


Section 16 Mechanical.



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<i>16.1.5 Population Densities</i>	<i>New occupancy table</i>
<i>16.2.2 Heating</i>	<i>New mandatory content</i>
<i>16.2.3 Hot water system</i>	<i>New reference to Section 12</i>
<i>16.2.3.1 DHW</i>	<i>New reference to Section 12</i>
<i>16.2.4 Reticulated Cooling Water Systems</i>	<i>New reference to Section 13</i>
<i>16.2.5 Ventilation and Filtration</i>	<i>Additional content</i>
<i>16.2.7.1 Airborne Noise</i>	<i>New content</i>
<i>16.3.1 Ductwork</i>	<i>Clarification</i>
<i>16.3.2 Dampers</i>	<i>Additional content</i>
<i>16.3.4 Pumps</i>	<i>Clarification of product type</i>
<i>16.4.6.4 Anchors, guides and supports</i>	<i>Additional and omitted content</i>
<i>16.4.6.5 Pipes</i>	<i>Additional and omitted content</i>
<i>16.4.6.6 Joints</i>	<i>Additional and omitted content</i>
<i>16.4.8 Commissioning Procedure</i>	<i>New mandatory content</i>
<i>16.4.8.1 Pressure Testing of Piped Systems</i>	<i>Additional content</i>
<i>16.5.4 Access Panels</i>	<i>New mandatory content</i>

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16.1 Overview

16.1.1 Purpose

Energy efficiency and acceptable comfort conditions shall be the prime consideration in the design of mechanical systems. Systems shall be effective in delivering the required conditions as nominated by the University to each thermal zone and/or application.

The University aims to achieve an optimum balance between capital and operating costs for buildings, consistent with a constant level of quality and service throughout the lifetime of its buildings.

Consultants must rationalise the selection of particular systems, equipment and products that may result in increased operating costs for the University over the life span of the item.

This section of the Design Standard Guidelines is intended to be read and implemented during design in conjunction with **Section 01 – General** and any project specific brief and agreements.

16.1.2 Existing Systems

16.1.2.1 Boilers

The University has a centralised boiler system which should be utilised for all heating throughout the university.

Where heating is required, connection to the centralised boiler system is required.

16.1.2.2 Cooling

The University has a chilled water ring-main served by two chillers which are located at the School of Biological Services and external to the Rutherford Building.

Where chilled water cooling is required, connection to the centralised chiller plant is required.

Alternatively, the University will consider proposals for pass through (artesian) systems, although connection to the existing ring main is preferred.

16.1.2.3 Connection to Existing

Any proposal to connect to existing services must be made through the Engineering Services Department.

When designing new services in an existing building, a review of existing flows within the existing building is to be undertaken to ensure that the building can accommodate the new services.

16.1.3 Maintenance Considerations

Maintenance is a key consideration for the University and shall be given due attention during design.

In the first instance all equipment requiring servicing shall be located in plant rooms (as opposed to ceiling voids for example). *Maintenance must be considered during the design and final layouts should facilitate safe removal and replacement of all components without requiring demounting or removal of other plant, equipment or building elements.*

Where this is not practicable - access hatches must be provided to all plant mounted in ceiling spaces to allow suitable access for maintenance, testing or servicing. In all instances adequate space shall be allocated for effective and unhindered maintenance.

The consultant shall co-ordinate and rationalise plant and equipment types to permit interchangeability of spares and simplify maintenance and operation across the University. Only current models of plant and equipment shall be accepted.

16.1.4 Commissioned Performance Expectations

Commissioning results must be within 5% of design parameters. A record of the results shall be added to the maintenance manuals. *CIBSE Commissioning Codes are the minimum standard to be met on all projects.*

16.1.5 Population Densities

For future flexibility design criteria should in the first instance be aligned with maximum population densities.

Additionally, there shall be inherent design features that permit ease of modification and flexibility to suit future room or partition layout changes.

Occupancy Table:

Space Type	UC Calculated Area per Occupant
Computer Lab	3.5
Lab Non Technical	2.0
Research Lab Dry	16.0
Research Lab Wet	16.0
Studio	7.0
Teaching Lab Dry	2.0
Teaching Lab Wet	5.5
Dark Room	4.0
Preparation	6.0
Informal Learning	2.5
Library	2.5
Practice	8.0
Individual office	10.0
Open plan office	8.0
Meeting	2.0
Reception	8.0
Cafeteria	2.4
Kitchen	2.0
Lounge	2.0
Performance	4.0
Pg Study	4.0
Class Room	2.0
Lectorial	2.8
Lecture Theatre	1.8
Staff Workroom	2.0
Workshop	4.0

16.1.6 Special Considerations for Laboratories

Spaces within laboratories or entire laboratories in which hazardous materials or products are used must be designed



16.1 Overview

and operated in conformity with specific standards and legislation. In some cases no specific regulation currently exists, in which case reference to international best practice must be made. All laboratories must be fit for purpose.

Examples of laboratory activities which require careful specific consideration include:

- Biological or microbiological laboratories
- Vivariums or plant houses
- Clean laboratories
- X-ray and radiological laboratories
- NMR (nuclear magnetic resonance) facilities
- Electron microscopy
- Use of cryogenics (e.g. liquid nitrogen or helium)

Examples of issues to be addressed may include:

- Containment strategies
- Clean room construction and specialised mechanical installations for high quality particulate air filtration
- Non-ionising radiation exposure (magnetic / electrical fields, laser, RF, IR and UV)
- Ionising radiation exposure (X-ray, gamma rays, alpha particles, beta particles)
- Hazardous goods handling (e.g. cryogenics - very low temperatures, oxygen displacement, delivery by lifts, special storage)
- Mechanical vibration or freedom from vibration
- *Other project specific requirements*

16.1.7 Electrical For Mechanical

The University has detailed requirements for 'Electrical for Mechanical' which are required to be met on every project. Compliance with these requirements is an ongoing issue at the University and requires the full attention of the design team.

The requirements are outlined in the subsequent sections of this document; and users of this document shall also ensure the full requirements of the following sections are also met where applicable to electrical for mechanical systems:

- **Section 08 - Electrical**
- **Section 17 - Metering and Controls**



16.2 Design Concepts

16.2.1 Building Management System (BMS)

Mechanical services plant and equipment shall be of the electronic type and be capable of being interfaced with the University Building Management System (BMS).

All communication links, data cables, modems etc., together with any interfacing equipment and software/hardware programming necessary to enable all plant information to be displayed on the University's computers, shall be provided by mechanical contractor.

Time schedule and set point adjustment controls must be located in areas not accessible to the general public. Locations are to be the closest plant room or switchboard cupboard. Time clocks and temperature adjustments must be controlled via the Building Management System (BMS).

Refer to Section 17 - Metering and Controls for further requirements.

16.2.1.1 Local Instrumentation

Individual items of plant shall have local instrumentation including temperature and pressure gauges as applicable that enable plant to be monitored locally.

All instruments and gauges shall be calibrated in SI Units as recommended by the standards.

All gauges shall be provided with service cocks to shut off the gauge when not in use and red lines to indicate the normal operating point.

16.2.2 Heating

Expansion loop system for pipework and associated fittings is the preferred system to be used.

Balancing and throttle valves and in-line flow meters are required at every take-off to ensure correct flow of water through apparatus.

Panel radiators/connectors shall be equipped with automatic temperature control valve and balancing valve.

- Manifold or single unit flues are able to be used for fme cupboards.
- Plate heat exchange systems are to be used.
- Panel radiators are used throughout the University for heating. These are to be securely fixed to either walls or floors.

Heating systems for major refurbishments and all new build projects should be designed for Low Temperature Heat sources. Use of the central boiler plant for heating or hot water generation should not be considered.

16.2.3 Hot Water Systems

Refer to section 12 - Hydraulic Design Guideline.

16.2.3.1 Domestic Hot Water Systems (DHW)

Refer to section 12 - Hydraulic Design Guideline.

16.2.4 Reticulated Cooling Water Systems

Refer to Section 13.3.4.3 Infrastructure.

16.2.5 Ventilation & Filtration

Air intakes shall be located away from dust or traffic zones. Air intakes must also be located away from any process

which creates water vapour. All ventilation is to have filtration.

Fresh air shall be at positive pressure within the building distribution system.

Air intakes must be located away from all sources of contamination, this includes but is not limited to:

- Kitchen extracts
- Fume cupboard extracts
- Process extracts
- Toilet extracts
- Car park exhausts
- Etc.

16.2.5.1 Exhaust Systems

Where emissions of obnoxious gases is cause for concern, the consultant shall provide computer modelling of the discharge plume and submit results to the architect who shall pursue Environment Protection Authority approval.

The use of water scrubbers, filters etc. may be considered in the removal of noxious gases from the discharge air.

Exhaust air shall be kept at negative pressure within the building distribution system.

16.2.5.2 Ventilation Fans

Laboratory requirements may include the provision of fume cupboards, specialised ventilation or local exhaust systems. The impact of such systems on air-conditioning loads, and opportunities for fresh or tempered air make-up should be considered.

16.2.6 Air Conditioning

Air cooled or water cooled condensers are preferred for heat rejection. Alternatively, the University will consider proposals for pass through (artesian) systems, although connection to the existing ring main is preferred

Water cooling towers are not to be used.

16.2.7 Noise and Vibration

16.2.7.1 Airborne Noise

Refer to the ECAN resource consent requirements for boundary noise levels.

16.2.7.2 Structure-borne Noise and Vibration

Mechanical plant and equipment shall be vibration isolated from the building structure to prevent structure borne noise.



16.3 Materials & Equipment

16.3.1 Ductwork

All ductwork *material selection should be appropriate for the proposed functional/operational requirements and these confirmed by the designer as part of the design process.*

Ductwork systems shall have aerodynamically formed and designed transition pieces, bends and elbows.

Flexible ductwork is not permitted on exhaust systems. Only short lengths (less than 3 metres) of flexible ductwork connected to the outlet register on supply air systems is permitted.

Ductwork is to be designed for maximum velocity through the system, sized appropriately to ensure there are no unwanted draughts on users and noise from grills.

16.3.2 Dampers

Motorised dampers with position feedback are preferred. *Refer to the requirements of the CIBSE Commissioning Codes for the balancing of air systems. Refer to Section 10 – Fire and Life Safety Systems for Fire Dampers.*

16.3.3 Compressed air

Acoustic attenuation is required for all compressors.

Oil and water separation is mandatory and all compressors are to have filtration and air dryers as required by standards. Oil-less compressors are to be used on special applications only.

16.3.4 Pumps

All mechanical pumps over 1Kw are to be fitted with a *Schneider* (Variable speed drive) VSD with BACnet interface for connection to the BMS.

16.3.5 Plant and Equipment

Plant or equipment exposed to weather shall have waterproofing treatment and corrosive protection to guard against corrosion, UV sunlight and wind erosion.

Chemical treatment to water systems shall be provided for condenser water, chilled water and heating water systems. Chemical treatment shall include corrosion inhibitor, anti-algae or bacteria growth agents (biocides) as required, dependent upon pipe materials and water.

All systems shall be provided with automatic refill and dosing equipment, including storage.

Chemicals used in the above treatments shall be to the approval of ECAN and EPA. Where possible "environmentally friendly" chemical treatments shall be used.

A material safety data sheet is required for each chemical used in all plant.

16.3.6 Electrical For Mechanical Systems

16.3.6.1 Cable Selection

Refer also to **Section - 08 Electrical** and **Section 17 - Metering and Controls** for further requirements and cable marking guidance.

All cabling shall be standard copper and all instrument cabling shall be screened cable.

Cabling used for KNX is outlined in Metering and Controls, Section 17, sub-section 17.5.13 Automated lighting control and Desigo Tra.

Cable used for BACnet or Modbus over RS485 shall be of Beldin manufacture and be suitable for the transmission of RS485 data. MIMS or fire rated cables shall be used for all essential services or fire services power and control circuits.

Mains and sub-main cables shall be PVC / PVC circular supported on continuous tray or rack.

Extra low voltage cabling shall not be exempt from AS/NZS 3000 regulations and shall comply in every respect with the regulations on higher voltage cabling.

The use of copper sheath for the neutral conductor shall not be accepted. A full size neutral must be installed.

16.3.6.2 Isolation and Overload Protection

Contactors, thermal overloads and relays shall be Schneider Electric manufacture or equal approved.

Not more than one power circuit shall be enclosed in the same conduit.

Isolating switches shall be provided adjacent to all items of equipment. Isolating switches on variable speed drives must be installed before the variable speed drive (VSD) and there shall be no isolators on the output of any VSD.

Short-circuit protection may be provided by HRC fuses or circuit breaker. The capacities and types shall be chosen according to the manufacture's recommendations, with due regard for the temperature of their location, frequency of operation, etc.

16.3.6.3 Controls and Indications

Where extra low voltage controls are employed the preferred voltage is 24VAC.

Each control circuit shall be provided with an engraved label and selector switch offering the choice of manual-off-automatic along with indicator lights using the following indicator colours:

- Green = Run Light
- Red = Fault Light

All indicating light assemblies shall be Schneider Electric type. The panel design shall provide a test button to check that all lights glow.

Control cabling within a switchboard shall be flexible stranded copper "appliance wire" and shall adhere to the following colour standards:

- 24VAC shall be orange (phase) and brown (neutral)
- 24VDC shall be purple (+) and grey (-)
- 230VAC shall be red (phase) and black (neutral)

16.3.7 Pipework Materials

- MTHW - Seamless steel piping to A.S.T.M. A53 Grade "B" suitable for working pressure of 1034 KPa and temperature of 177°C.
- Chilled water – PP-R to AS 1432 Type A hard drawn. PE
- LTHW - Seamless steel piping to AS 1432 Type A hard drawn.
- Condenser Water - Fusiotherm to AS 1432 Type A hard drawn.
- Natural Gas - Copper or plastic tube piping to AS 1432 Type A hard drawn



16.3 Materials & Equipment

- Pneumatic - Copper piping or plastic tube piping to AS 1432 Type A hard drawn.
- Mains Cold Water – PP-R, HP PVC (Remove PVC) to AS 1432 Type B or REHAU PE-Xa cross linked polyethylene pipe
- Domestic Hot Water - Butylene up to 25mm, PP-RCT over 25mm to AS 1432 Type B hard drawn.
- Recirculated Cooling Water, Chilled Drinking Water, Vents, Drains, Wastes, etc. - UPVC (remove UPVC) type or Fusiotherm. All bends, tees and elbows shall be of manufactured type. Bends shall be standard long radius type.

16.3.7.1 Medium Temperature Hot Water Pipework

- All bends on high pressure (temperature) pipework shall have a radius of not less than five times the internal diameter of the pipe.
- Gasket material - Shall be suitable for use in MTHW systems rated for 177 degrees Celsius and 1034 kPa pressure (Utex style 1310 or similar).
- Packing material - Used in valve glands shall be of the braided PTFE type (Utex Industries style 232 or similar). Used in MTHW circulation pumps shall be of the braided flexible graphite type (Utex style 687 or similar) and have mechanical seals.
- All gasket and packing materials shall be approved by the University prior to construction.

16.3.8 Filtration

Air filters for central plant air conditioning/heating systems are to be Camfil Farr 30/30. Filters are to have a minimum average of 90% efficiency in accordance with standards and be oil free design.

For special applications, the consultant shall submit full details of proposed air filtration methods including expected efficiencies and dust holding capabilities.

Pressure gauges shall be installed across filter banks with indicators that show the need for filter replacement.

On systems with large fresh air quantities or systems subjected to dusty conditions, pre-filters shall be installed.

Full walk-in service access shall be provided for filter replacement. Filters in confined spaces shall not be permitted, and areas are to be well lit.

16.3.9 Pipe Work Valves and Fittings

All approved valves are listed in the Design Standard Guideline Appendices. Valves shall generally be flanged bronze globe valves, unless otherwise stated. All valves shall be fitted with brass identifying tags numbered by paint filled engraving to correspond with a valve schedule affixed to the wall of the plant room.

Control valves shall be magnetic (as per the equipment schedule) control modulating valves with 0-10v position feedback.

Control valves to heat exchanges and calorifier shall be fitted with independent back up high temperature limit shut off valves.

STAT or approved balancing-isolating valves for suitable working pressures and correct temperature ratings shall be used for systems balancing.

Valves shall not be of the single gland nut type. All valve studs and nuts shall be of stainless steel.

All parallel slide valves 150mm and over shall be fitted with a flanged by-pass valve and connections.



16.4 Installation Requirements

16.4 Installation Requirements

16.4.1 Construction Drawings

To aid on-site installation, all construction drawings must be presented complete with the schedule of plant / equipment to be installed referenced on that drawing. The schedule should be detailed either directly on the relevant drawing, or where space considerations preclude it, on an attached and referenced separate sheet.

16.4.2 Completion of Work

During construction, on-site drilling or cutting may be required within the switchboard cabinet. Where this occurs, filings, swarf, etc. shall not be allowed to lodge in electrical components. Cabinets shall be well cleaned out using vacuum cleaners, etc. at the completion of work.

Complete as-built schematics shall be provided within each mechanical board showing both electrical controls and Building Management System (BMS) controller inspection openings (I/O).

16.4.3 Dust and Dirt Control

The ventilation system shall maintain plant rooms in a dust-free condition. The specification shall state clearly that all plant rooms shall be cleared of debris and properly cleaned on completion by the mechanical contractor.

16.4.4 Pipework

Steel pipework up to 50mm can be screwed or welded, 65mm up can be flanged or welded. Copper pipework up to 40mm shall be soldered or compression jointed. 50mm up can be soldered or flanged.

16.4.5 Insulation

Medium Temperature Hot Water (MTHW) piping shall be lagged with rigid pre-form mineral insulating sections of equivalent sectional type lagging, Fibreglass, [Thermobreak](#), clad with galvanised iron or zincanneal.

Low Temperature Hot Water (LTHW) piping shall be lagged with sectional type fibreglass, of density 60-100 kg/m³. Exposed piping shall be clad with galvanised iron or zincanneal and concealed piping shall be covered with aluminium foil. [Thermobreak](#)

Chilled water piping shall be as for LTHW piping, with the addition of a vapour seal.

All valve bodies and flanges shall be insulated and provide access for glands.

Domestic Hot Water (DHW) piping of 25mm or less shall be lagged with Armaflex or Centurylon [Thermobreak](#) or similar. Piping above 25mm shall be lagged as noted for Low Temperature Hot Water LTHW piping.

16.4.6 MTHW Installation Specification

16.4.6.1 Pressure and Temperature Requirements

Unless noted otherwise below the following minimum pressure and temperature conditions shall be used in the design of valves, piping, flanges and expansion systems:

- Pressure - 1034kPa
- Temperature - 177°C
- Ambient temperature - 1.7°C

16.4.6.2 MTHW Valves

All valves shall be approved by the University prior to acceptance. Medium Temperature Hot Water (MTHW) valves of 50mm diameter and under shall be bronze globe valves, flanged ends, special alloy valve and seat. Flanges shall be to British Standard Table E.

All valves shall have flanged ends, external screwed stem and bolted yoke and be capable of withstanding test pressure of 1500 kPa. Valves to be packed with Chesterton Teflon packing or other approved manufacture (including drains and vents).

The contractor shall allow for repacking of all valve glands as they settle under heat throughout the maintenance period.

Bronze and cast steel strainers shall have flanged ends. Y type shall be used, where required, on 65mm diameter and above.

Butterfly valves must be lug type only, and have a silicon liner rated for 180°C.

Bronze and cast steel check valves shall have flanged ends with removable or lifting valve type special alloy valve and seat. They must be of non-hammer design.

Bronze flow regulating or modulating valves shall have flanged ends external screw, special alloy main valve and seat, bolted body, exposed packing gland with Teflon packing set.

Cast steel flow regulating or modulating valves shall have flanged ends, special alloy valve and seat bolted body, exposed packing gland with Teflon packing.

16.4.6.3 Expansion Systems

Expansion bends or approved bellows type expansion fittings shall be provided *as required by the design* or where otherwise necessary to provide for thermal expansion and contraction.

Where appropriate, allowance may be made in designing expansion bends and bellows for the use of cold set. During installation such a cold set shall be accurately measured and anchored in position to ensure that the cold set allowed is not exceeded in any case. The degree of cold set shall not be greater than that allowed by the manufacturer under applying conditions.

Stainless Steel Expansion Bellows shall be of approved manufacture, specially designed for the pressures and temperatures involved. Bellows shall be installed strictly in accordance with the manufacturer's recommendations and be fitted to the mains by flanged joints.

The piping and expansion bellows units shall be accurately restrained by anchors and guide rollers in accordance with the manufacturer's recommendations, so as to retain perfect alignment under all conditions.

16.4.6.4 Anchors, Guides and Supports

All anchors and guides shall be of a size and design consistent with existing MTHW installations at the University or shall comply with drawings issued by the University. Use of any hanging support requires pre-approval.

Wherever required, piping shall be supported on approved variable support spring hangers, selected for the appropriate duty. *Variable support spring hangers shall be suitable for the weight, expansion and particular system design requirements.*

Anchors shall evenly distribute bearing loads to the pipes and shall not impose bending moments.



16.4 Installation Requirements

Anchors shall be designed to withstand all loads which can be applied, including expansion bend reactions; expansion bellows reactions, pressure loads and dynamic reactions on bends *as per the manufacturers guidelines for the particular pipework materials.*

Wherever necessary, the consultant shall specify guides of approved design to maintain pipe alignment for the effective functioning of any expansion device.

Anchors shall be so located whenever practicable so as to minimise expansion stresses in valves, fittings etc.

~~Flanges — All flanges shall be forged steel S.O.W. type, Table H. Flanges shall be welded internally and externally squarely on the pipe end and jointed with a full face gasket.~~

~~All bolts shall be bright machined steel with hexagonal heads. Nuts shall be of the correct diameter to suit flanges. Threads shall protrude no more than two threads through the nut when fully tightened.~~

16.4.6.5 Pipes

Refer to the material table included in section 12.3 Hydraulics.

~~Pipe shall be seamless steel pipe ASTM A53 grade B. Bends shall have a radius of not less than five internal diameters of the pipe size being installed.~~

~~All junctions shall be of manufactured design, or a smaller diameter "stub" may be welded into a larger diameter pipe ensuring there is no protrusion into the larger pipe.~~

~~All pipe work is to be thoroughly flushed to remove scale, slag, etc. before any expansion bellows are fitted prior to testing.~~

~~All Medium Temperature Hot Water (MTHW) piping shall be insulated with fibreglass to insure minimum achievable heat loss and clad with galvanised weatherproof metal sheathing where exposed to elements. All valves, strainers, flanges, dirt boxes and bellows shall have easily removable and replaceable insulation and cladding to allow for service or inspection.~~

16.4.6.6 Joints

Joints are size specific as previously noted in clause 16.4.4.

~~Face and drill flanges shall be to British Standard Table H. All pipe joints other than at welded flanged joints or valves, bellows, strainers or pipe work that requires to be disassembled for maintenance purposes, shall be welded. No screwed joints shall be allowed without written approval by the University.~~

16.4.7 Electrical For Mechanical

Refer also to **Section - 08 Electrical** and **Section 17 - Metering and Controls** for further requirements.

16.4.7.1 Location and Fixing of Cables

Wiring shall be circular TPS cables in conduit or cable tray, with conductors rated to suit the respective load circuit.

Wiring within the ceiling space shall be run in an orderly manner parallel to the structure and on either cable trays, catenary wires or other approved method.

Cabling in accessible false ceiling spaces shall be installed in cable ducts or supported on cable tray, sized to allow 30% future expansion. Cabling in other false ceiling spaces shall be neatly clipped to battens or tied to catenary wires with nylon cable ties.

Cables shall not be supported from suspended ceilings structure or be unsupported.

Mains and sub-main cables shall be supported on continuous tray or rack.

Wiring within plant room areas shall be surface run in conduit or on cable tray but shall be concealed within the building fabric in areas external to the plant room.

All conductors shall be terminated with an approved clamp or crimp type cable lug.

Where switchboards and control cabinets are located in basements, they shall be raised a minimum of 120mm above floor level on concrete plinth.

16.4.8 Commissioning Procedure for M.T.H.W System

Commissioning shall be carried out in strict accordance with the requirements of the CIBSE Commissioning Codes.

Prior to operation of the system or any section, the system shall be flushed to remove any scale or debris and all dirt boxes cleaned and refitted.

The piping shall be fully charged with water and all air vented from the system. Charging water shall be from mains supply suitably protected by "Back Flow Devices" and checked for cleanliness before connecting.

The connection of new sections to the operating system shall be coordinated between Consultant and the Project Manager, after commissioning of a new section has been completed.

The actual "livening" of the new section shall be done by University of Canterbury Engineering Services Department.

The temperature in the new section shall to be raised by 10°C per hour to allow for gradual expansion of the system. All bellows, anchors, and supports shall be regularly monitored during this period (approximately 16 hours).

The new section shall to be monitored for 4 hours at the system operating condition and approved by University of Canterbury before being left unattended.

At all times the branch isolating valves on the existing high temperature hot water system are to be operated by staff of University of Canterbury only

16.4.8.1 Pressure Testing of Piped Systems

Testing - All pipe work is to be static tested to 1500 K.P.A. before insulation. Test pressure is to be held for 1 hour and be sited by University of Canterbury. *Test pressures to be 1.5 times system working pressure up to a maximum of 10bar.*



16.5 Numbering & Labelling

16.5 Numbering & Labelling

16.5.1 Equipment, Thermometers & Sensors

All items of equipment, thermometers, remote sensing points, must be labelled with permanently fixed durable labels. A valve schedule should be provided in plant rooms to indicate valve number and function.

16.5.2 Valves and Gauges

Labels shall be fixed to all valves engraved with the name of the valve. Each label shall be satin chrome brass with black infilled lettering. Labels shall be fixed either directly to the valve body, or by means of substantial metal brackets screwed or bolted to the valve.

16.5.3 Electrical for Mechanical Wiring

Each wire should be identified at both ends with approved cable marker showing number that corresponds to the wiring diagram. Requirements for this are specified in **Section 17 - Metering and Controls**.

16.5.4 Access Panels

Access panels should be located to allow easy access to all installed components, valves, dampers etc. Final locations and sizes should be agreed with UCFM team as part of the design documentation. Access panels installed in ductwork shall be of the maximum size possible for the particular duct size up to a maximum of 450mmx450mm on large ducts. As for other access panels locations shall be agreed during design stage.



Compliance Checklist

Project Name:	Date:
Submitting Consultant:	Design Stage:

Section 16 – Mechanical Compliance Checklist

		Complies	Does Not Comply	Not Applicable	Comments:
1.0	Section 01 – General				
#	All Clauses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.1	Overview				
16.1.1	Design Concepts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.1.2	Existing Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.1.3	Maintenance Considerations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.1.4	Commissioned Performance Expectations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.1.5	Population Densities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.1.6	Special Considerations for Laboratories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.1.7	Electrical For Mechanical	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.2	Design Concepts				
16.2.1	Building Management System (BMS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.2.2	Heating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.2.3	Hot Water Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
0	<i>Refer to section 12 - Hydraulic Design Guideline.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Reticulated Cooling Water Systems				
16.2.5	Ventilation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.2.6	Air Conditioning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.2.7	Noise and Vibration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.3	Materials & Equipment				
16.3.1	Ductwork	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.3.2	Dampers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.3.3	Compressed air	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.3.4	Pumps	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.3.5	Plant and Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.3.6	Electrical For Mechanical Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.3.8	Filtration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.3.9	Pipe Work Valves and Fittings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.4	Installation Requirements				
16.4.1	Construction Drawings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	



Compliance Checklist

Project Name:

Date:

Submitting Consultant:

Design Stage:

Section 16 – Mechanical Compliance Checklist

		Complies	Does Not Comply	Not Applicable	Comments:
16.4.2	Completion of Work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.4.3	Dust and Dirt Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.4.4	Pipework	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.4.6	MTHW Installation Specification	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.4.7	Electrical For Mechanical	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.5	Numbering & Labelling				
16.5.1	Equipment, Thermometers & Sensors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.5.2	Valves and Gauges	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16.5.3	Electrical for Mechanical Wiring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	



Compliance Checklist

Project Name:

Date:

Submitting Consultant:

Design Stage:

Section 16 – Mechanical Compliance Checklist

Complies

Does Not Comply

Not Applicable

Comments:

Date:

Acceptable

University Reviewer:

Acceptable subject to comments

Signed:

Resubmission required

