or drain valves to facilitate flushing of the unit. Expansion vessels shall be located on the cold feed rather than on the hot water side of the system.

Surface (i.e. non-intrusive) scale-prevention plant should be provided when performing extensive works to existing central HWS generators.
New plant shall have probes mounted within the pipework.

Natural Gas

All gas services shall be in accordance with all relevant British and European Standards, IGEM Series and references, The Gas Safety (Installation and Use) Regulations 1998, this UWE Design Specification, and the UWE Gas Safety Management Policy HSP_003 and all Appendices.

Pipework is only to be installed by competent persons, keeping mechanical joints to a minimum and initial tightness tested. All external gas pipework shall be yellow, kitemarked MDPE with trace wire.

All gas pipework to be clearly labelled GAS.

Gas installation line diagrams for new installations and all amendments to existing must be provided. They shall be mounted on site plus a copy given to Estates at handover.

The Gas DSEAR Risk Assessment must be reviewed and updated with details of any new installation and amendment.

Gas detection systems linked to gas solenoid valves shall be provided within all boiler houses. For installations over 300KW, these shall be linked to the BMS.

Where Gas solenoid valves are provided the system must be designed to ensure they do not auto open upon power re-instatement, plus control provision should be made such that its power supply is not interrupted during UWE's regular fire alarm testing regime.

Gas pipework shall not have any joints that are above the high-level ventilation provision, and absolute minimal joints within 500mm of ignition source. Within plant rooms and enclosed spaces, gas pipework should have no joints upstream of the solenoid / isolation valve.
Adequate isolation valves and purge points shall be fitted to enable annual pipe tightness testing.

Emergency Isolation Points and gas proving systems shall be provided in all laboratories and kitchens.

Hard-wired interlock of gas supply with extract air for all main kitchens is essential.

Medical Gas/Laboratory Gas/Compressed Air

Pressurised systems, pressure vessels, pressure relief devices, etc. must all be identified on the register of relevant statutory equipment examined by the University's competent engineers appointed by the University's insurer.
In addition, Air Compressor systems must be added to the UWE Estates Risk Assessment RA_016.

Mechanical Ventilation

Ducted supply **ventilation**: Major supply AHU's (above 0.5m3/s) should have the following:

- Pre filter: panel to EU3
- Main filter: Bar to EU6
- BMS pressure sensors across both filters.

Facility for recirculation of air where possible via motorised dampers. Where full fresh air is essential, other methods of heat recovery shall be evaluated.

Air Handling Units: Packaged units must be able to be fitted with UWE BMS controls, such that the UWE BMS completely controls the AHU, with full visibility of the AHU status at the UWE BMS head-end.

Automated windows and Ventilators: Where installed, they should be complete with position indication or contacts**.**

Variable speed **drives**: Use of these drives to be assessed to maximise efficiency of the system.

Direct drives: Fan power should be of the direct drive type as opposed to belt drive.

Fire damper type: To be specified and installed for ease of annual testing, external resettable fire dampers shall be used wherever possible. The designer shall witness the operation of all fire dampers as part of their witnessing of the commissioning process.

Displacement Ventilation: Use of this principle is preferred where practical and cost effective.

Intake and discharge locations: These should be considered at an early stage in the project whilst applying good design principles and CIBSE guide B recommendations. Consideration of discharge and intake pollution must also be considered.

Where cost effective, a ground coupled fresh air supply system shall be used.

In all cases, the risk as detailed in the Water Safety Plan, including the legionella risk, of passing intake air over water should be considered and low-level air intakes should be sited to avoid any accumulation of floor washing or rain water.

Ducted supply & extract fans: Differential Pressure Switches to be mounted across all fans.

VAV supply & extract fans: These should have differential pressure sensors rather than switches.

Humidification: Humidifiers are not accepted. Approval must be sought from UWE Estates for the use of any humidification or dehumidification equipment.

Exhaust Air heat recovery: A section of appropriately sized ductwork section shall be allowed for the future retrofit of heat recovery before the external exhaust weather louvre, this applies even if the AHU's have Plate heat exchangers or thermal wheels.

Fire hydrants

The requirement and position of fire hydrants will be determined by the fire strategy. UWE has a full suite of drawings showing the existing hydrant circuit.

Fire Hydrant marker posts shall be set in concrete to anchor them into the ground. The posts shall be as manufactured by "Elite Precast Concrete" type Hydrant Post – CG305A.
The "H" signs shall be supplied by "Safety Sign Notices Ltd".

UWE insurers specify that all fire hydrant covers must be highlighted by yellow paint. This is in addition to the marking requirements in BS 750: "surface box covers shall be clearly marked by having the words "FIRE HYDRANT" in letters not less than 30 mm high, or the initials "F.H." in letters not less than 75 mm high, cast into the cover." UWE requires the use of "FIRE HYDRANT", rather than "F.H." unless space constraints prevent this.

All hydrants must be installed to allow fully accessible maintenance.
Handover documentation for each hydrant from the Contractor shall include:

- Certificate of Conformity in line with BS9990.
- Flow test in Litres per minute
- Pressure test in BAR
- Signage information
- Pit and cover information
- Depth of valve

Mechanical Heating/Cooling/ Refrigeration Systems

Heating Season (air temperature)

Winter ambient: - 5.5°C db/100% RH
100% outside air ventilation ambient: -7.0°C db/100% RH
Allowances for intermittent heating: as per CIBSE guides.

Cooling Season (air temperature)

Summer ambient: 28°C db/20°C wb
Summer ambient (heat-rejection plant): 30°C db/21°C wb

Mechanical cooling shall only be considered by UWE Estates once the use of natural cooling has been fully considered in accordance with TM52. TM52 shall also be used to establish the set point of any mechanical cooling system utilised.

Heating

Flow and Return Wet System Temperatures:
Optimum flow and return temperatures to achieve peak efficiency shall be selected dependant on the heat source. Generally, the flow temperature shall be kept as low as possible, with the greatest

delta T across the heat emitter, if an existing heating source is used the flow shall be no higher than 60^0C.

Heat source: Low or zero carbon heating sources shall be used. Fossil Fuel heat sources shall not be used. An assessment should include consideration of connecting to the proposed district heating network at Frenchay Campus, and any other known, existing or, proposed district heating systems in the proximity to the specific site whether UWE-owned or by another.

Supply Water for Wet System: Mikrofill units meeting Category 5 requirements and shall be used.

Spare capacity: Except in individually served housing units, a minimum of two heat sources must be installed: 150% total nominal capacity.

Three or more heat sources: 120% total nominal capacity

Pumped circuits: Each pumped circuit must have dual pumps (i.e. run and standby). Pumps shall be specified with variable speed drives.

Design Margin: A minimum of +10% of heat out-put should be added to all terminal/(heat emitting) devices. Adequate allowance for heat loss from distribution pipework should be made.

Electrical Heater Batteries: Must be agreed in advance with UWE Estates.

Zoning: Appropriate heat zoning and controls should be defined to maximise system efficiency, and to accommodate differences in end user needs. Reference Design Specification Chapter 12 Controls.

Comfort Cooling

The refrigerant proposed shall be agreed in advance with the Estates team to comply with the F Gas Regulations taking into account phase-out and phase-down timescales. In accordance with the F Gas Regulations, the designer must carry out a formal documented Risk Assessment with regard the specified F-Gas, quantity, and location.

The limit for a refrigerant is the highest concentration allowed in the categorised space which will not result in any impairment effects or create a risk of ignition. The maximum charge that will be permitted is calculated by the category of the space into which the refrigerant could leak. The Project design team will provide these calculations of refrigerant volume by location exactly in line with BS EN 378.

The Project Design Team shall carry out a formal written Risk Assessment in compliance with DSEAR. The Risk Assessment shall assess all potential risks of the use, application, and presence of a dangerous, flammable, and/or explosive substance such as refrigerant.

Supply Water for Wet System: Mikrofill units meeting Category 5 requirements and shall be used.

The system/s shall also comply with the following:

- Cooling towers or other spray units will not be accepted.
- Number of chillers: A minimum of 2 chillers should normally be installed: nominal System total nominal capacity: 125%.
- Chillers must have dual safety valve configuration to minimise loss of refrigerant during maintenance procedures.
- Larger computer rooms which require comfort cooling will require sensible coolers selected with minimal latent cooling capacity, N+1 cooling provision shall be provided, consideration shall also be given to future expansion of the cooling requirement, a report shall be submitted to Estates for approval, detailing the level of cooling to be provided and method of calculation.
- Heat rejection of the Nominal cooling shall be considered for heat recovery to be utilised locally eg water to water heat pump.
- The standby system can be selected without heat recovery e.g. air source heat pumps.
- The standby system shall be utilised when heat recovery isn't possible e.g. overnight when the local heating or DHW may be turned off
- Reference Design Specification Chapter 12 Controls.
- Where possible, Auto-restart upon power reinstatement

The mechanical designer should ensure the details of the amount of refrigerant used and source of power supply is provided on a trafolyte label screwed to the condensing unit.

Approved Mechanical Suppliers

Heating Plant	
Boilers up to 70 kw	Worcester Bosch Andrews Baxi. Vaillant.
Boilers over 100 kw	Hamworthy, Hoval
Burners	Riello, Nuway
Radiators	Stelrad (or to match existing) Runtal / Hudevad in specifically agreed locations
TRV's	

Cooling Plant	
Chillers	Daikin, Airedale, Carrier, Trane
DX/VRV	Daikin, Mitsubishi
Ventilation Plant	
AHU	Dalair, Senior Moducel
Fans	Nuaire, Nicotra-Gilbert, Ziel-a-begg
Building Management System	

	Oventrop TRV's. Model Series AV6 (TRV Body). Uni LGH (Sensing Head), Combi 4 (LSV).		**BMS**	Schneider. (Trend)
			Water Generators	
Pumps / Pressurisation Units	Armstrong, Grundfos, Smedegaard, Mikrofil.		**Instantaneous electric**	Heatrae Sadia, Santon, Cooleraid
Water Conditioning			**Direct gas fired**	Lochinvar, Andrews, AO Smith
Water Conditioning	Hydrotec (UK) Ltd Enigma Environmental		**Drinking Water Dispensers**	
Fire Stopping	Quelfire, Rockwool		**Drinking Water Dispensers**	Hydration Station units Cooleraid
Basin Mixer Tap	Delabie Tempomix 79400015CO		**Basin Deck-mounted Tap**	Delabie Tempostop