OWEN FERGUSON HEALTH

SOP PRIVATE HOSPITAL DA REPORT

Steensen Varming (Australia) Pty Ltd

SYDNEY
Level 2, 160 Sailors Bay Road
Northbridge NSW 2063

MELBOURNE
15 Gisborne Street
East Melbourne VIC 3002

BRISBANE
Level 2, 447 Upper Edward Street
Brisbane QLD 4000

CANBERRA
Ground floor, 128 Northbourne Avenue
Braddon ACT 2612

STEENSEN VARMING

MECHANICAL SERVICES DA REPORT

PRODUCED FOR
St Vincent's Hospital

ENGINEER
Steensen Varming (Australia) Pty Ltd
Level 2, 160 Sailors Bay Road
Northbridge NSW 2063
Tel: (02) 9967 2200
Fax: (02) 9967 2992

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CONTENTS

Mechanical Services

Introduction

General Description of the Project

The SOP Private Hospital is a new six storey building with basement and roof top plant room.

The basement will comprise a Kitchen, car park, stores and plant rooms.

The Ground floor level will comprise Administration, Hydrotherapy pool, Gymnasium, Main reception and Medical imaging

The first and second floors are both consultant rooms with some admin provisions on the second floor.

The third and forth floors are wards with an ICU ward on the forth level.

The fifth floor is operating theatres, recovery and CSSD.

Guidelines and Standards

The mechanical services shall be design and constructed in accordance with the requirements of the Building Code of Australia, relevant Australian Standards, NSW Health Department Engineering Services Guidelines TS11 and the relevant local Supply Authority requirements.

Occupational Health & Safety (OH&S)

Adequate space will be provided for servicing of equipment and parts in plantrooms and the general areas. Equipment will be installed to ensure adequate serviceability without the need for unsafe work practices. Reference will be made to:

- Manufacturer's installation instructions
- Workcover requirements
- Australian Standards

Equipment

Standardization of plant equipment shall be provided to reduce maintenance and numbers of different spare parts. Adequate space and access shall be provided to all plant equipment to avoid difficulties in servicing and replacing plant components.

Therefore, where possible, new plant for all sites will be of similar configuration, component manufacture and control sequence.

Objectives

The objective of this document is to outline the services requirements for the proposed Private Hospital Building redevelopment and identify systems and reticulation strategies appropriate to the DA stage.

Overview of Proposed Heating and Cooling Systems

The boilers and chillers will be centrally located, boilers will be gas operated and chillers water cooled units. Chilled water will be reticulated to air handling units and fan coil units, heating hot water will also be reticulated to air handling units and fan coil units. Spaces will be ventilated, heated and cooled via the air handling units and fan coil units.

It is proposed that the central energy plant will be located in enclosed plant rooms on Level 6. Cooling Towers will be located on Level 6 but in a separate open ventilated enclosure.

Air Handling unit will be located in level 6 plant room to serve the operating theatres on level 5.
Fan coil units will be located on the ward levels, level 3 and 4, such that they can be controlled by the occupants depending on whether they want mechanical ventilation and air conditioning or natural ventilation and cooling. Outside air fans located within the level 6 plant room will serve these fan coil units
Provisions will be made for fan coil units on the consultant room levels, level 1 and 2, similar to levels 3 and 4.
The ground floor will be arranged to be served by both air handling units as well as local fan coil units.

Mechanical Ventilation and Air Conditioning Services

Design Parameters

i) Outdoor Design Conditions for Homebush

Summer: 34℃ Dry bulb temperature
24℃ Wet bulb temperature

Winter: 5℃ Dry bulb temperature

Category 2 Areas

Space Temperatures for Design Conditions

Summer - 23^0 C $\pm$ 2^0 C
Winter - 22^0 C $\pm$ 2^0 C

Air conditioning systems will be ducted type both for supply and return air. Fully modulating outside air economy cycles will be fitted to central AHUs with up to 100% intake. This requires that the air handling unit, fan-coil section or equivalent indoor unit section is of sufficient size and capacity to effectively employ the outside air cycle or otherwise groups of fan-coil units could be fed from a common outside air cycle where it is appropriate to do so.

Air filtration for AHUs will be high efficiency dry media type using pre-filter panels and deep bed main filters in series fitted into custom built mixing plenums. In fan coil units high efficiency panel filters will be employed but with filters also employed in the outside air supply.

The following departments will all be considered as TS-11 Category 1 areas.

L4 – HDU ward

L5 – Operating Theatres

L5 – Recovery ward

The following departments will all be considered as TS-11 Category 2 areas.

Ground - Admin
Medical Imaging

Level 1 Consultant rooms

Level 2 Consultant rooms
Admin

Level 3 Wards

Level 4 Wards

Air Handling Design Requirements

For briefing purposes the following principles will be followed. Actual zoning and locations will be developed at Scheme Design stage.

i) **Air Handling Systems**

a) For VAV system the design will enable use of variable control of air flow either by variable speed motor controls or step controls on smaller units. Zone reheat coils shall be selected to comply with BCA Section J limits.

b) Modulating outside air economy cycles will be included on all significantly sized air handling plant.

c) Fan coil units will be employed to allow the choice of mechanical or naturally ventilated spaces.

d) Air handling plant will employ air filters that help the reduction of mandatory minimum fresh air quantities particularly in high population areas. Air filters will be made very accessible for cleaning and shall employ manometers with indicator lamps to ensure adequate frequency of cleaning or renewal.

e) Air systems will be designed to be air tight in sheetmetal ducts and AHU's. A review of the building fabric and ceiling details will be undertaken to ensure minimum leakage of air into or out of the building.

f) Separate localised air conditioning plant shall be provided for rooms with unusually high heat gains or intermittent operation, ie meeting rooms.

g) Zoning of all air-conditioning systems shall acknowledge different dynamic loads and conditions likely to occur due to:

- External glazing and wall materials
- Roofs and suspended floors
- Hours of operation
- Clinical or process functions
- Internal heat gain from people, lights, equipment.

f) Good access for maintenance away from clinical and in-patient spaces, this may require fan coil units to be placed over corridors.

g) Provision for excluding dust from plant room areas and air intakes by seals around entry doors and roughing filters behind intake louvres.

Smoke management

Provided the building is sprinklered, the height of the building does not require smoke control systems under the requirements of the BCA.

Heating and Cooling

Selection of suitable energy plant may therefore include:

- Central water chillers (air cooled).
- Central water chillers (water cooled).
- Hot water boilers (Natural gas fired).
- Reverse cycle water heat pumps (air cooled).

It is proposed that central water chillers and hot water boilers / heat pumps will be used to serve the Hospital.

The choice of air cooled chillers or water cooled chillers depends upon the degree of difficulty associated with maintaining water treatment in cooling tower systems as water cooled chillers are inherently more efficient than air cooled chillers. Currently in Sydney Metropolitan area water cooled chillers are preferred.

Water cooled chillers coupled to closed circuit coolers would be preferred to direct air cooled type. The main advantages are in energy savings both at high ambient conditions and in waste heat recovery.

All chillers irrespective of selection will be at least dual refrigeration circuit type and will be selected to operate on R134a or R407c as suitable zero ozone depletion refrigerants.

Boilers will be natural gas boilers fitted with modulating pressure jet burners. Boilers shall be selected for low standby losses and operational efficiency. Boilers shall be provided with condensing flue sections provided the waste energy can be usefully used, ie pre-heating the domestic hot water or heating of the hydrotherapy pool.

Steam boilers

Steam boilers will be provided within the roof plant room to generate steam for use within the sterilising department. These boilers will be vertical gas pressure jet burner type with flues to above the roof level.

Spatial Requirements

The plant final spatial requirements shall be determined by the designers, however it is anticipated the following indicative spatial requirements would be required. These however should be used only as a guide at this stage.

Item	Area	Comments
Chiller plant – air cooled chiller on the roof	200m2 at roof	Located at roof level in the open. Note – Acoustic advice should be sought regarding

	level	the impact of vibration on the operating theatres. Alternatively if vibration is considered to be an issue then water cooled chillers could be used with cooling towers on the roof and chillers in the basement.
Boiler plant – gas fired boilers	80m2 at roof level	Located at roof level within a plant room. Good natural ventilation required.
Steam boilers – if autoclaves do not have their own steam generators	80 m2 at roof level	Located at roof level within a plant room. Good natural ventilation required.
Air handling plant at roof level, ie AHUs for operating theatres, ground floor level and basement level, outside air fans for levels 1 – 4, exhaust fans for car park, kitchen and toilets / bathrooms, stair pressurization fans.	880m2 Roof level	Located at roof level within a plant room with good access into risers to serve the levels below.
Riser space	G – 2m2 1 – 12m2 2- 14m2 3 – 17m2 4 – 20m2 5 – 23m2	
Medical imaging	36m2	Ground level to allow for the possibility of the medical imaging machines to have their own air cooled chillers

Cost estimate

Mechanical services order of cost – BASED ON VERY PRELIMINARY SYSTEM DETAILS

Exclusions

Level 1 and 2 fit out of mechanical services

Ground level fit out of Imaging mechanical services

Sterilising and washing equipment

Inclusions

Basement - Car park exhaust
Kitchen exhaust and conditioned supply air

Stores and plant room supply air and exhaust

Ground floor – Hydrotherapy pool air conditioning and exhaust
Gymnasium air conditioning and changing room exhaust
Offices air conditioning
Foyer, corridor and reception air conditioning

Level 1 – Chilled water and heating hot water valved and capped ready for extending.
Outside air duct ready for extending into floor and into plant room above.
Toilet exhaust duct ready for extending into floor and into plant room.

Level 2 – Chilled water and heating hot water valved and capped ready for extending.
Outside air duct ready for extending into floor and into plant room above.
Toilet exhaust duct ready for extending into floor and into plant room.

Level 3 – Fully air conditioned via fan coil units
Outside air supply
Toilet exhaust

Level 4 – Fully air conditioned via fan coil units
Outside air supply
Toilet exhaust

Level 5 – Air conditioning and relief air to seven operating theatres
Air conditioning to CSSD
Air conditioning to recovery and holding areas
Toilet exhaust and other exhaust systems

Roof level – Chillers and associated equipment
Heating hot water boilers and associated equipment
Steam boilers and associated equipment
Air conditioning plant
Outside air fans
Exhaust fans

Fire Stairs - pressurisation

Order of cost - $4,500,000.00 plus GST

Medical Gases

The requirement of medical gases will be quite high on the level 5 operating theatre floor and also the level 4 ICU floor, elsewhere it is expected to be minimal due to the nature of the departments.

MEDICAL GAS SERVICES – SPATIAL REQUIREMENTS

The plant final spatial requirements shall be determined by the designers, however it is anticipated the following indicative spatial requirements would be required. These however should be used only as a guide at this stage.

Item	Area	Comments
Bulk Oxygen compound	6m x 3m	Located on the ground level with clear vehicular road access with vehicle hard standing off service road. Concrete compound slab and vehicle hard standing, no tarmac permitted. Open mesh and gated front to comply with AS1894.
Medical breathing air plant Three oil free air compressors, driers, vessel and regulators.	7m X 3m	Located at ground or basement level in a plant room. Good maintenance access required. Mechanical ventilation required, natural supply and mechanical exhaust.
Vacuum suction plant Three vacuum pumps, bio filters, vessel	6m x 3m	Located on ground or basement level in a plant room, could be adjacent medical air compressors. Good maintenance access required.
Tool air (two pallets of 12 cylinders)	4m x 1.8m	Ground level close to loading dock, ie good vehicle access for cylinder delivery. Open meshed front with gate access.
Nitrous oxide, if required.	2.7m x 1m	Ground level close to loading dock, ie good vehicle access for cylinder delivery. Open meshed front with gate access.
Ventilated space for empty and spare medical gases cylinders	3m x 3m	Ground level close to loading dock, ie good vehicle access for cylinder delivery. Open meshed front with gate access.

COST ESTIMATE

Medical gases services order of cost – BASED ON VERY PRELIMINARY SYSTEM DETAILS

<u>Exclusions</u>

All items that plug into the outlets.

Inclusions

Basement - No allowance

Ground floor – Bulk oxygen tank and standby supply
Nitrous oxide store
Tool air store
Pipework ready for medical imagining fitout.

Level 1 – No provisions

Level 2 – No provisions

Level 3 – Pipework
Isolation valve panels
Alarm panels
Outlets

Level 4 - Pipework
Isolation valve panels
Alarm panels
Outlets

Level 5 – Pipework
Isolation valve panels
Alarm panels
Outlets

Roof level – Medical air compressors and storage vessel
Vacuum suction pumps and receiver vessel

Order of cost - $600,000.00 plus GST

BUILDING MANAGEMENT SYSTEMS AND AUTOMATIC CONTROLS

Scope

A DDC (Direct Digital Control) system shall be provided with a BMCS head end. The BMCS shall be a Bacnet or other approved open protocol based system and shall be suitable for future extension.

The system will cover the following services:

- Mechanical services
- Chilled water plant
- Heating plant
- Air handling systems
- Ventilation systems
- Lighting
- Power
- Medical Gases supply
- Water systems
- Interface with security and other communication systems as appropriate.

Items to be monitored by the BMCS and level of monitoring

The following types of points shall be monitored:-

Chilled Water System

- Chiller on/ off and fault
- Cooling tower fans on / off and fault
- Chilled water and condenser water pumps on/off and fault
- Supply and return chilled water temperatures
- Chilled water mains supply and return flow rate
- Systems sequencing and lead/lag/standby operation.
- Electrical current consumption

Heating Water System

- Boiler on/ off and fault
- Supply and return heating water temperatures
- Heating water pumps on/off and fault
- Heating water mains supply and return flow rate
- Systems sequencing and lead/lag/standby operation.

Air Handling Systems

- Fan on/off and fault.
- Supply and return air temperatures
- Filter pressure
- Outside air temperature

- VAV box open percentage
- VAV box reheat battery
- Cooling and heating coil water temperatures

Medical Gases
- Oxygen tank level
- Medical air compressors on/off and fault
- Suction pumps on/off and fault
- System pressure of all gases
- Alarm signals of all gases

Hydraulic Systems
- All pumps on/ off and faults
- Hot water temperature

Security System
- Interface with alarm points

Electrical System
- Incoming supply voltage
- kW and kVA monitoring and recording.
- Generator status
- Load shedding
- Lighting circuit switching

Lifts
- General lift fault

Spatial Requirements

The BMCS data gathering panels shall be located within plant rooms and on floor communication rooms, the head end will be located within the Engineers Office.

ESD Initiatives

Energy efficiency will be an integral part of all mechanical services design. The following key elements will be included or pursued:

- Outside air economy cycles will be included in all air-conditioning systems, heat recovery between exhaust/relief and outside air will be included whenever these duct routes permit.
- Fan coil units to wards to allow air conditioning to match occupation times.
- Advice to improve thermal performance of building envelope through effective sun shading, high performance glass and innovative construction details. Part J of the BCA shall be complied with as a minimum.
- The use of high efficiency equipment such as variable speed low friction loss centrifugal chillers with environmentally friendly refrigerants such as R134a and R407c and high coefficients of performance.
- The pursuit of heat recovery and cogeneration in the central energy plant with an absorption chiller is to be considered.
- Advice will be provided to the architect regarding the insulation requirements to the various forms of wall and roof construction, in particular related to BCA Section J requirements.
- Consideration will be given to using condensing boilers with the waste heat being used for pre-heating the cold feed make up to the domestic hot water and heating of the hydrotherapy pool.
- Photovoltaic cells will be considered to supplement the normal mains supply and to provide a percentage of direct green energy.