Hunter Medical Research Institute

Mechanical, Lighting, Electrical, Fire Detection, Communication, Security Services and Vertical Transportation

Development Application Report

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S2F Pty Ltd
ABN 68 685 634 275
ACN 085 430 388
Level 1, Building 1
21-31 Goodwood Street
PO Box 89
Richmond VIC 3121
Australia
T +61 3 8456 4800
F +61 3 8456 4899
E melb@s2f.com.au
www.s2f.com.au

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1 MECHANICAL SERVICES

1.1 Introduction

The mechanical engineering systems proposed will be designed to provide an effective research environment for the occupants with the following as key drivers:

> Energy efficiency & environmental sustainability;

> Compliance with applicable Building Codes & Australian Standards;

> Flexibility;

> Budget constraints;

> Ease of maintenance;

> Occupational Health & Safety;

1.2 Reticulated Services

The following reticulated services will be provided:

> Chilled Water;

> Condenser Water;

> Heating Hot Water;

> Steam & condensate recovery;

> Air Conditioning, Ventilation & Heat Recovery Systems;

> Exhaust Systems;

> Fume cupboards and exhaust systems;

> Provision for process cooling as required;

> Compressed Air;

> Vacuum;

> Laboratory Gases;

> Liquid Nitrogen & Liquid Carbon Dioxide (to Cryogenic Cell Bank only);

> Gas detection & shut off systems;

> Oxygen depletion monitoring & alarms (as required by HMRI);

> Automatic controls & monitoring network;

> Electrical Services for Mechanical Plant.

1.3 Central Plant

Central plant will consist of:

> Water cooled chillers;

> Evaporative cooling towers;

> Gas fired heating hot water boilers;

> Gas fired steam boilers;

> Compressed air;

> Laboratory Vacuum;

> Building Management System (BMS).

1.4 Design Conditions

The following design parameters will be used for sizing of central plant & equipment. These parameters are based on current guidelines given by The Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH).

1.4.1 External Design Conditions

Summer External Temperature: 30.4 ºC dry bulb; 22.6 ºC wet bulb

Winter External Temperature: 6.6 ºC dry bulb; 90% relative humidity

1.4.2 Internal Design Conditions

Areas	Dry Bulb Temperature	Relative Humidity
Office, Administration & Interaction Spaces	22 – 26 ºC	Not controlled
Foyers, Transient Areas	18 – 26 ºC	Not controlled
PC2 Laboratory Areas	22.0ºC ± 2.0ºC	Not controlled
Bioresources Areas	22.0ºC ± 2.0ºC	55.0ºC ± 10º%
Wash Up, Prep Areas, Change Areas	22.0ºC ± 2.0ºC	Not controlled
Cold Rooms	+4.0ºC	Not controlled
Gas bottle stores, Cryogenic Cell Bank	Not controlled	Not controlled
Amenities	Not controlled	Not controlled

1.5 Outside Air Requirements

Outside air provision will be provided to cater for the air quantity required for fume cupboard operation, special exhaust requirements, pressure regimes, laboratory environments and minimum outside air requirements for the occupants in accordance with AS 1668.2.

1.6 Codes & Standards

The mechanical services will be designed to comply with the latest edition (except where noted) of relevant codes, standards and guidelines including the following:

> Building Code of Australia (BCA) 2009;

> Australian Standards;

> International Standards (where applicable);

> HMRI Institutional Bio-safety Committee (IBC) requirements;

> Australian Institute of Refrigeration, Air Conditioning and Heating. (AIRAH);

> OGTR (Office of Gene Technology Regulator);

> AQIS (Australian Quarantine and Inspection Services);

> Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

1.7 Plant Configuration, Flexibility and Expansion

The design incorporates the following features:

> Air-handling systems provided on a floor by floor basis;

> Provision of nominal spare capacity in the selection of the cooling and heating equipment;

> Provision of capped exhaust ducts within the risers and ceiling space for future fume cupboards;

> Provision of spare laboratory gas lines in risers;

> Provision of CHW & HHW flow and return risers with valved connections at each level within the plantrooms to allow for isolation and for future connections;

> Provision of valved connections at each level on laboratory gas, compressed air & vacuum pipe risers to allow for the isolation of services and for future connections;

> Provision of spare capacity in mechanical services switchboards.

No provision for future expansion will be provided.

1.8 ESD and Energy Efficiency

In considering sustainable ways in which to deliver cooling, heating & ventilation to the facility, the following energy saving measures are proposed:

> Efficient façade design to reduce solar heat gains and losses;

> Appropriate ambient design temperatures;

> Wider tolerance of internal design conditions within Office & Interaction areas;

> Outside air intakes located on shaded façades where possible to reduce cooling loads;

> Zoning of ventilation systems into areas of similar load profile to avoid overcooling;

> Areas of distinctly different functions served by individual ventilation / air conditioning systems to minimise unnecessary operation of plant;

> Modulating economy cycles on non single-pass air handling systems;

> After hours control by local User controlled switching;

> Energy recovery on ventilation systems where possible (either by re-circulation of air or by energy exchangers);

> Gas source heating in lieu of electric;

> Use of appropriate low energy technologies;

> Use refrigerants with low ozone depletion potential and comparatively low greenhouse gas emissions used on chilled water generating plant;

> Efficient control strategies;

> Variable speed drives fitted on chillers, pumps & fans where appropriate;

> Low pressure & leakage ductwork to reduce fan energy consumption;

> CO2 monitoring in areas of high occupancy;

> Metering of mechanical systems and central plant;

> The Requirements of BCA Section J;

- High efficiency plant and systems;
- Provision for closed circuit cooling systems to laboratory equipment should the need arise;
- Condensate recovery on Steam systems;
- Perimeter zones may incorporate variable air volume supply air for energy efficiency.

1.9 Reliability and Redundancy

Appropriate levels of reliability and redundancy of plant for periods of maintenance or in the event of plant failure will be provided.

1.10 Plant locations, services distribution & maintenance access

Major plant & equipment will be located in dedicated plant areas either on the roof or on level 1. Local plantrooms will be provided on each level for air handling equipment.

Maintenance access will be provided to facilitate inspection of equipment and to allow maintenance duties to be undertaken safely.

1.11 Existing Mechanical Services

The existing John Hunter Hospital has no spare capacity available and it has been determined that the preferred course of action is to keep the HMRI independent of the Hospital's infrastructure.

1.12 Chillers, Heat Rejection and Chilled Water

Chilled water (CHW) for cooling in the HVAC systems will be generated by central high efficiency water-cooled chillers with heat rejection via evaporative cooling towers.

The chilled water distribution systems will incorporate primary and secondary pumps equipped with variable speed drives.

1.13 Boilers and Heating Hot Water

Heating hot water (HHW) for heating in the HVAC systems will be generated by central gas fired boilers.

The heating hot water distribution systems will incorporate primary and secondary pumps equipped with variable speed drives.

The boiler plantroom will be naturally ventilated in compliance with the requirements of AS 5601.

1.14 Boilers and Steam

Steam will be generated by central gas fired with clean condensate returned to a central condensate collection system for re-use in the boilers.

The plantroom will be naturally ventilated in compliance with the requirements of AS 5601.

The steam will serve autoclaves & cage washers, air handling humidification equipment and to generate potable & non-potable hot water.

1.15 Air Handling, Air Conditioning and Ventilation Systems

1.15.1 General

The occupied spaces within the building will be air-conditioned & ventilated with a variety of systems which are split into functional groups according to the proposed usage of the given area as follows:

- Office, Administration, Clinical Support and Meeting Areas
- Lecture Theatre & Interaction Areas
- PC2 Laboratory Areas
- Bioresources Facility

> Controlled Environment Rooms

> Computer Server Room

Generally, air handling systems will be of the multi-zone arrangement split into thermal zones as appropriate.

In line with current international practice, to maximise future flexibility and to eliminate the risk of cross-contamination between different research groups, single pass air will be utilised for all PC2 laboratory areas and Bioresources facilities.

Heat reclaim from the exhaust air will be incorporated via run around coils located in the exhaust and supply air streams.

Areas of high heat load such as equipment rooms, rooms to accommodate -80ºC freezers and the like will be provided with dedicated local re-circulating chilled water fan coil units for spot cooling.

Office and Administration areas will utilise return air to minimise running costs however, under periods of favourable ambient conditions, the air-handling units will have an economy cycle to utilise 100% outdoor air to reduce energy consumption.

Air conditioning to meeting rooms and seminar rooms will be provided with dedicated fan coil units with the ability to disable the air conditioning when these areas are not in use.

Localised after hours control will be provided which will enable the systems for a further 2-hours operation.

Cold rooms will be provided with a dedicated direct expansion refrigeration system for independent control and operation.

To maintain continuous and secure operation of the Computer Server Room data centre, multiple chilled water fed Computer Room Air Conditioning (CRU) units with 100% (n + 1) redundancy capacity, run from UPS power supply are proposed.

1.16 Exhaust Systems

Ducted exhaust systems will be provided to mechanically ventilate the following areas:

> Bioresources facility;

> Central wash facility and De-contamination room;

> PC2 laboratories incorporating separate general, fume cupboard & special equipment exhaust systems;

> Hazardous goods stores, gas bottle stores, cryogenic cell bank, waste stores;

> Electrical Switch rooms, Substation & Generator Room;

> Chiller plantroom;

> Office, Administration and Interaction areas;

> General Stores, Change areas and Amenities.

All discharges that are deemed objectionable by AS 1668.2 will be exhausted vertically above roof level and the flues designed in accordance with AS 1668.2.

Discharges not deemed objectionable by AS 1668.2 will either be exhausted locally or at roof level in accordance with AS 1668.2.

1.17 HVAC Fire Strategy

A fire engineered ventilation solution will be provided which includes:

> Stair pressurisation systems designed in accordance with AS 1668.1

1.18 Fume Cupboards

New fume cupboards will be provided in accordance with user requirements and be fully compliant with the latest edition of AS2243.8.

1.19 Compressed Air & Vacuum

Compressed air & vacuum will be provided by central plant and will be reticulated from the central plant though the building to the points of use within the laboratories and throughout the facility.

1.20 Laboratory Gases

Laboratory gas cylinder storage will be located within the central gas bottle store on level 1 which will be accessible to facilitate cylinder replacement.

Laboratory gases will be reticulated from the central stores though the building to the points of use within the laboratories and throughout the facility.

1.21 Liquid Nitrogen and Liquid Carbon Dioxide

New vessels will be provided to reticulate liquid nitrogen & liquid carbon dioxide to cryogenic vessels & outlet points. The vessels will be located externally.

1.22 Automatic Controls & Monitoring

A new Building Management System (BMS) will be provided to monitor and control all HVAC systems and utility meters.

1.23 Electrical Services for Mechanical Plant

The mechanical services will be powered from dedicated Mechanical Services Switchboards (MSSB) located in close proximity to the areas and equipment they serve.

New sub mains will be provided from the MSSBs, which will be split into essential and non-essential supplies to allow critical HVAC equipment to run on generator power.

2 ELECTRICAL, LIGHTING, FIRE DETECTION, COMMUNICATION & SECURITY SERVICES

2.1 Electrical Services

2.1.1 General

The extent of the Electrical Services required shall consist of but not be limited to the following systems:

- Provision of adequate electrical supply for the expected building load from the HV Infrastructure at the John Hunter Hospital Site
- Provision of (400V) low voltage Main Switchboards (MSB) and low voltage mains supply from the new substation.
- Provision of standby generator
- Provision of a UPS for the server room
- General light and power
- Provision of an internal emergency and exit lighting system Fire detection system.
- Fire detection and EWIS systems
- External building security lighting.

2.1.2 Electrical Supply

HV Reticulation and Sub Station

Energy Australia have been involved in the recent electrical site infrastructure upgrade works via correspondence with the Department of Commerce to determine the future power requirements for the John Hunter Hospital campus.

The department of commerce have managed the design, procurement and construction of the electrical infrastructure upgrade.

The upgrade to the High Voltage infrastructure has taken into account existing facility loads and future planned loads (which includes HMRI) plus spare capacity. The department of commerce have advised that the recently completed infrastructure has capacity for the new HMRI facility.

Further to this, Energy Australia have been consulted with and advised of the prospective timescale for the connection of the HMRI facility. It should be noted that no further capital works are required by Energy Australia to connect the new facility, as all HV works will be carried out by the successful electrical contractor.

The estimated demand for the new facility is approximately 2.5MVA.

It is proposed that the supply will have 25% spare capacity for flexibility and future increase in building loads. This will require a substation capacity of 3.2MVA.

The supply for the new facility will be taken from the High Voltage network on the John Hunter Hospital site.

A new chamber sub-station with two 1600kVA transformers is proposed to be located in the new facility.

Main Switchboard

The Main Switchboards for the new facility will be located in a dedicated Main Switchroom and shall be a minimum Form 4 construction. The main bus of the switch boards shall be rated for the full current capacity of the installed transformers.

Standby Electricity

A 1000kVA emergency generator will be provided to cover essential mechanical plant, server room, UPS supplies, fridges/freezers and other nominated electrical equipment nominated by the client.

All safety devices within the new building will be covered by the standby generator including:

- Fire detection, EWIS and extinguishing systems
- Smoke control systems
- Emergency lifts
- Required general lights and power

Uninterruptible Power Supply System (UPS)

A dedicated “dual redundant” UPS will be provided for the computer server room equipment. The UPS will be rated at 140kVA with 30 minutes autonomy.

2.1.3 General Lighting

Lighting will be provided in accordance with AS/NZS 1158 to car parks, pathways, roads and building perimeter to provide a safe environment for the movement of vehicular traffic and pedestrians.

External lighting will be designed to limit light pollution in accordance with AS4282. External lighting will be controlled via a daylight sensor. Light fittings selected will have an efficacy of not less than 60 lumens/W to comply with section J6 of the BCA.

Internal lighting will be designed in accordance with AS 1680 and section J6 of the BCA.

Generally the offices and laboratories shall be illuminated using high efficiency T5 fluorescent lighting with electronic ballasts. Motion sensors will be used to control lighting where appropriate.

Emergency and exit lighting will be provided in accordance with AS2293 and the BCA.

2.1.4 General Power

Power outlets will be provided throughout the facility to meet the requirements of the space and equipment therein.

2.1.5 Fire

An analogue addressable fire detection system will be provided for the new HMRI facility. Fire detection coverage will be in accordance with AS1670.1.

Fire Fan Control modules will be incorporated into the Fire Indicator Panel to control smoke control equipment.

The system will link into the site wide fire network on the hospital campus

2.1.6 Emergency Warning and Intercommunication System (EWIS)

A full function EWIS will be provided for the new HMRI facility in accordance with AS1670.4.

2.1.7 Lightning Protection

The requirement for a lightning protection system has been assessed in accordance with AS 1768 and it has been determined that lightning protection is not required.

2.2 Communications Services

Communication services (data and telephony) will be provided to the New HMRI facility Via the Bio First & Energy Australia Lower Hunter Fibre Loop.

New fibre cables will be provided from the John Hunter PABX Room and the Royal Newcastle Centre PABX to the new HMRI Facility for connection to the Bio First & Energy Australia Lower Hunter Fibre Loop.

Licenses for connection into the Bio First & Energy Australia Lower Hunter Fibre Loop will be agreed by HMRI prior to connection.

2.3 Security Services

The new HMRI facility will have a security system, which will primarily provide access control, duress alarms, CCTV Surveillance and intruder detection for the facility.

All staff and visitors to the new HMRI facilities will be issued with security photo identification access cards. Access permissions will be programmed for each individual as determined by HMRI.

Electronic lockdown of the facility will occur outside of business hours. Exact times to be agreed with HMRI. Access to the building outside of working hours will be restricted to authorised personnel and programmed into their access cards.

Staff duress buttons are proposed for the reception and contact rooms.

CCTV coverage is proposed to cover the external entry points to the facility, public areas, entrances to the bioresources area and the entrance to the car park.

The security system will also be linked to the Hospital security system. The final details of the Security Management Plan for the John Hunter Hospital site as a whole and the new HMRI Facility will be finalised by HMRI and John Hunter Hospital prior to building occupation.

Lighting will be provided in accordance with AS/NZS 1158 to car parks, pathways, roads and building perimeter to provide a safe environment for the movement of vehicular traffic and pedestrians.

External lighting will be designed to limit light pollution in accordance with AS4282. External lighting will be controlled via a daylight sensor.

2.4 Design Parameters

2.4.1 General

Generally, design parameters will be in accordance with the stated Australian standards and the BCA.

2.5 Code Compliance / Applicable Standards

2.5.1 Australian Standards

The latest editions of the following, together with standards referenced therein, shall apply:

- AS/NZS 3000 – Wiring Rules, including all appropriate standards referred to therein
- AS/NZS 3010 – Electrical Installations – Generating sets
- AS/NZS 2201 – Intruder Detection Systems
- AS 2293 Part 1 – Emergency Escape Lighting and Exit Signs for Buildings
- AS 1670 – Automatic Fire Detection and Alarm Systems
- AS 1680 – Interior Lighting
- AS/ANZ 1768 – Lightning protection
- AS/ANZ 1158 – Lighting for Roads and Public Spaces
- AS 1940 – The storage and handling of flammable and combustible liquids
- AS 1670.4 – Fire Detection, Warning, Control and Intercom Systems
- AS/NZS 2243 – Safety in laboratories
- AS/ANZ 2381 – Electrical equipment for explosive gas atmospheres
- AS/ANZ 3080 – Telecommunications Installations – Generic cabling for commercial premises
- AS/ANZ 3084 – Telecommunications Installations – Telecommunications pathways and spaces for commercial buildings
- AS/NZS 3085-1 – Telecommunications Installations - Administration of Communications Cabling Systems

- AS/ANZ 3439 – Low Voltage Switch gear and control gear assemblies
- AS 3548 – Electrical Interference - Limits and Methods of Measurements of Information Technology Equipment.
- AS/NZS 4251.1 – Electromagnetic compatibility – Generic emission standard – Residential, Commercial and Light Industry
- AS/NZS 4806 – Closed Circuit Television (CCTV)
- AS/NZS 14763-3 – Telecommunications Installations –Specification for Testing of Optical Fibre Communication Cabling in accordance with values set out in AS/NZS 3080.
- AS/NZS 61935.1 – Telecommunications Installations – Generic Cabling Systems –Specification for Testing of Balanced Communication Cabling in accordance with values set out in AS/NZS 3080.
- AS 62040 – Uninterruptible Power Systems
- The Building Code of Australia
- Section J of the BCA
- Fire Authority requirements
- Local and Federal Government regulations
- Workplace Surveillance Act 1998
- AS/ACIFS008 – Requirements for authorised cabling products.
- AS/ACIF S009 – Installation requirements for Customer Cabling (Wiring Rules)
- TIA/EIA-606-A – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

3 VERTICAL TRANSPORATION

3.1 General

Lifts will be selected to provide personnel flow within the building, ensuring lift service commensurate with a high quality facility. Lifts will also be a major element of materials handling within the facility.

Preliminary traffic studies have been carried out to ensure the following items are addressed:

> Waiting times are within an acceptable range;

> Car dimensions are appropriate, i.e.:
  - Stretcher compliant

> Fit for purpose, i.e.:
  - Passenger lift
  - PWD (Persons with Disability) lift
  - Goods lift

> Number of lifts are appropriate

Car finishes, shaft access requirements, and provision of services will be fully coordinated with the relevant parties.

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