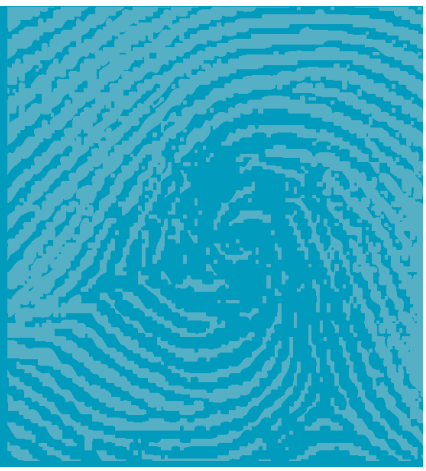

Design guidelines for hospitals and day procedure centres

Part E - Building services and environmental design

Victoria
The Place To Be

Issue 1 Release Notes

This release represents the first public issue of the new Victorian Guidelines for Hospitals and Day Procedure Centres (DGHDP). All previous releases were marked DRAFT for review and comment only.

Every effort has been made to check the new guidelines for errors and inconsistencies. Many difference stakeholders, proof-readers and reviewers have participated in this process. Nevertheless, As may be expected of issue 1 of a comprehensive set of new guidelines, errors and inconsistencies may still be found. These will be progressively corrected in future editions of the guidelines

Important Disclaimer

These Guidelines have been created as "Stand-alone" documents. Nothing in these Guidelines implies that compliance with them will automatically result in compliance with other Legislative or Statutory requirements. Similarly, nothing in these Guidelines implies compliance with the Australian Standards or the Building Code of Australia. Parts of these Guidelines such as Room Layout Sheets necessary show elements which may be subject of those Legislative or Statutory requirements. Every effort has been made to ensure such compliance, however no guarantees are made. It is the responsibility of each user to check and ensure compliance with other "Stand-alone" Legislative and Statutory requirements.

As the name suggests, the documents provided are "Guidelines". Users are advised to seek expert opinion on the important issue of Health Facility Design whilst considering these Guidelines. Many of the concepts covered by these Guidelines require a minimum level of knowledge of Health Facilities and Health Facility Design. Due to the generic nature of these Guidelines, all the individual circumstances can not be anticipated or covered. Furthermore, these Guidelines do not cover the operational policies of individual facilities. Delivery of excellence in health care as well as the provision of a safe working environment will depend on appropriate operational policies. The authors of these Guidelines as well as those involved in the checking or approval of these Guidelines accept no responsibility for any harm or damage, monitory of otherwise caused by the use or misuse of these Guidelines.

What is New?

These guidelines were specifically prepared by Health Projects International for Victoria using a specially customised database of health design knowledge. Over the last few years, thanks to a framework of cooperation between different State Departments of Health, the guidelines have been offered as the core of the proposed future National Health Facility Design Guidelines. The same database system is used to deliver the new NSW Health Facility Guidelines over the next few years. The delivery system, the structure and content database are shared, whilst each State initially has its own version meeting legislative and policy requirements. Over time, various State variations of the guidelines are expected to reduce to pave the way towards the future unified Guidelines.

Use of Other Guidelines

These Guidelines have been prepared after considering numerous other Guidelines available in Australia and overseas. Both words and concepts found in the other Guidelines have been used when appropriate, sometimes with changes to terminology or methods of measurement. Since very similar concepts and requirements are covered by many different guidelines, a clause by clause reference to other guidelines would be impractical. A short list of other Guidelines reviewed for the preparation of these Guidelines can be found under "References and Further Reading" in each section of the Guidelines. Nothing in these Guidelines implies or guarantees compliance with every requirement of those other Guidelines.

Credits

These Design Guidelines as well as the Guidelines Web Site have been prepared by:
Health Projects International Pty Limited (HPI) for the Department of Human Services, Victoria, (DHS).

Suite 1, Ground Floor, 68 Alfred Street, Milsons Point, NSW, 2061
Tel: 02 9460 4199 Fax: 02 9460 4299 www.hpi.net.au healthpi@ozemail.com.au

Index

Part E- Building Services and Environmental Design

1 ENGINEERING SERVICES - GENERAL

General

1 .1.00 This Guideline is performance oriented for desired results. It is assumed that accepted engineering practice, relevant codes and statutory regulations will be observed as part of normal professional services and that these aspects require no specific reference.

This Guideline is not intended to restrict innovation. In some circumstances it may be desirable to exceed the prescribed minimum standard.

1 .2.00 Engineering services in health care facilities shall satisfy general comfort demands, health procedure and patient care relevant requirements.

1 .3.00 An important role of engineering services is controlling specific risks characteristics within a particular Health Care Facility. Engineering services become part of the complex risk management environment which includes many other factors such as maintenance and management. The optimal solution is the structuring of risk management to suit the potential risks specifically for the facility and financial circumstances (that will vary among projects).

This guideline cannot cover all engineering options or define the requirements of a risk management system for engineering services. These systems should be developed during the design phase of the project.

1 .4.00 As energy efficient solutions are becoming increasingly important further requirements are proposed for inclusion in the BCA in the near future. Some energy efficient solutions based on good engineering and general project development approach do not necessarily increase capital costs.

The provision of most energy recovery equipment does increase capital costs of the project, therefore life cycle cost analysis will be required to justify additional expenditure and application of this equipment will depend on budget.

1 .5.00 It is not the intention of the Guideline to cover every aspect of public and private health facilities. Project specific issues that are expected to be covered in the project brief include:

- Involvement of affected stakeholders
- Nomination, listing of critical and sterile areas, including unacceptable risks
- Application of energy recovery systems, life cycle cost analysis and other financial requirements
- Provisions for foreseeable modifications
- Emergency power distribution
- Facility specific requirements
- Specific risks and risk management policy
- Trade wastes
- Service requirements for health care equipment
- Specific Management and Maintenance requirements
- Critical safety and performance parameters required being included into the maintenance regime.

1 .6.00 Healthcare procedure specific equipment is excluded from the engineering services as the service contractors usually do not provide them. Engineering services shall be provided as necessary to suit equipment.

General

1 .7.00 The engineering services are divided to the following main categories (in alphabetical order) in the Guideline:
- Ancillary mechanical services
- Communication
- Electrical power
- Fire Services
- HVAC (Heating, Ventilation, Air-conditioning) Services
- Hydraulic services
- Lift and escalator services
- Lighting
- Medical gases
- Security
- Structural

1 .8.00 Types of services shall be easily identifiable.

1 .9.00 Engineering services shall comply with relevant, applicable legislations and this Guideline. For a list of relevant legislation pertaining to HVAC, Medical Gases and Hydraulic Services refer to Enclosure E2.

1 .10.00 Other guidelines are mandatory by other authorities. For a comprehensive list refer to Enclosure E2.

1 .11.00 Services, or their loss, shall not cause any unacceptable hazard. The particular risks involved with patients and healthcare procedures shall be considered. Where loss of service could cause unacceptable risk (including post disaster function), services shall be continuously available and provide reliable operation.

1 .12.00 All services shall satisfy the facility specific healthcare procedure requirements, patients' and other occupants' needs. All services shall be designed and installed in a manner that will minimise the opportunities for patient self-harm.

All services shall satisfy comfort requirements as determined in Enclosure E1, including acceptable noise.

1 .13.00 All services shall be designed for safe usage and maintenance. Maintenance shall only cause acceptable minimal disruption to healthcare procedures and minimal disturbance to patients.

1 .14.00 Access points are recommended to be located outside patient areas and thoroughfares to avoid patient disturbance and frequent traffic.

1 .15.00 No services shall create a hazard to or damage the environment.

1 .16.00 Services shall be designed for minimal dust collection and easy cleaning.

General

1 .17.00 All services shall be energy and cost efficient within the budgetary limits of the project. The requirements of Energy Efficient Government Buildings - Sustainable Energy Authority Victoria should be incorporated into all aspects of the design and construction whenever possible.

1 .18.00 Operation, monitoring and control of services shall suit the specific patient and healthcare procedures needs of the area serviced. Controls generally shall be tamperproof.

As-built drawings and detailed Operation and Maintenance Manuals shall be supplied at the end of a project. The drawings shall be clearly marked "AS BUILT" in large lettering and submitted to the health care facility.

At the completion of the works, or section of the works, testing shall be carried out to prove the suitability and operation of the works or section of the works and that the installation complies in full with the requirements specified. Tests shall be conducted to NEBB or equivalent standard and complete and detailed results shall be submitted for review.

1 .19.00 All equipment shall be suitable for the environment where they are located and operate (including temperature and pressure) and for the material they handle.

General acoustic requirements, acceptable noise levels shall comply with AS2107.

2 ELECTRICAL SYSTEMS

Minimum Standards

2 .1.00 The minimum requirements for the provision of electrical installations in Health Care Facilities shall be those listed in Enclosure E1.

In addition to the minimum requirements and depending upon the type of the facility and installed services the following Australian Standards shall apply:

- Energy Efficient Government Buildings: Sustainable Energy Authority Victoria
- AS 3011 - Electrical Installations - Secondary batteries installed in buildings
- AS 2676 - Guide to the installation, maintenance and testing of secondary batteries in or on buildings
- AS 2430 - Classification of hazardous areas
- AS 2243.7 - Safety in laboratories - electrical aspects
- AS/ NZS 1680.4 - Maintenance of electric lighting systems
- AS 1768 - Lightning protection
- AS 1169 - Minimising of combustion hazards arising from the medical use of flammable anaesthetic agents.

All clauses outlined in the following section shall be in addition to statutory requirements.

Submains for Critical Care Services

2 .2.00 Standby lighting and power systems to AS 3009 shall be provided in critical care areas.

Light and general purpose power outlets in critical care areas shall have dedicated submains originating from the main switchboard. The switchboard and submains shall be configured to ensure continuous availability of electrical supply by means of an essential section on the switchboard.

Two dedicated submains circuits shall be provided for each critical care area. At least one of the circuits shall be connected to the emergency generator supply where installed. Critical care submains cables are not required to be fire rated. Protection against mechanical damage shall be provided.

Emergency power shall be connected to all critical patient equipment involved in invasive subcutaneous procedures and diagnostic procedures. High load diagnostic equipment shall be fitted with low power modes where possible to enable connection to a UPS. This will allow clinical personnel time to complete or finalise an invasive procedure without risk to the patient.

Standby Power

2 .3.00 The following factors shall be considered when dual high voltage electrical supplies are to be used without providing emergency generators:

- Do high voltage supply feeders originate from two independent network circuits?
- Are high voltage supply feeders reticulated through two separate geographical routes?
- Does the standby feeder have full capacity available all the time?
- Are the high voltage supply feeders reticulated overhead or underground?
- Is an automatic bus tie permitted by the Supply Authority?
- Are either HV feeders likely to be interrupted due to weather conditions, vehicle crashes or vandalism?
- Total life cost (initial capacity cost, authority charges and recurrent standby charges).

Emergency generators are recommended to be installed to ensure continuity of essential electrical supply in critical areas, when suitable dual supply high voltage feeders are generally not available.

Where the facility has a post disaster function or requires chilled water / cooling services for sustaining human life or critical service, this shall be achieved by providing sufficient electrical generation capacity to start and run chillers, chilled water pumps, critical air-conditioning necessary for the continued operation of all critical areas and services.

Connection of Mobile Generator

2 .4.00 For hospitals where life-sustaining procedures are undertaken and no emergency generator is installed, a quick connection facility is recommended to be provided to enable connection of a mobile generator to the essential (emergency) section of the main switchboard.
Designers shall analyse and document the risks associated with this system.

Earthquake Protection for Generator

2 .5.00 The main electrical switchboards and emergency generators including remote cooling plant design and installation shall comply with AS 1170.4 Earthquake loads for seismic constraint requirements.

Standby Power Electrical Outlets

2 .6.00 Power outlets and light switches connected to a UPS or automatic diesel generator shall have either toggles or plates distinctively colour coded. Engraving of outlets will be acceptable in lieu of coloured flush plates or rockers.

Emergency Light and Power (UPS)

2 .7.00 Fixed surgical luminaries in Operating Rooms shall be connected to an Uninterruptible Power Supply (UPS) System. Examination lights in Procedure Rooms, Birthing Rooms and the like shall be connected to 'Vital (1sec)' cental battery systems. Other 'Vital (1 sec)' lighting circuits may be connected to the central battery power system or may consist of self contained single point systems.

All battery supported equipment such as PABX, radio paging and fire alarm systems, together with medical gas warning, nurse call and similar systems shall be connected to 'Vital (1 sec)' circuits, (maximum delay 1 second).

Any room or enclosure containing secondary batteries with a stored capacity exceeding 1 kWh or a floating voltage which exceeds 115 volts, that installation shall comply with the installation requirements of AS 2676 ' Guide to the installation, maintenance, testing and replacement of secondary batteries in buildings' and AS 3011 'Secondary batteries installed in buildings'. Note that vented batteries require specific emergency wash down and washing facilities to be provided.

Emergency lighting shall be provided in corridors, stairways, toilets, ensuites, utility rooms, patient treatment areas and other critical use areas for the safe management of patient care.

Planned Spare Electrical Capacity

2 .8.00 An allowance of additional floor space to accommodate future electrical capacity shall be considered in the design phase.

Planned spare electrical capacity shall be based on predicted future building loads and future equipment loads or the following table:

BUILDING CATEGORIES		VA per m2	kVA per m2
AIR-CONDITIONING WITH NON-ELECTRIC HEATING		100	0.10
AIR-CONDITIONING WITH ELECTRIC HEATING		120	0.12
AIR-CONDITIONING REVERSE CYCLE		110	0.11
ELECTRIC HEATING NO COOLING		100	0.10
NON-ELECTRIC HEATING NO COOLING		60	0.06

Patient Electrical Protection Systems

2 .9.00 Patient treatment areas where electrico-medical equipment may be used for procedures classified as either body-type or cardiac-type as defined by AS 3003, shall have electrical installations installed to comply with AS 3003 'Electrical installations - patient treatment areas of hospitals and medical and dental practices'.

Labelling and Identification of Outlets & Switches

2 .10.00 All RCD protected outlets shall be labelled 'RCD Protected'. All outlets and switches shall be labelled. Circuits and phase number shall be suitably identified at each light and outlet switch position.

Outlets in Nursery and Clinical Patient Rooms shall be RCD protected and shall be fitted with safety shutters.

General Lighting

2 .11.00 General lighting levels shall comply with the BCA and shall not be less than the recommended illuminance stated in AS 1680.1 'Interior lighting - General principles and recommendations'.

Night lights shall be installed in all Patient Care Areas and exit passages where normal lighting levels will decrease at night. Night lights shall be mounted at a low level and shall be low intensity and diffused. Night light levels shall not interfere with patient sleep.

Clinical Lighting

2 .12.00 Light fittings with a colour rendering index complying with AS/NZS 1680.2.5 - 'Interior lighting - Hospital and medical tasks', shall be provided based on clinical need as determined by the facility.

Triphosphor lamps with a colour rendering index of 85 shall be fitted only after consultation with clinical staff.

A clinical observation light shall be provided where clinical observation is required. A patient reading light shall be mounted at each bed head. If the clinical observation light is not required to be colour corrected, clinical observation lighting and patient reading lighting can be incorporated into one fitting.

Energy Efficiency

2 .13.00 The following energy efficiency measures are not mandatory but are recommended; a cost benefit study will often confirm these systems as cost effective:

- High efficiency motors over 1.5 kW
- Variable speed drives installed in all pumps and fans over 4 kW to enable turn down during out of hours operations
- Fluorescent light fittings to be fitted with power corrected, low loss ballasts; consider the installation of triphosphor light tubes
- Power factor correction capacitors on the main switchboard to achieve a power factor of greater than or equal to 0.95
- Automatic lighting controls.

3 COMMUNICATIONS

Minimum Standards

3 .1.00 The minimum requirements for the provision of voice and data communications in Health Care Facilities shall be those listed in Enclosure E1.

All clauses outlined in the following section shall be in addition to statutory requirements.

Telephone

3 .2.00 Telephone Block cabling shall conform to Austel technical standards and specifications. An expansion capacity of 25 percent is recommended to be allowed. All cableways shall be fully accessible.

Intermediate distribution frames (IDF) and (SDF) are recommended to be located in areas that are secure and fully accessible.

Combined voice-data outlets are recommended to be installed where appropriate.

Nurse Call System

3 .3.00 Nurse call systems shall be hard wired and designed and installed in accordance with AS 3811 'Hard wired patient alarm systems'. Nurse activated emergency call buttons are recommended to be separate from the patient nurse call button.

Interfacing of Alarms

3 .4.00 Intelligent alarm interfaces are recommended to be provided on nurse call systems to accept digital and analogue alarm inputs from duress systems, fire information panels, patient egress monitors, security systems and plant alarms such as oxygen failure.

Public Address System

3 .5.00 A public address system shall be installed in the hospital facility and shall incorporate evacuation warning (tones or messages), area paging, intercommunication facilities, background music and other communications services as considered appropriate. Where installed, such systems should not be unduly intrusive to patients in ward areas. When functioning as a part of the facility's emergency evacuation system it shall continue to operate during periods of major power failure.

An Emergency Warning Intercom System (EWIS) shall be provided where required by the Building Code of Australia. The installation of an EWIS in other cases is recommended.

Paging System

3 .6.00 A paging system shall be used to supplement the hospital telephone system for contact with key staff members. This facility may include arrangements for assistance call and other emergency signals. Automatic interface with the fire alarm system is recommended. Paging may be of the public address or self contained radio frequency type which produces full alpha/numeric message information.

Paging facilities shall be maintained in the event of a major power failure in accordance with AS 3009 'Electric installations - Emergency power supplies in hospitals'.

4 SECURITY SYSTEMS

Minimum Standards

4 .1.00 The minimum requirements for provision of security systems in Health Care Facilities shall be:
- AS 2630 Guide to selection and application of intruder alarm systems for domestic and business premises
- AS 2201.1-4 Intruder alarm systems.

All clauses outlined in the following section shall be in addition to statutory requirements.

A documented risk analysis shall be conducted to determine the appropriate level of security systems required.

Duress Alarms

4 .2.00 Duress alarm points shall be installed in the following positions:
- Front entrances
- Emergency Unit triage
- Staff and nurse stations
- Mental health counselling rooms
- Pharmacies
- Cashiers areas
- Any area where staff are regularly alone with patients or the public.

Security Lighting

4 .3.00 External lighting shall be configured to take into account security requirements.

Access and Egress Control

4 .4.00 Building/s exteriors shall be capable of being secured against unauthorised entry.

The installation of a central monitored electronic security system linked to the fire indicator panel is recommended.

Intruder Alarms and Security Systems

4 .5.00 Provide security systems to those categories as nominated in these Guidelines.

5 LIFTS AND ESCALATORS

Minimum Standards

5 .1.00 The minimum requirements for provision of lifts and escalators in Health Care Facilities shall be those listed in Enclosure E1.

In addition to the minimum requirements and depending upon the type of facility and installed services the following Australian Standards shall apply:
- AS/NZS 1680.2.5 Interior Lighting - Hospital and medical tasks.

All clauses outlined in the following section shall be in addition to statutory requirements.

Requirements for Lifts

5 .2.00 A Health Care Facility with patient services located on a level other than the ground floor shall install one or more passenger lifts.

Lift Car Size

5 .3.00 Lift car sizes shall be determined by a traffic study which will result in a recommendation for the number, type, speed and occupancy requirements of the lift/s in the facility. The traffic study will determine the lift dimensional requirements.

Lift/s required for transporting patients on beds and emergency lift car/s shall be capable of accepting the largest hospital bed with emergency equipment attachments and attendants.

Emergency Lifts

5 .4.00 Each lift shall start sequentially and 'home' to the Ground Floor at rated speed, open its doors and allow any passengers to alight, then shut down with doors open. The preceding lift must shut down before the next lift starts.

All lifts shall illuminate a 'Returning to Ground Floor' indicator on the car operating panel until the lift has arrived and the doors opened. Car lighting and ventilation fan within each lift shall remain operative while on emergency power operation.

On completion of the homing assignment a minimum of one lift shall continue to run and answer calls on a two button collective system and on fire service control as applicable. The other lifts shall be prevented from starting until normal mains power is restored.

Patient Transfer Lift Lighting

5 .5.00 Patient transfer lifts shall have clinical observation lighting complying to AS/NZS 1680.2.5 'Interior lighting - Hospital and medical tasks'.

Lift Doors

5 .6.00 Lift car doors shall be of the horizontal opening, power operated type.

Door operators shall be adjustable speed and torque type to provide positive, efficient, quiet and smooth door closing.

Each lift car door shall be provided with a passenger protection device of the solid state modulated multi-beam infra red type with extended convergence zone protection into the hallway for greater passenger protection and to reduce the doors being damaged by trolleys and hospital beds.

Automated Service Lifts

5 .7.00 The installation of service lifts with automated loading and unloading ability is recommended to be considered between:
- Sterile Supply Unit and Operating Units
- Pharmacy and Inpatient Units

Good planning will minimise the need for vertical transport services. Service lifts and dumb waiters cost less to install than passenger lifts.

Telelift, Document Hoist & Pneumatic Tube Systems

5 .8.00 The installation of document and materials transport systems should be considered to assist in reducing demand on passenger lifts.

6 HEATING, VENTILATION AND AIR-CONDITIONING

Minimum Standards

6 .1.00 The minimum requirements for the provision of heating, ventilation and air-conditioning in Health Care Facilities shall be those listed in Enclosure E2.

In addition to the minimum requirements and depending upon the type of facility and installed services the following Guidelines and Australian Standards shall apply:

- Guidelines for the Classification and Construction of Isolation Rooms in Health Care Facilities - Department of Human Services Victoria
- Guidelines for the Use of Glutaraldehyde in the Health Industry - Department of Human Services Victoria
- Energy Efficient Government Buildings - Sustainable Energy Authority Victoria
- AS 4508 - Thermal resistance of insulation for ductwork used in building air conditioning.
- AS 4343 - Pressure equipment - Hazard levels
- AS 4260 - High efficiency particulate air (HEPA) filters - Classification, construction and performance
- AS 3666.1-3 - Air handling and water systems of buildings - Microbial control
- AS 3653 - Boilers - Safety, management, combustion and other ancillary equipment
- AS/NZS 2982.1 - Laboratory design and construction - General requirements
- AS 2639 - Laminar flow cytotoxic drug safety cabinets - Installation and use
- AS 2593 - Boilers - Unattended and limited attendance
- AS 2243.3 - Safety in laboratories - Microbiological aspects and containment facilities
- AS 2243.6 - Safety in laboratories - Mechanical aspects
- AS 2243.8 - Safety in laboratories - Fume cupboards
- AS 1807 - Cleanrooms, workstations, safety cabinets and pharmaceutical isolators - Methods of test
- AS1668.1 The use of ventilation and airconditioning in buildings - Fire and smoke control in multi-compartment buildings
- AS1668.2 The use of ventilation and airconditioning in buildings - Ventilation design for indoor air contaminant control
- AS1668.3 The use of ventilation and airconditioning in buildings - Smoke control systems for large single compartments or smoke reservoirs
- AS/NZS 1677.2 Refrigerated systems - Safety requirements for fixed applications
- AS 1386.1 - Cleanrooms and workstations - Principles of clean space control
- AS 1386.4 - Cleanrooms and workstations - Non-laminar flow Cleanrooms - Class 3500
- AS 1228 - Pressure equipment - Boilers

All clauses outlined in the following section shall be in addition to statutory requirements.

General

6 .2.00 Heating includes equipment, providing heating for comfort or other purposes and can be part of an air-conditioning system.

Mechanical ventilation includes toilet and general exhaust systems, fume cupboards, biohazard cabinets, exhaust hoods, smoke management and pressure and infection control systems based on pressure and airflow direction control. Mechanical ventilation can be part of an air-conditioning system.

Air-conditioning is the process of treating air to control all or some selected parameters such as temperature, humidity, pressure, air movement pattern / velocity and cleanliness.

Refrigeration means cooling equipment for coolrooms and other not comfort related cooling purposes.

6 .3.00 Heating shall be provided and cooling is recommended to be provided for each area used by patients. Cooling is not required in any bathroom or toilet area with an exhaust system.

6 .4.00 Ducted air-conditioning systems shall be capable of providing sufficient mechanical ventilation, even if natural ventilation is available.

6 .5.00 Where loss of system performance will cause an unacceptable risk in critical areas, based on risk assessment, performance shall be maintained by duplex systems, monitored and an alarm shall be raised if performance lost.

6 .6.00 Ventilation systems in critical areas such as Operating Rooms, Recovery, CCU, ICU, Emergency Unit and Infectious Diseases Units shall operate on emergency power. All ventilation systems in areas defined as patient care in section 9a of the BCA are recommended to operate on emergency power.

6 .7.00 Access to plant rooms are recommended to not be via treatment areas. All services in occupied areas are recommended to be concealed where possible, but if exposed then arranged to limit dust and dirt build-up.

6 .8.00 All components such as temperature sensors and wall grills within an occupied space shall be suitable for swab down cleaning. (Not waterproof).

6 .9.00 Rooms containing heat producing equipment, such as boiler or heater rooms or laundries, shall be insulated and ventilated to prevent the floor surface above and/or the adjacent walls of occupied areas from exceeding a temperature of 6 degrees Celsius above ambient room temperature.

Infection Control

6 .10.00 Design principles throughout the patient care areas shall, in addition to comfort requirements, comply with infection control requirements. To minimise the risk of infection the ventilation system shall be designed and balanced to provide directional air flow from clean to less clean areas. Room pressurisation shall be maintained as prescribed in Enclosure E1 (Air Movement Relationships). This will frequently require air quantities in excess of the minimum scheduled in the Australian Standard AS 1668 Part 2, and these Guidelines.
Positive flow at adequate rates is preferred to the defining of pressure differentials between areas. In some circumstances, flow may be required only on opening of doors and the system shall have adequate flexibility to accommodate this requirement.

6 .11.00 Provision shall be made to ensure adequate air supply with varying filter resistances in areas requiring high levels of airborne contaminant control. Typically this will be in Operating Rooms, Set-up Rooms, Isolation Rooms and High Infection Risk Areas.

6 .12.00 Rooms or booths used for sputum induction, aerosolized pentamidine treatments and other high-risk cough inducing procedures shall be provided with local exhaust ventilation in addition to infection control requirements called up in these Guidelines for the classification and construction of isolation rooms in health care facilities - Department of Human Services Victoria. See enclosure E1 for ventilation requirements.

6 .13.00 Dirty linen and Dirty Utility Rooms shall be maintained at a negative air pressure relative to adjacent areas. Clean linen rooms in patient care areas shall be maintained at a positive air pressure relative to adjacent areas.

6 .14.00 If individual room recirculation (unitary fan coil) units are to be used in High Risk Areas, high efficiency filters shall be installed and additional cleaning procedures approved by the Infection Control Committee shall be implemented. Additional air handling equipment will be required to achieve the necessary clean to less clean airflow patterns.
Such areas include:
- Birthing / Delivery Rooms
- Nurseries
- Protective Isolation Rooms / Units
- Special Care Units
- Treatment Rooms
- Emergency Areas

Systems incorporating central air supply and remote filter stations are recommended for these areas.

6 .15.00 Fans in systems serving areas requiring airborne contaminant control shall be operated 24 hours per day to maintain airflow patterns from clean to less clean areas.

6 .16.00 Air-conditioning systems shall maintain fresh air, temperature, humidity and contaminant control (dust, micro-organisms and gases) of the air within prescribed limits

6 .17.00 Infectious diseases isolation and treatment rooms shall have negative pressure ventilation and shall be in accordance with the Guidelines for the classification and construction of Isolation Rooms in health care facilities - Department of Human Services - Victoria.

Outside Design Conditions

6 .18.00 Outside design conditions shall be based on the most accurate climatic data available for the location of the proposed project.

6 .19.00 Outside design conditions shall be selected as follows:

- For the locations listed in AIRAH - ACS Design Aid DA9a: Air conditioning systems - Design Temperature Data (2). For Operating Unit plants and Critical Care Areas use the 'Critical Process', 24 hour data if available for the location, otherwise use the 'Comfort or Non Critical' data with appropriate allowance.

  For all other plants use the 'Comfort or Non Critical Process Installations' data.

- For locations not listed in Design Temperature Data (2) use data for the nearest listed location having similar climatic characteristics. The data in reference Design Temperature Data (2) has been prepared by the Bureau of Meteorology from their archives for hundreds of locations in Australia and as such it represents a significant increase in the accuracy of data compared with what was available previously.

Room Design Conditions

6 .20.00 Room design conditions are summarised in Enclosure E1. Table 1 contains:

- Air movement (pressure difference) relationship between rooms
- Minimum outdoor air requirements
- Minimum air changes per hour
- 100% exhaust requirements
- Minimum filtration requirements
- Prohibition of air recirculation by room units
- Relative humidity
- Room design temperature.

550370.xls

6 .21.00 The temperature at 1.5 metres above the floor in a room shall not vary by more than 1 degree Celsius. The temperature difference between rooms on the same zone shall vary by not more than 3 degrees Celsius. The temperature difference between floor level and 1.5 metres above the floor shall be not more than 1.5 degrees Celsius. The temperature of the floor shall be within the range 19 degrees Celsius to 26 degrees Celsius.

6 .22.00 Average air velocity in the room shall be between 0.1 and 0.15 m/s. Particular care with the design of air distribution is required in Operating Rooms and rooms where patients are on beds and trolleys such as Patient Bed Rooms, Recovery, Emergency and Critical Care. Under no circumstances shall the supply air rate be less than 6 ACHR in any room any time. This applies to minimum air quantities on variable air volume systems as well as to constant volume systems.

6 .23.00 Evaporative cooling shall be designed to maintain acceptable indoor comfort conditions, based on heat stress index or similar criteria.

Room Design Conditions

6 .24.00 Zoning of air handling plant shall be provided to the extent required to limit the temperature difference between rooms served by the same zone to a maximum of 3 degrees Celsius.

Heating

6 .25.00 All occupied areas shall be heated.

6 .26.00 Central heating plants are recommended to consist of a minimum of two adequately selected heating units, furnaces or boilers, to provide standby in the event of failure or maintenance of one heating unit.

6 .27.00 Open fires, portable heaters and unflued gas heaters shall not be installed in patient areas.

6 .28.00 Boiler accessories including feed pumps, heat circulating pumps, condensate return pumps, fuel oil pumps, and waste heat boilers shall be connected and installed to provide both normal and standby service.

6 .29.00 Heating systems shall be thermostatically controlled. Heating systems with long thermal lag, for example, most types of in-slab heating, shall only be used when there is no alternative. These systems shall incorporate a control system to hold space temperature within 2 degrees Celsius of the winter design value. Temperature control that relies on opening windows to compensate for over heating shall not be used. The surface temperature of heating equipment in occupied areas shall not exceed 50 degrees Celsius. The temperature at floor level shall not deviate by more than 1.5 degrees Celsius above the air temperature at a height of 1.5 metres.

Cooling

6 .30.00 Cooling tower and evaporative condenser systems shall be designed and installed in accordance with the Health (Legionella) Regulations and AS 3666 - Air handling and water systems of buildings - Microbial control.

6 .31.00 Cooling towers and evaporative condensers shall include a side stream filter or cyclonic separator system to provide solids removals from the circulating water systems.

6 .32.00 Evaporative cooling may be used for support areas where relief cooling only is required such as kitchens and workshops and some other non-critical areas, where suitable. Observe standards and codes for design as for air-conditioning.

6 .33.00 Central cooling plant chiller sets shall be selected to ensure that in the event of failure of a compressor, adequate standby capacity is available for selected critical areas. Select chillers that maintain reliable, energy efficient low-load operation.

Ventilation - Outdoor Air

6 .34.00 Outside air shall be provided according to AS1668 Part 2 as adopted by the BCA. Enclosure E1 contains data from AS 1668 Part 2 with the addition of data on areas of hospitals not covered by the standard. Enclosure E1 shall be used as a supplement to Table A1 of AS 1668 and be read in conjunction with the Standard.

In areas where there are high people densities, the actual number of people in the space shall be used. It should be noted that values in AS 1668 for areas such as the Staff Cafeteria yield more people than is normal for such spaces in hospitals.

6 .35.00 All ventilation systems shall be designed to control the high level of odours often generated within Health Care Facilities.

6 .36.00 All bathroom and toilet exhaust systems shall be fully ducted and discharge to outside, not to common roof or ceiling space.

6 .37.00 Variable volume supply air systems shall incorporate control devices to ensure minimum outdoor air supply to all areas is maintained at all times.

6 .38.00 Regardless of whether the area is served via operable windows, forced fresh air shall be provided in accordance with these guidelines to all air-conditioned occupied spaces.

6 .39.00 Sanitary compartments, Dirty Utility Rooms and similar spaces shall not be ventilated by a system which also serves areas such as Operating Rooms.

6 .40.00 Ventilation systems for rooms where ethylene oxide (ETO) sterilizers are used and ETO store shall be designed in accordance with the Occupational Health and Safety section of these Guidelines. Upon loss of exhaust system airflow, an audible and visual alarm shall activate in the steriliser work area, and at a location that is continually staffed.

6 .41.00 Where conditions permit, natural ventilation may be used, for non-patient areas such as boiler rooms and central storage.

Ventilation - Exhaust Air

6 .42.00 Contaminated exhaust systems, including those serving toilets, and those necessary to attain positive air flow from clean to dirty areas shall be provided with duplex fans or fan motors and automatic change over from duty to standby in the event of a failure of the fan or motor. Alternatively, single motor fan systems are recommended to be fitted with differential pressure switches, to provide remote alarm indication of fan failure. This shall not apply to independent toilet exhaust systems serving single use toilet/shower or bath areas.

Ventilation - Exhaust Air

6 .43.00 Each space routinely used for administering inhalation anaesthesia and inhalation analgesia shall be served by a scavenging system to vent waste gases. If a vacuum system is used, the gas collecting system shall be arranged so that it does not disturb patients' respiratory systems. Gases from the scavenging systems shall be exhausted directly to the outside.

Anaesthesia evacuation systems may be combined with the room exhaust systems, provided that the component used for anaesthesia gas scavenging exhausts directly to the outside and does not recirculate. Scavenging systems are not required for areas where gases are used only occasionally, such as emergency rooms and offices for outline dental work. Acceptable concentrations of anaesthetising agents are unknown at this time. The absence of specific data makes it difficult to set specific standards. However, any scavenging system is recommended to be designed to remove as much of the gas as possible from the room environment. It is assumed that anaesthetising equipment will be selected and maintained to minimise leakage and contamination of room air. (Refer also to the Occupational Health and Safety requirements in these Guidelines).

Air Handling Systems

6 .44.00 In selecting air handling system types, consideration shall be given to the cost and ease of maintaining the systems. Points to be considered include:

- Plant and components located over occupied areas shall be installed in a manner so that routine maintenance does not cause disruption to normal hospital activities; in this respect plant is recommended to not, for example, be located in ceilings over patient beds
- The level of maintenance expertise available on site and the level of technical expertise available to the hospital to operate and adjust the system
- Preference shall be given to simple systems requiring simple maintenance and adjustment with extended periods between routine maintenance.

6 .45.00 All supply air, return air and exhaust shall be fully ducted in areas defined as Patient Care Areas in section 9a of the BCA.

6 .46.00 Plant room ventilation supply air shall be filtered.

6 .47.00 The bottoms of ventilation (supply / return) openings shall be at least 75 mm above the floor.

Air Handling Systems

6 .48.00 Humidifier systems shall comply with the following requirements:
- Humidification shall be achieved by the direct injection of low pressure steam into the supply air stream; where reticulated steam is not available an electrode type humidifier shall be used.
- Ducting surrounding the humidifier discharge shall be constructed to minimise the possibility of corrosion by using materials such as copper or grade 321 stainless steel, for a distance of 1500 mm downstream and 500 mm upstream of the unit.
- The base of the humidifier duct shall be graded into an open tundish through a trap next to the outlet.
- An electrical interlock shall be provided so that the humidifier can operate only when the supply air fan is operating.
- If duct humidifiers are located upstream of the final filter, they shall be located at least 4.5 metres upstream of the final filters.
- Ductwork with duct mounted humidifiers shall have a means of water removal.
- An adjustable high-limit humidistat shall be located downstream of the humidifier to reduce the potential of condensation inside the duct.
- All duct take-offs are recommended to be far enough downstream of the humidifier to ensure complete moisture absorption.
- Reservoir type water spray or evaporative pan humidifiers shall not be used.
- Duct lining shall not be installed within 4.5 metres downstream of humidifiers.

6 .49.00 Supply air and exhaust air grilles shall be made of non-corrodible material, for example, anodised aluminium section. Supply air ducting shall be designed and manufactured to prevent possible induction of contaminated air.

6 .50.00 Air handling duct systems shall be designed to be accessible for duct cleaning.

Access panels shall be fitted at each reheat coil and fire and smoke damper to allow annual Essential Services inspection

6 .51.00 Duct insulation shall be external to the duct to allow internal cleaning where required.

6 .52.00 Duct acoustic treatment and equipment such as fan coil units, conditioners and VAV boxes incorporating fibrous insulating materials shall not have fibres exposed to the airstream. Perforated facing shall have impervious linings.

6 .53.00 All duct work of air-conditioning systems and ventilation systems which supply or recirculate air shall comply with the following requirements:
- No internal lining
- Reasonable access for low frequency cleaning without need for major works
- Attenuators to have impervious lining between facing and acoustic lining
- Attenuators shall be readily removable and located within plant rooms and other accessible areas that facilitate easy removal.

6 .54.00 Air handling units and air-conditioning units in Level 1 and 2 hospitals shall comply with the following:-
- Accessible and cleanable as per AS 3666 - Air handling and water systems of buildings
- Internal lining shall have impervious facing on the air side

Air Handling Systems

6 .55.00 Air handling units and air-conditioning units in Level 3 and above hospitals shall comply with the following:

- Easy door/hatch access and space to all internal areas of units for inspection, maintenance and cleaning; door access required where size permits.
- No internal lining
- All internal surfaces to be hygienic and cleanable such as powder coat finish, stainless steel or high quality paint finish
- Internal lights shall be installed in all units over 3000 l/s airflow
- Condensate trays to be well sloped to drain with no water retention in tray and constructed of corrosion resistant materials
- All sections downstream of filters that operate below ambient pressure shall be sealed to prevent air leakage.

6 .56.00 In psychiatric patient rooms ceiling mounted air devices shall be of a secure type.

6 .57.00 Duct linings exposed to air movement shall not be used in ducts serving Operating Rooms, Birthing/ Delivery rooms, Labour/ Delivery Rooms, Nurseries, Protective Environment Rooms and Critical Care Units. This requirement shall not apply to mixing boxes and acoustical traps that have special coverings over such lining.

6 .58.00 Filter frames shall be durable and dimensioned to provide an airtight fit with the enclosing ducting. All joints between filter segments and the enclosing ducting shall be fitted with a gasket or sealed to provide a positive seal against air leakage. A manometer is recommended to be installed across each filter.

Air Filtration

6 .59.00 Heating, ventilation and air-conditioning systems shall control the concentration of air-borne particulates in High Risk Areas to minimise the risk of infection by means of air pressure, flow control and air filtration. The level of control shall be proportional with the risk.

6 .60.00 Air filtration efficiencies shall be as specified in Enclosure E1. (Refer also to Chapter 'Room / Area Specific Requirements'.

Filtration efficiency ratings are based on average efficiency according to AS 1324 - 'Air filters for use in general ventilation and air-conditioning' and AS 4260 - 'High efficiency particulate air (HEPA) filters - Classification, construction and performance'.

Control Systems

6 .61.00 All adjustable controls such as thermostats are recommended to be provided with locking covers to prevent tampering.

6 .62.00 Provision shall be made to operate the air-conditioning system within the required temperature and humidity range prescribed in Enclosure E1. The range may need to be adjusted to suit local preference or medical needs, when, for instance elderly patients and babies may require higher temperature.

Energy Conservation and Management

6 .63.00 Energy conservation design shall not compromise infection control systems. The requirements of AS 4187 shall be maintained in respect of ambient conditions for sterile stock.

6 .64.00 It may be practical in many areas to reduce or shut down mechanical ventilation during appropriate climatic and patient-care conditions and to use open windows for ventilation.

6 .65.00 Each mechanical ventilation system supply or exhaust is recommended to be equipped with a readily accessible means of either shut-off or volume reduction.

6 .66.00 To conserve energy when Operating Rooms are not in use, low air flow modes of operation can be used. Systems that maintain correct pressure gradients at lower flow rates, however, have greater temperature throttling ranges. Heating and cooling can be shut down during extended periods of non use provided supply air fans are left running. An over-ride system shall be installed to enable out of hours operation of heating and cooling.

6 .67.00 Air-handling systems shall be arranged to allow the closing down of whole non critical or high risk areas at times of low occupancy. The air-conditioning system shall incorporate sufficient separation of air handling systems, zoning for temperature control and smoke exhaust mode operation to maintain conditions when common air-handling plant is used.

The requirements of Energy Efficient Government Buildings - Sustainable Energy Authority Victoria should be incorporated into all aspects of the design and construction whenever possible.

Occupational Health and Safety

6 .68.00 Where Ethylene Oxide (ETO) is used for sterilisation:

- ETO steriliser installations shall be designed, installed, operated and maintained in accordance with AS 2647 Biological Safety Cabinets
- Sterilisation operations involving ETO shall be isolated from all non-ETO work areas
- Fan blades and other associated components of the ventilation system shall be made of non-sparking material
- Local exhaust inlets shall be located at areas close to the steriliser and aerators
- The installation design shall ensure that gases are pulled away from the operator when the door of the steriliser is opened
- Exhaust air shall not be discharged into any work area or into the general environment without decontamination or decomposition by using a Catalytic Converter or other equivalent.

6 .69.00 Cooling shall be provided on the following basis:

- If natural ventilation is proven to be inadequate, laundries and workshops shall be cooled using ducted evaporative cooling systems.
- Depending on the proximity and the intensity of the heat source to a person, spot cooling may be required. Kitchens are recommended to be served by evaporative cooling systems with facilities for tempering the supply air during winter months or be fully air conditioned if it is a cook-chill facility.

6 .70.00 Ducts which penetrate shielded rooms such as an X-ray Room shall not impair the effectiveness of the protection.

Occupational Health and Safety

6 .71.00 Dark Rooms or any film processing area shall be provided with sufficient mechanical exhaust capable of removing any vapour released from the process.

6 .72.00 Surgical plume generated during laser and diathermy use shall be exhausted. Surgical plume contains tissue particles, carbon debris, hazardous chemicals, and bacterial and viral particulates and presents a potential hazard to the health of personnel in the Operating Room.

6 .73.00 Occupational Health and Safety (Noise) Regulations shall be fully complied with in all plantrooms, workshops and areas where noise levels exceed those required by the regulations. Certification shall be provided showing compliance.

6 .74.00 Occupational Health and Safety (Plant) Regulations shall be fully complied with in all respects. Certification shall be provided showing compliance.

Operating Units

6 .75.00 SUPPLY AIR
Supply air to Operating Rooms shall be delivered at high level in a way that minimises recirculation of potentially contaminated room air and provides the cleanest practical air supply over the operating table area. The directions of air flows within Operating Units shall always be from the Operating Room and Set-up Room, through immediately adjacent inner anterooms, Scrub-up and Anaesthetic rooms to the Entrance Foyer, Recovery, Changing and post operative Clean-up Rooms; from clean to less clean areas.

Graduated pressurisation relative to pressure in areas adjacent to the Operating Unit ranging from not less than 10 Pascal positive in the Operating Room/s to slightly positive pressure in areas like Entrance Foyer, Recovery and Change Rooms and slightly negative in Clean-up Room/s can be achieved by using carefully balanced supply air and exhaust air systems. (Refer to Enclosure E1 for details of pressurisation requirement).

6 .76.00 Total circulated air quantity shall be not less than 20 air changes per hour when the supply air filters are at their maximum pressure drop of which a minimum of 50% shall be outdoor air.

6 .77.00 Airflow into the Operating Unit shall be by means of a distribution system that provides a flow of clean supply air over the operating area first then away. Entry of air shall be from the ceiling to deliver a downward air movement with a minimum velocity 0.2 m/s at the level of the operating table.

The barrier effect caused by air movement and not the actual pressure difference is important. As the pressure differentials are relatively small, the preferred method for setting up the air flow is for the total of return and exhaust air to be in the order of 150 l/s to 200 l/s less than supply air with all doors and openings closed. Different designs of Operating Rooms may require some variance in the bleed air quantity. Active control of the pressure difference is not necessary, however, supply air fans are required to be selected so as to maintain constant air quantity as filter resistance increases. This can be achieved by selecting good fan curve characteristics or controls measuring supply air quantity and controlling fan speed to maintain supply air quantity. Air not exhaust or spilled outward from high risk areas may be recycled as return air.

Operating Units

6 .78.00 Room relative humidity shall be maintained within the range of 30% to 60% relative humidity (RH), except when flammable agents are used, in which case the requirement of AS 1169 - 'Minimizing of combustion hazards arising from the medical use of flammable anaesthetic agents' - is to maintain relative humidity above 55% and noted in Enclosure E1. Where humidifiers are used they shall be of the steam type and shall comply to the requirements of clause 6.48.00. Limiting humidity range by cooling coil design is acceptable unless there is a specific surgical requirement to warrant precise control of humidity.

6 .79.00 The Operating Room temperature shall be adjustable to suit the requirements of the procedure in progress. The temperature adjustment range is recommended to be 16 degrees Celsius to 24 degrees Celsius. The proposed function of the room will determine what degree of adjustment is provided.

To enable individual temperature, infection and odour control, each Operating Room or pair of Operating Rooms shall be served by a dedicated air-conditioning unit which may also serve that Operating Room's adjacent sterile support rooms.

6 .80.00 EXHAUST ARRANGEMENT
Exhaust registers shall be located so that the whole room is effectively scavenged, particularly at floor level. Special arrangement such as provision of balanced counter weighted flap to each low level exhaust point shall be installed to prevent an outflow of air from an exhaust point due to adverse air pressure when opening any of the Operating Room doors. The consultant shall account for the adverse effect of air flow pattern near the surgical field created by surgical lamps due to their shape, size location and the heat generated by the lamps. Operating Rooms for special procedures such as orthopaedic surgery, organ transplants or total joint replacement may require the provision of an Ultra Clean Air (UCA) system to suit their intended use.

6 .81.00 Extraction of relief air and, if incorporated, return air shall be located at low to mid level. Supply air outlets shall be located directly above the operating table. Exhaust / relief air shall be extracted at a point as close as possible to the anaesthetic delivery trolley to remove anaesthetic gas leakages from the work area whilst ensuring good airflow through the room. Low level exhaust shall be extracted at 200 mm above floor level.

6 .82.00 Low level exhaust and other provisions in accordance with AS 1169 - 'Minimizing of combustion hazards arising from the medical use of flammable anaesthetic agents', shall generally be provided where flammable anaesthetics are used. Where full provision is not made in accordance with AS1169, Operating Rooms shall have a notice, affixed as required, indication that flammable agents must not be used. Further, nitrous oxide shall not be used where low level exhaust is not provided and the range of surgical procedures undertaken in the Operating Room restricted accordingly.

6 .83.00 DESIGN REQUIREMENTS FOR UCA SYSTEMS
UCA systems shall provide sufficient filtered air moving in the correct direction to efficiently remove the bacteria dispersed by the operating team. The air flowing from the final filter shall contain not more than 0.5 Colony Forming Units per cubic metre of air (CFU/m3).

Operating Units

6 .84.00 AIR FLOW
Down flow system: the air flow at one metre from the supply air outlet shall have a minimum average velocity of 0.35m/s and at working height, not less than 0.3m/s.

Cross flow system; The minimum average velocity shall be 0.4m/s measured one metre from the filter or diffuser face.

The siting of the return air grills shall not cause short circuiting of the supply air. The control instrumentation shall include the indication of:
- Operating status such as 'in use' or 'not in use'
- Terminal filter pressure differential
- System Purging
- UCA systems.

6 .85.00 Where procedures such as organ transplants justify special designs, installation shall meet performance needs as determined by applicable Australian Standards. These special designs are recommended to be reviewed on a case by case basis.

6 .86.00 Engineering requirements for Orthodontic Operating Rooms shall be the same as for General Operating Rooms.

6 .87.00 Operating rooms where lasers are being used shall have adequate suction / evacuation controls for the plume generated.

Procedure, Recovery, Delivery and Dental Rooms

6 .88.00 Procedure Rooms in which the administration or aspiration of gaseous anaesthetics or analgesics are carried out, shall have adequate ventilation to ensure that the level of gaseous contamination does not rise above a maximum acceptable level. The utilization of a scavenge system is acceptable. Local extraction of patient exhaled anaesthetic gas at source is strongly recommended. This becomes a mandatory requirement and shall be provided where measured levels of anaesthetic gas within the area are considered excessive by the Hospital's Occupational Health and Safety Committee.

6 .89.00 Total air circulation shall be not less than 10 ACHR of which the minimum outside air supply shall be the greater of 20 l/s per person or 2 air changes per hour. Alternatively, localised exhaust shall be provided at each bed achieving a minimum of 50 l/s exhaust per bed.

6 .90.00 Cupboards containing anaesthetic machines shall be ventilated to remove the build-up of nitrous oxide within the cabinet.

Bronchoscopy and Sputum Induction Unit/s

6 .91.00 Supply air to Bronchoscopy and Sputum Induction Units shall be delivered at high level in a way that minimises recirculation of potentially contaminated room air and provides the cleanest practical air supply over the procedure area. The directions of air flows within the Procedure Room shall always be from clean to less clean areas.

Bronchoscopy and Sputum Induction Unit/s

6 .92.00 Total circulated air quantity shall not be less than 12 ACHR when the supply air filters are at their maximum pressure drop of which a minimum of 25 % shall be outdoor air. Room air shall not be recirculated. Procedure Rooms and Recovery Rooms shall be maintained at a negative pressure in relation to adjacent areas. Design and construction shall be in accordance with the requirements in Guidelines for the classification and Design of Isolation Rooms in Health Care Facilities published by the Department of Human Services Victoria. A minimum filtration efficiency of F8 air filters shall be installed.

6 .93.00 Rooms or booths used for Bronchoscopy, Sputum Induction, aerosolized pentamidine treatments and other high risk cough-inducing procedures shall be provided with local exhaust ventilation.

Cardiac Catheterisation Unit/s

6 .94.00 Supply air to Cardiac Catheterisation Units shall be delivered at high level in a way that minimises recirculation of potentially contaminated room air and provides the cleanest practical air supply over the procedure area. The directions of air flows within the Procedure Room shall always be from clean to less clean areas. Graduated pressurisation relative to pressure in areas adjacent to the Procedure Room can be achieved by introducing 10 % more supply air than exhaust air. Recirculated room air-conditioning shall not be used.

Total circulated air quantity shall be not less than 15 ACHR when the supply air filters are at their maximum pressure drop of which a minimum of 20% shall be outdoor air. A minimum filtration efficiency of F9 air filters shall be installed.

Endoscopy Units

6 .95.00 Where manual endoscopes disinfection with glutaraldehyde occurs, the endoscopes and disinfection trays shall be contained by a system of local exhaust ventilation capable of providing adequate capture of contaminants in accordance with Department of Human Services Guidelines for the Use of Glutaraldehyde in the Health Industry. Recirculated filtered air systems shall not be used. A fume cupboard type hood with a sliding sash shall be provided. This hood is recommended to incorporate a perforated supply air plenum at the top and down draft slots and plenum exhaust to the sinks. Ventilation in workrooms where endoscopes are cleaned shall achieve a minimum of 15 air changes per hour

When a hood is installed in an Operating Unit between the Clean-Up and Set-Up Rooms, it shall be of pass-through design with interlocked sliding sashes. The relative positive pressurisation of the Suite shall not be adversely affected when either door is open.

Alternatively, complete manual disinfection of scopes may be carried out in a dedicated scope disinfection room equipped with a down draft trough with perimeter exhaust slots exhausting at a rate sufficient to contain fumes.

Endoscopy Units

6 .96.00 Manual disinfection of fiberoptic endoscopes is recommended to be carried out in a dedicated endoscope disinfection room equipped with a down draft trough with perimeter exhaust slots, exhausting at a rate sufficient to contain fumes.

Where automatic or semi-automatic disinfectors are used, a localised exhaust system shall be provided to achieve appropriate capture and removal of contaminated air. Fumes shall be drawn away from the operator's work position. Machine mounted filters are not always sufficient and require monitoring.

6 .97.00 Fiberoptic endoscopes storage cupboards shall be mechanically vented with an exhaust system to remove glutaraldehyde residuals.

Sterile Supply Services

6 .98.00 Sterile Supply Services shall be air-conditioned with a minimum of 10 ACHR. Air movement and ventilation shall achieve a positive airflow from clean to contaminated work areas. Ventilation rates shall be maintained when the zone is not occupied sufficient to ensure dilution rates are maintained.

Isolation Rooms

6 .99.00 Isolation Rooms shall be designed and installed in accordance with the requirement of Guidelines for the Classification and Design of Isolation Rooms in Health Care Facilities published by the Department of Human Services.

Alternating pressure (reversible airflow) isolation rooms shall not be installed or used.

Isolation Rooms

6 .100.00 Isolation Room design and installation shall comply with the following tables:

FEATURE	Class S	Class N	Class P
SEALED ROOM WITH ADJUSTABLE DOOR GRILLE		Yes	Yes
> OR = 12 AIR CHANGES PER HOUR PER PATIENT OR 145 L/S MINIMUM		Yes	Yes
100 % FRESH AIR		Yes	
PROVISION TO INCREASE FAN SPEED		Yes	Yes
CONSTANT VOLUME SUPPLY AIR SYSTEMS	Yes	Yes	Yes
15 PA PRESSURE GRADIENT STEPS: CORRIDOR, ANTE-ROOM & ROOM		Yes	Yes
SEAL ROOM AIR-TIGHT		Yes	Yes
LOCAL FAN FAIL ALARM		Yes	Yes
FANS/ ALARMS ON ESSENTIAL ELECTRICAL SUPPLY		Yes	Yes
DIFFERENTIAL PRESSURE MONITORING		Yes	Yes
INDEPENDENT SUPPLY AIR		Yes	
HEPA FILTERS ON SUPPLY AIR			Yes
LOW LEVEL EXHAUSTS		Yes	Yes
BACK DRAUGHT PREVENTION ON COMMON DUCTS		Yes	
INDEPENDENT EXHAUST		Yes	
EXHAUST DUCT UNDER NEGATIVE PRESSURE WITHIN BUILDING		Yes	
HEPA FILTERS ON EXHAUST		Yes	Yes

6 .101.00 Isolation Room Pressure Gradients:

ROOM TYPE	Room	Ensuite	Anteroom
CLASS N	-30 Pa	-15 Pa	-15 Pa
CLASS P	+30 Pa	+15 Pa	+15 Pa
CLASS P WITH NEGATIVE PRESSURE ANTEROOM	+15 Pa	+15 Pa	-15 Pa

Pathology, Autopsy and Body Holding

6 .102.00 Systems serving Pathology Areas shall be independent of other systems. Exhaust from these areas shall be designed not to create any harmful effect to occupants or contamination to any adjacent areas.

Pathology, Autopsy and Body Holding

6 .103.00 Supply air and exhaust serving autopsy and dissection areas shall be designed to protect personnel undertaking procedures and be discharged in a manner that will not contaminate any adjacent area or system.

6 .104.00 Requirements for facilities that conduct autopsies include:-

- Single pass air-conditioning utilising 100% exhaust of all air
- Exhaust intakes arranged to provide maximum fume and odour removal with protection of personnel
- Operate the room at negative pressure in relation to adjacent areas
- If necessary filter exhausted air with carbon filters
- Install down-draught or back-draught exhaust
- Back-draught exhaust shall have a minimum face velocity of 2.5 m/s.

Note: The above is for facilities which undertake regular autopsies.

Pharmacy, IV Additive and Cytotoxic Suites

6 .105.00 Laboratory and Dispensing Areas in Pharmacy shall be investigated for the necessity to control air flow and exhaust to avoid any possibility of contamination to any adjacent areas.

6 .106.00 Cytotoxic Suites shall be designed and constructed in accordance with AS 2639 'Laminar flow cytotoxic drug safety cabinets - Installation and use'. The basic design shall be that of a Class 350 Cleanroom varied in accordance with the requirements of AS 2639.

Laboratories and Clean Rooms

6 .107.00 Laboratory Areas and Dispensing Areas in Pharmacy shall be designed to comply with AS/NZS 2982.1 'Laboratory design and construction - General requirements' and AS 2243.8 'Safety in Laboratories - Fume cupboards'.

6 .108.00 Physical Containment (PC) laboratories shall be designed and constructed according to the requirements of the Genetic Manipulation Advisory Committee publication 'Guidelines for Small Scale Genetic Manipulation Work' when any work involving genetic manipulation is undertaken.

Dark Rooms and Film Processing Areas

6 .109.00 Air spill shall not occur from the Dark Room to adjacent spaces. Dark Room exhaust shall balance or exceed supply and shall be balanced considering equipment connected exhaust systems.

6 .110.00 Daylight processing equipment shall be provided with adequate local exhaust ventilation to prevent the uncontrolled escape of chemical emissions. Fumes or potentially contaminated air shall be exhausted to outside air and not recirculated.

6 .111.00 Special ventilation requirements shall be dependent upon the type of film processor (automatic or manual) to be installed in an X-ray Dark Room, Processing and Viewing Areas. Adequate ventilation is required to contain the uncontrolled spread of fumes from potentially harmful chemicals into occupied spaces.

Dark Rooms and Film Processing Areas

6 .112.00 Through-the-wall processors require local exhaust ventilation to each side of the wall. Most processors also require indirect connection of the drier fan discharge to an exhaust system, in addition to general room exhaust for fumes emitted from stored chemicals and the machine cleaning process. Ventilation shall be provided to film processors in accordance with the manufacturers' recommendations.

6 .113.00 If remote chemical mixing, reticulated chemical supply and silver reclaiming is utilised, the chemical mixing tank or silver reclaiming unit shall be contained within a ducted enclosure, connected to an exhaust system as described above.

6 .114.00 Local exhaust ventilation shall be provided above sink units used in connection with the regular cleaning of X-ray processor equipment components.

6 .115.00 Work areas and enclosures used in connection with the manual processing of x-ray film such as dental clinics, shall be provided with dilution ventilation and temperature controls to prevent the build up of fumes.

6 .116.00 Vapour emissions from tundishes into which liquid photographic waste discharges shall be controlled.

6 .117.00 Ducts that penetrate construction intended to protect against X-ray, magnetic, Radio Frequency Interference, or other radiation shall not impair the effectiveness of the shielding protection.

Podiatry, Prosthetics, Dental & Orthodontic Workshops

6 .118.00 Fresh air, ventilation and air-conditioning systems shall be provided with a minimum supply air quantity of 20 litres per second per square metre of facility floor space. Extraction shall be localised as close as practicable to the sources of contamination identified above. Exhausts from this area shall be suitably filtered and discharged in a manner that will not contaminate any adjacent area or system. Capture velocities at the point of localised extraction shall exceed 2 m/s. Consideration is recommended to be given to acoustics to prevent noise nuisance.

6 .119.00 Fume cupboards complying with AS 2242.8 'Safety in Laboratories - Fume cupboards' shall be installed in chemical mixing areas.

Linen Processing Areas

6 .120.00 Air filtration, mechanical ventilation and air-conditioning systems servicing linen processing areas shall be designed to ensure appropriate lint and dust control. Mechanical ventilation systems shall be designed to remove the heat generated by laundry drying processes utilising systems such as exhaust registers over the dryers or dryers ducted direct to outside air with lint collection provision on all exhaust discharges. Provision shall be made for regular maintenance to prevent the excessive build up of lint which can be the source of a fire hazard.

Linen Processing Areas

6 .121.00 Spot cooling with air-conditioned or evaporative cooled supply air is recommended to be considered to provide adequate operator comfort in laundries.

6 .122.00 Ventilation shall be provided in accordance with AS1668 Part 2 'Mechanical ventilation for acceptable indoor-air quality'. Where air-conditioning is installed, a minimum of 25 ACHR is recommended. For evaporative cooling a minimum of 36 ACHR is recommended. Airflow shall be from clean to less clean areas.

6 .123.00 Soiled linen rooms shall be exhausted through a dedicated exhaust system to reduce the risk of cross infection.

6 .124.00 The Clean Linen Store shall be supplied with clean, filtered air. Air pressure shall be positive in respect to the rest of the Laundry.

6 .125.00 Air conditioning shall be installed to reduce the moisture content of linen.

Noise and Acoustic Attenuation

6 .126.00 Noise levels in any area shall not exceed the exposure standard established in the Occupational Health and Safety (Noise) Regulations. For the purposes of the regulations, the exposure standard means the eight (8) hour equivalent continuous sound pressure level of 85 dB(A) measured in A-weighted decibels referenced to 20 micro Pascals. Due consideration shall be given to the amplification of noise due to multiple sound sources to ensure the exposure standard is not exceeded.

6 .127.00 Noise breakout from any plant areas shall not exceed the values for interior noise as determined in AS 2107 - 'Acoustics - Recommended design sound levels and reverberation times for building interiors'. Due consideration shall be given to exterior noise levels to prevent nuisance to the external environment by noise generated by plant.

Mental Health Units

6 .128.00 Consideration shall be given to the type of heating and cooling units, ventilation outlets, and equipment installed in patient occupied areas of Mental Health Units. Special purpose equipment designed for psychiatric or prison use shall be used to minimise opportunities for self harm. The following shall apply:

- All air grilles and diffusers shall be of a type that prohibits the insertion of foreign objects
- All exposed fasteners shall be tamper-resistant
- All convector or HVAC enclosures exposed in the room shall be constructed with rounded corners and shall have closures fastened with tamper-resistant screws
- HVAC equipment shall be of a type that minimises the need for maintenance within the room.

7 ANCILLARY MECHANICAL SERVICES

Pneumatic Transport Systems

7 .1.00 Pneumatic transport tubes systems with leak proof carriers which have a clear see through section to enable visual inspection of content prior to opening are recommended.

Use of a clear, leak-proof inner bag system is recommended.

The pneumatic piping system is to be designed and suitable to permit clean out of piping and disinfection via use of a special dispensing tube or other strategy.

Transport tube system carriers shall be capable of being sterilised or disinfected.

7 .2.00 If pneumatic transport systems are installed, a pneumatic transport station is highly recommended to be located in or adjacent to the Operating Unit.

8 HYDRAULIC SYSTEMS

Minimum Standards

8 .1.00 The minimum requirements for the provision of potable water supply, hot water supply, warm water systems, sanitary plumbing and drainage, stormwater drainage and gas installations in Health Care Facilities shall be those listed in Enclosure E1.

8 .2.00 In addition to the minimum requirements and depending upon the type of facility and installed services the following Regulations and Australian Standards shall apply:

- Plumbing (Cooling Towers) Regulations
- Building (Cooling Tower Systems Register) Regulations
- AS 4343 - Pressure equipment-hazard levels
- AS 4032 - Thermostatic mixing valves - Materials, design, and performance requirements

All clauses outlined in the following section shall be in addition to statutory requirements.

General

8 .3.00 Materials shall be selected that are suitable for the specific characteristics of the service being installed. This shall include consideration of parameters such as temperature and concentration of wastes, corrosion, leaching and chemical attack.

8 .4.00 Where loss of a service can cause unacceptable risk, service shall be monitored, alarmed and provided with a back-up. Critical areas such as Renal Dialysis, Operating Unit, ICU, CSSD, Acute Inpatient Units (one Dirty Utility and one Bathroom), Biochemistry and activities where relevant unacceptable risk can occur, shall be defined in the project brief.

8 .5.00 Fixed services and maintenance points shall be located in a manner that does not create unacceptable risk or disturbance to patients, staff including maintenance personnel and health care procedures.

8 .6.00 Service elements such as pipes, isolating valves operating switches and alarms shall be clearly identified.

8 .7.00 Location and operation of fixtures shall suit to the application and shall not cause health risk.

8 .8.00 Fixtures shall be easily cleanable. Water discharge devices such as flushing tanks and shower roses, shall be selected to enhance water conservation.

Water Supply

8 .9.00 Where water quality does not comply with Health - Quality of Drinking Water - Regulations, National Health and Medical Research Council / Australian Water Resources Council 1987 Guidelines or local guidelines, water treatment / filtration plant shall be provided to maintain the integrity of hot water equipment, tapware, specialist health equipment and air-conditioning plant pipework.

Water Supply

8 .10.00 Water quality shall not cause risk to patients and shall be suitable for intended medical procedures

8 .11.00 Where water supply is critical it shall be available all the time.

8 .12.00 Where the water supply is unreliable, local critical demand shall be satisfied with individual local back-up. Duty and standby pumps shall be designed and installed if the supply system includes pumping.

8 .13.00 Where possible, locate reticulation pipes in the roof spaces, clear of mechanical equipment with droppers connected to the sanitary fixtures and equipment. Avoid locating pipework over inpatient areas and other areas that could be adversely affected by noise generated in water pipes. Hot and cold water pipes shall be separated by enough distance to avoid heat transfer. Hydraulic services shall not be located above electrical services.

8 .14.00 Water supply systems shall be adequately zoned and isolated to provide local safety shut downs whilst maintaining maximum availability.

8 .15.00 If practicable, the water service is recommended to be supplied from an external ring main. The service is recommended to be connected at two locations with a valve midway to maintain a continuity of supply in each section of the building should maintenance be required. Isolation valves shall be located on service lines to individual fixtures or group of fixtures. All valves are recommended to be easily accessible adjacent to/from roof-space access walkway.

8 .16.00 Pipework shall be identified in accordance with AS 1345 'Identification of the contents of pipes, conduits and ducts'.

8 .17.00 Single fixture or zone backflow prevention devices shall be designed to comply with AS 3500.1 'Water supply'. Vacuum breakers shall be installed in hose bibs and supply nozzles used for connection of hoses or tubing in laboratories, cleaner's sinks, bedpan-flushing attachments and autopsy tables.

8 .18.00 To prevent condensation, closed cell foam insulation shall be installed on pipework where the dew point can be reached. Insulation shall have a continuous vapour barrier.

8 .19.00 All isolation valves for hydraulic services shall have permanently fixed plastic or brass identification discs. Discs shall be clearly permanently engraved to identify the item.

8 .20.00 When the operational policy includes haemo-dialysis, continuously circulated filtered cold water shall be provided.

Hot Water Supply

8 .21.00 System design generally shall comply with AS3500.4 'Hot water supply systems'.

A minimum of two hot water units is recommended to be installed in each main system. Remote point of use type systems may utilise a single unit.

8 .22.00 Hot water piping is recommended to be arranged in a ring main or a number of ring mains and incorporate a hot water return pipe.
Branch pipework to individual outlets or groups of outlets shall not exceed three metres for 15 mm diameter pipe in order to minimise deadlegs. Each branch shall be equipped with an isolation valve for maintenance purposes located adjacent to the cold water supply branch isolation valve serving the same outlets.

Hot water supply to areas such as Dirty Utilities is recommended to be separated from the remainder of the hot water system using approved back-flow preventers.

8 .23.00 Central hot-water distribution systems serving patient care areas shall have a flow and return to provide continuous hot water at each hot water outlet. The temperature of hot water for showers and bathing shall be appropriate for comfortable use but shall comply with AS 3500.4 'Hot water supply systems'.

When the cold water supply fails, the hot water supply shall be shut down automatically to avoid risk of scalding. Circulation pumping shall be designed and installed with both a duty and stand-by pump. Calorifiers shall be of a failsafe design.

Warm Water Supply

8 .24.00 Thermostatic mixing valve (TMV) designs shall comply to AS 4302 'Thermostatic mixing valves - Materials, design and performance requirements', and installation shall comply to AS 3500.4 'Hot water supply systems'. Tempering valves shall not be used. Where concealed TMVs shall be identified with clear signage in a visible location to ensure servicing is carried out.

8 .25.00 Warm water systems producing water in the temperature range of 30 to 60 degrees Celsius, shall be designed and installed to achieve compliance with the Health (Legionella) Regulations and DHS Legionella Risk Management, Supplementary Notes for Hospitals, Chapter 'Warm Water Systems'.

Sanitary Plumbing and Drainage

8 .26.00 Drain pipes shall be designed and installed to comply with AS 3500.2 'Sanitary plumbing and sanitary drainage' and to suit the waste carried and the temperature of waste. Where possible, pipework is recommended to be concealed. Vents are recommended to be interconnected in roof or ceiling spaces to reduce the number of roof penetrations.

8 .27.00 Inspection and cleaning openings shall be positioned external to the building fabric. Where this is not possible, inspection and cleaning openings shall be positioned in ducts or within the wet areas it serves. Inspection and cleaning openings shall not be positioned in ceiling spaces.

Sanitary Plumbing and Drainage

8 .28.00 Access pits suitable for cleaning and pumping out are recommended in service areas rather than cleanout openings within pipes and junctions. Access pits are recommended to be located adjacent to vehicular access.

8 .29.00 Gravity drain systems shall be installed wherever possible. If pumping systems for the disposal of sewerage or effluent are installed they shall be installed in duplicate and shall be connected to the hospital standby generator power supply. Alternatively, the systems shall incorporate a minimum of four (4) hour storage in the event of disruption in normal power supply.

8 .30.00 Mixing of chemicals wastes that result in fume emissions shall take place within a vented drainage system and not at a common tundish.

8 .31.00 Waste water systems access covers, inspection openings and inspection chamber covers shall not be located within High Risk areas.

8 .32.00 Waste water systems shall be planned to eliminate access covers, inspection openings and inspection chamber covers being located within functional areas.

8 .33.00 Waste pipes are recommended to be located in service areas and not pass through walls and ceiling spaces of patient rooms and treatment rooms.

8 .34.00 Floor drainage grates shall not be installed in the clean area of a Sterile Supply Unit or treatment area. Floor drains are recommended to be rationalised to an absolute minimum due to their ability to harbour bacteria.

8 .35.00 Floor drains or open tundishes shall not be installed in Operating and Birthing / Delivery Rooms.

8 .36.00 Drain liners serving automatic blood-cell counters shall be carefully selected to eliminate the potential for undesirable chemical reactions (and/or explosions) between sodium azide wastes and copper, lead, brass, and solder.

8 .37.00 Drainage piping is recommended to not be installed within the ceiling or exposed in Operating and Delivery Rooms, Nurseries, food preparation areas, food serving facilities, food storage areas, computer centres and other sensitive areas. Where exposed overhead drain piping in the areas in unavoidable, special provisions shall be made to protect the space below from leakage, condensation, or dust particles.

Trade Waste

8 .38.00 The treatment of industrial wastes shall be in accordance with the requirements of the local Water Supplier and other relevant regulations and statutory codes / rules.

Trade Waste

8 .39.00 Copper pipes shall not be used to convey trade waste products as photographic wastes corrode copper. UPVC is the preferred material. Fixer and developer shall be collected and stored for off-site treatment and disposal. Fixer and developer shall not be discharged to sewer.

8 .40.00 A silver recovery system shall be installed in accordance with the trade waste agreement or provision made for the collection of all spent solution that contains silver (such as bleach fix). All solution shall pass through this system.

8 .41.00 In Radiology, close attention shall be given to the discharge of waste from X-ray film processing machines as only rinse water can discharge to sewer. Associated chemicals are not permitted to be discharged to sewer and must be disposed off-site.

Connect mechanical plant equipment drains to the sewage system, in particular, plant which discharges water containing chemicals. Drains from fan coil and air handling units may discharge to sewer or stormwater.

8 .42.00 Kitchen grease traps shall be located and arranged to permit easy access without the need to enter food preparation or storage areas. Grease traps shall be accessible from outside of the building without need to interrupt any services.

8 .43.00 Plaster traps shall have easy access for emptying and cleaning. Plaster traps should be located outside the treatment room or should be accessible from outside the room. Servicing should be able to be carried out with minimum disruption.

8 .44.00 All pre-treatment waste systems such as dilution pits, arresters and strainer baskets shall be located in the service / dirty zones of the department if the system cannot be installed externally.

Storm Water Drainage

8 .45.00 Storm water system design generally shall comply with AS3500.3 'Stormwater drainage' as referred to in the BCA and local Authorities' by-laws that are applicable.

Roof drainage systems shall be designed to handle a 1:100 year intensity based on available Bureau of Meteorology statistics and incorporate separate overflow relief discharge to minimise roof gutter overflow and consequent building damage and service interruptions.

Consideration shall also be given to ways of preventing leaf build up in gutters to prevent building damage and service interruption due to gutter overflow.

8 .46.00 Storm water drainage grates shall be cross-webbed in car parks and paths and not be located in wheel chair access areas or trolley areas.

8 .47.00 Pumps, if required, shall be as previously specified for sewer pumps.

Gas Installations

8 .48.00 Provision shall be made for the continuity of gas supply where the facility has a post-disaster function or requires gas services for sustaining human life, by duplication of the gas supply provided it is an independent supply or dual fuel firing of critical plant.

8 .49.00 Kitchens shall be provided with appropriately labelled gas isolation valve/s at the main entry point for isolation in event of fire.

9 FIRE SYSTEMS

Minimum Standards

9 .1.00 The minimum requirements for the provision of fire control systems in Health Care Facilities shall be those listed in Enclosure E1.

In addition to the minimum requirements and depending upon the type of facility and installed services the following Regulations, Department of Human Services Guidelines and Australian Standards shall apply:
- AS 4214 - Gaseous fire extinguishing systems
- Capital Development Guideline 7.2 Fire Risk Management Guidelines, Capital Management Branch, Department of Human Services Victoria

All clauses outlined in the following section shall be in addition to statutory requirements.

General

9 .2.00 Where specific facility related fire risks are not covered adequately in the BCA and other relevant regulations, the risk shall be analysed and a suitable engineering solution shall be developed and implemented to maintain an acceptable risk level. The need for additional measures for a specific facility and the suitable solution shall be established during the design process.

9 .3.00 Fire services include the following:
- Fire fighting equipment
    - hydrants
    - hose reels
    - fire extinguishers
    - fire sprinklers
- Smoke management systems
- Emergency lighting, detection and warning systems.

Note: Some smoke management relevant sections of the BCA are strongly linked to HVAC services. Consequently relevant issues are discussed in the HVAC section of the Guideline.

9 .4.00 When sprinkler systems are installed in areas used by mental health patients, concealed type, ceiling mounted sprinkler heads shall be installed.

Sprinklers

9 .5.00 Health buildings shall be planned to minimise the need for sprinkler systems.

The need for fire sprinklers for a specific facility and the suitable solution shall be established during the design process by a Certified Fire Engineer.

10 MEDICAL GAS SYSTEMS

Minimum Standards

10 .1.00 The minimum requirements for the provision of medical gas systems in Health Care Facilities shall be:
- AS 1169 - Minimising of combustion hazards arising from the use of flammable anaesthetic agents
- AS 2568 - Medical gases - Purity of compressed medical breathing air
- AS 2896 - Medical gas systems - Installation and testing of non-flammable medical gases pipeline systems.

All clauses outlined in the following section shall be in addition to statutory requirements

General

10 .2.00 Medical gas systems include the following services:
- Oxygen
- Nitrous oxide
- Medical breathing air
- Surgical tool gas
- Mixtures of medical gases
- Carbon dioxide
- Medical suction

Medical suction systems can be:
- Central vacuum
- Venturi ejector operated type

The major difference between the two types of suction systems is that the available pressure difference in venturi system discharge pipes is low and consequently discharged (contaminated) gases are difficult to filter and pipe runs are recommended to be kept short.

10 .3.00 Each medical gas is recommended to emanate from a central storage or generation point and reticulated to outlets throughout the hospital.

Medical oxygen, compressed air and nitrous oxide multi-bottle storage manifolds shall be arranged in a 'Duty' and 'Reserve' configuration incorporating automatic change-over facility. Each manifold is recommended to include sufficient bottle storage to meet two days demand with additional bottles held in storage to meet three days or holiday period demand. All medical gas bottle manifolds are recommended to be sited adjacent to each other in a location which facilitates ease of access for bottle delivery and pick-up.

10 .4.00 The medical gases installation shall incorporate an appropriate low and high pressure audible and visual alarms for each medical gas system and vacuum system respectively. The alarm system shall also be hard wired from the essential power supply if available with status indication panels sited strategically throughout the hospital on a master and slave arrangement. The master panel shall be in a permanently manned location such as the Emergency Unit with slave panels sited in critical areas such as Operating Unit and Intensive Care Unit. Alternatively, an independent alarm panel can be provided for Operating Unit and Intensive Care Unit. These panels would sense pressures in gas pipelines serving each respective area by means of pressure switches located downstream of isolation valves.

General

10 .5.00 Readily accessible isolation valves shall be provided in each main gas branch pipe to special areas such as Operating Unit and Intensive Care Unit. Valves shall be located in a wall mounted dedicated valve box incorporating a clear Perspex cover and suitably labelled.

10 .6.00 Patient rooms shall have oxygen and suction from a fully reticulated system. The minimum provision shall be an oxygen and suction point provided to each single bedroom and shared oxygen and suction points between two beds within multiple bedrooms.

10 .7.00 An active aspirated gas scavenging system shall be provided where anaesthetic gases are administered. This requirement does not apply to areas where analgesic gases are administered and adequate ventilation is provided.

10 .8.00 Vacuum (suction) systems utilising central vacuum is recommended to be reticulated to each point, except for suction scavenging points which will scavenge flammable anaesthetic gases or a high content of oxygen. These are recommended to utilise Venturi-suction with discharges as per requirements for suction pump discharges in AS 2896 'Medical gas systems - Installation and testing of non-flammable medical gas pipeline systems'.

10 .9.00 Venturi type suction systems shall not be used in rooms where infection control is required.

Room / Area Specific Requirements

10 .10.00 SPECIALISED EQUIPMENT FOR NITROUS OXIDE SEDATION

When nitrous oxide is being used to provide sedation an appropriate method for scavenging of expired gases shall be provided. The risks of chronic exposure to nitrous oxide is recommended to be considered.

10 .11.00 Each Recovery bed space shall be provided with an oxygen outlet and medical suction outlet.

11 STRUCTURAL DESIGN

Minimum Standards

11 .1.00 The minimum requirements for structural design in Health Care Facilities shall be those listed in Enclosure E1.

All clauses outlined in the following section shall be in addition to statutory requirements.

Compliance With Regulations

11 .2.00 The design and construction of all building elements shall be in accordance with the current Victorian Building Act.

Cost Effectiveness

11 .3.00 It is the policy of The Department of Human Services to actively encourage the design and construction of health facilities for the minimum cost consistent with the minimum requirements set out in the Benchmark and Guidelines reference documents. The following principles have been adopted to achieve this objective:

- Alternative structural systems may be considered
- Minimum loading requirements may be adopted
- Rationalised and repetitive structural systems are most likely to be more cost effective
- Standardised structural details and connections are recommended to be adopted
- Services integration shall be considered
- Prefabrication and modularisation is recommended to be considered
- Future flexibility which involves additional costs shall be approved by the Department of Human Services
- Rigorous commercial approaches and practices are recommended to be adopted.

11 .4.00 Where possible, the design and structure is recommended to offer maximum opportunity for local trades, materials and Australian products.

Structural Drawings and Documentation

11 .5.00 Structural drawings shall include a set of general notes with the following information:

- The design codes used in the design
- The design live loading including service loads
- The design wind loading (ultimate) and terrain category
- Any imposed construction / erection loadings such as earth moving equipment
- Foundation design parameters
- Required concrete strength and cover to reinforcement and slump
- Welding categories
- Corrosion protection treatment.

11 .6.00 A set of 'As Constructed' drawings shall be handed over to the occupier during the 'Approval to Occupy' inspection.

Design Loads

11 .7.00 WIND LOADS
Refer to Architectural section.

SEISMIC LOADS
Refer to Architectural section.

LIVE LOADS
Areas designed for compactus loadings shall be clearly identified on the drawings. Final locations of these compactus areas shall be determined during the planning of the building.

Superstructure

11 .8.00 STRUCTURAL RESISTANCE AND DURABILITY
The structure is recommended to be designed to provide a projected building life equivalent to either the anticipated useful economic life of the facility, or 50 years, whichever is the greater.

11 .9.00 DEFLECTION
The structure shall be designed to avoid excessive deflections, vibrations or resonance that may affect the serviceability of the structure, services, Operating and Procedure Room light fittings, applied finishes, equipment or any secondary construction such as partition walls.

11 .10.00 PLANNING CONSIDERATIONS
Attention is recommended to be paid to the ability to change floor layouts at reasonable cost without undue effect on other parts of the building. Load bearing is recommended to be restricted to those elements which will not inhibit future planning.

11 .11.00 The spacing, size and nature of the elements shall be appropriate for the functions of the buildings, after consideration of the cost economics of various spans and planning flexibility.

11 .12.00 ROOF
Complex roof designs, internal box guttering and high maintenance features are recommended to be avoided. The roof design shall be appropriate to the intended use. Open vented roof types such as sheet metal decking on purlins with suspended ceilings shall not be used over critical care areas.

11 .13.00 COVERED WAYS
External walkways, footpaths and entrances shall be designed and constructed, taking due account of ground movement, storm water drainage, surface type to prevent slipping when wet or icy, thermal movement and durability.

11 .14.00 Coverings to walkways shall be designed and constructed to provide waterproofing, protection from weather and well lit for users both day and night. They shall be braced for stability.

11 .15.00 Roofs may be constructed with metal sheeting supported on timber or steel purlins spanning between timber or steel trusses or beams. Columns may be timber, steel, concrete or brick. All timber used shall be properly seasoned. Unless alternative paving is required, all areas are recommended to be concrete paved with appropriate edge thickenings and column footings.

Modifications & Alterations to Existing Structures

11 .16.00 The existing structure shall be reviewed and a report provided to the Department of Human Services stating current condition and compliance with the requirements of these Guidelines.

11 .17.00 Projects involving alterations and/or additions to existing buildings shall be programmed and phased to minimise disruption of retained existing functions.

Competence / Certification

11 .18.00 The Department of Human Services has the authority to require an independent check of the structural design if deemed necessary.
Design calculations and assumptions may be requested by the commissioned independent consultant to verify the structural adequacy, and shall be made available as required. Copies of calculations are acceptable provided they are legible.

Site / Civil Works

11 .19.00 Paved roads shall be provided within the boundaries of the site for access to all entrances, parking areas, service, delivery and maintenance points and emergency receiving points (if applicable).

11 .20.00 Paved pathways shall be provided for external pedestrian traffic within the site. Fortis shall include movement from bus stops to all accessible on-site locations. Where applicable, Council crossovers are recommended to be considered when designing site roadways, as their impact on public roadways will affect the neighbourhood by impacting local traffic patterns and road design.

11 .21.00 All side entry pits, lintels, kerbs, channels and grated drains shall be constructed of reinforced concrete. Road surfaces are recommended to be bitumen paved with appropriate base, sub-base and sub-grades, all formed to provide adequate storm water drainage. Aprons to the ambulance bay, the main entry and the loading docks are recommended to be constructed of reinforced concrete on the appropriate base, sub-base and sub-grades.

11 .22.00 Bulk oxygen vessel foundation slabs and truck loading aprons shall be constructed of concrete. Bitumen products shall not be used due to the risk of ignition if an oxygen leak occurs during filling.

VENTILATION REQUIREMENTS

VENTILATION REQUIREMENTS FOR AREAS AFFECTING PATIENT CARE HOSPITALS AND OUTPATIENT FACILITIES

Area Designation	Air pressure relationship to adjacent area	Minimum air changes of outdoor air per hour	Minimum total air changes/ hour	All air exhausted directly to outdoors	Filtration Efficiency [2]	Re- circulated by means of room units	Relative humidity (%)	Design Temp ^{0}C
SURGERY AND CRITICAL CARE								
Operating/surgical Cystoscopic Rooms	Positive	AS 1668.2 [(3)]	20	50%	G4-F8 HEPA[1]	no	30-60	19-24
Operating Rooms - Cardiac, UCV	Positive	AS 1668.2 [(3)]	20	50%	G4-F8 HEPA[1]	no	30-60	16-27
Birthing/ Delivery Room	Positive	5	20		G4 - F9	no	30-60	20-23
Set-up Room and Sterile Store	Positive	AS 1668.2 [(4)]	15		G4-F8 HEPA	no	30-60	20-23
Recovery Room	Positive	AS 1668.2 [(5)]	10		G4 - F8	no	30-60	21
Critical and Intensive Care	Positive	2	6		G4 - F8	no	30-60	21-24
Neonatal Intensive Care	Positive	2	6		G4 - F8	no	30-60	22-26
Burns	Positive	3	10		G4 - F8	no	30-95	21-32
Treatment room	Positive	2	6		G4 - F8			24
Trauma room	Positive	3	15		G4 - F8	no	45-60	21-24
Anaesthesia gas storage	Negative	2	8	Yes	G4 - F8	no		
Endoscopy	Negative	2	6		G4 - F8	no	30-60	20-23
Bronchoscopy, Sputum Induction and Pentamidine	Negative	3	12	Yes	G4 - F8	no	30-60	20-23
Emergency Unit & Radiology Waiting Room	Negative	2	12	Yes	G4 - F8	no	30-60	20-23
Emergency Unit Triage	Negative	2	12	Yes	G4 - F8	no	30-60	20-23
NURSING								
Patient Room	Positive	2	6		G4 - F8			21-24
Toilet Room	Negative	2	10		G4 - F8			
Newborn Nursery Suite	Positive	2	6		G4 - F8			24
Protective Environment Room	Positive	AS 1668.2 (4)	12		G4-F8 HEPA			24
Airborne Infection Isolation Room	Negative	AS 1668.2 (4)	12	Yes	G4 - F8	no		24
Isolation alcove or anteroom	Neg or Pos	AS 1668.2 (4)	12		G4 - F8	no		
Labour/ Delivery/ Recovery/ Postpartum Room (LDRP)	Positive	2	6		G4 - F8			21-24
Patient Corridor		2	6		G4 - F8			
DIAGNOSTIC AND TREATMENT								
Examination Room		2	6		G4 - F8			24
Medication Room		2	6		G4 - F8			
Treatment Room		2	6		G4 - F8			24
Physiotherapy and Hydrotherapy	Negative	2	6		G4 - F8			24
Soiled Workroom or Soiled Holding	Negative		10	Yes	F4	no		
Clean Workroom or Clean Holding		2	6		G4 - F8			
Haemodialysis		2	6		G4 - F8	no		20-25
ANCILLARY								
Radiology								
Radiology (surgical/critical care and catheterisation	Positive	3	15		G4 - F9	no	30-60	21-27
Radiology (diagnostic & treatment)		2	6		G4 - F8			21-24
Darkroom	Negative	3	10	Yes	F7	no		

VENTILATION REQUIREMENTS

VENTILATION REQUIREMENTS FOR AREAS AFFECTING PATIENT CARE HOSPITALS AND OUTPATIENT FACILITIES

Area Designation	Air pressure relationship to adjacent area	Minimum air changes of outdoor air per hour	Minimum total air changes/ hour	All air exhausted directly to outdoors	Filtration Efficiency [2]	Re- circulated by means of room units	Relative humidity (%)	Design Temp ^{0}C
Laboratory								
General			6		F7			24
Biochemistry	Positive	2	6	Yes	F7	no		24
Cytology	Negative	2	6	Yes	F7	no		24
Glass washing	Negative	2	10	Yes	F7	no		
Histology	Negative	2	6	Yes	F7	no		24
Microbiology	Negative	2	6	Yes	F7	no		24
Nuclear Medicine	Negative	2	6	Yes	F7	no		24
Pathology	Negative	2	6	Yes	F7	no		24
Serology		2	6		F7	no		24
Sterilising	Negative	2	10	Yes	F7	no		24
Autopsy room	Negative		12	Yes	F7	no		
Non-refrigerated Body Holding Room	Negative	2	10	Yes	F7	no		21
Pharmacy		2	6		G4 - F8			
STERILISING AND SUPPLY								
ETO steriliser room	Negative	2	10	Yes	G4 - F8	no		24
Steriliser Equipment Room	Negative	2	10	Yes	G4 - F8	no		
Central Medical and Surgical Supply								
Soiled or Decontamination Rm	Negative	2	6	Yes	F4	no		20-23
Clean Workroom	Positive	2	6		G4 - F8	no	30-60	
Sterile Storage		2	6		G4 - F8		max 70	
SERVICE								
Food Preparation		3	10		F4	no		
Dish/ Pot Washing	Negative	3	10	Yes	F4	no		
Dietary Day Storage	Negative	2	6		F4			
Laundry General		3	10	Yes	F4	no		
Soiled Linen (sorting and storage)	Negative	3	10	Yes	F4	no		
Clean Linen Storage		2	6		G4 - F8			

Notes:

1. HEPA filters shall be installed at the air outlet
2. Filtration Efficiency: First filter listed is the prefilter if two filters are listed, second is the main filter and the HEPA if listed is the final terminal filter
3. The minimum outdoor airflow rate shall be 20 L/s per person at an occupancy of 5m2 per person or 50%, whichever is greater
4. The minimum outdoor airflow rate shall be the greater of 10 L/s per person or 2m2 per person
5. The minimum outdoor airflow rate shall be the greater of 10 L/s per person or 4m2 per person

ENGINEERING SERVICES - GENERAL REQUIREMENTS

Legislative Environment

The following requirements refer to Australian Standards and shall be complied with where applicable:

Building Code of Australia
Building Act
Building (Legionella) Act
Building Regulations
Plumbing Regulations
Health (Legionella) Regulations
Plumbing (Cooling Towers) Regulations
Building (Cooling Tower Systems Register)
Building (Legionella Risk Management)
Occupational Health and Safety (Noise)
Occupational Health and Safety (Plant)
Health Quality of Drinking Water Regulations
National Health and Medical Research Council /
Electrical Safety Act
Electrical Safety Regulations
Austel Technical Standard TS 009
Austel Technical Standard TS 008

Authorities

The following Authorities may have interest and have jurisdiction over health care facilities and related services:

Health Department
Environmental Protection Authority
Sustainable Energy Authority
WorkSafe Authority
Building Commission
Plumbing Industry Commission
Local Councils
Office of Gas Safety
Office of the Chief Electrical Inspector
Fire Brigade
Supply (Reporting) Authorities

Australian Standards

The following list of Australian Standards shall be complied with and includes Standards referred to in the Guidelines as well as additional Standards:

AS No	Australian Standard Title
AS 1170	SAA Loading Code
AS 1221	Fire hose reels
AS 1324.1	Air filters for use in general ventilation and air-conditioning - Application, performance and construction
AS 1603	Automatic fire detection and alarm systems
AS 1670	Fire detection, warning, control and intercom systems - System design, installation and commissioning
AS 1668.1	The use of mechanical ventilation and air-conditioning in buildings - Fire and smoke control in multi compartment buildings
AS 1668.2	The use of mechanical ventilation and air-conditioning in buildings - Mechanical ventilation for acceptable indoor-air quality

ENGINEERING SERVICES - GENERAL REQUIREMENTS

Australian Standards	
AS 1668.2	Supplement 1 - Mechanical ventilation for acceptable indoor-air quality
AS 1668.3	The use of mechanical ventilation and air-conditioning in buildings - Smoke control systems for large single compartments or smoke reservoirs
AS 1680.0	Interior Lighting - Safe movement
AS 1680.1	Interior Lighting - General principles and recommendations
AS/NZS 1680.2.	Interior Lighting - Hospital and medical tasks
AS 1735.1-16	Lifts, escalators and moving walks
AS 2107	Acoustics - Recommended design sound levels and reverberation times for building interiors
AS 2118	Automatic fire sprinkler systems
AS 2293	Emergency evacuation lighting for buildings
AS 2419	Fire hydrant installations
AS 2500	Guide to the safe use of electricity in patient care
AS 2901	Medical devices - Characteristics of audible and visible alarm signals
AS 3000	Wiring rules
AS 3003	Electrical installations - Patient treatment areas of hospitals and medical and dental practises
AS 3008	Electrical installations - Selection of cables
AS 3009	Electrical installations - Emergency power supplies in hospitals
AS 3080	Telecommunications installations - Integrated telecommunications cabling systems for commercial premises
AS 3084	Telecommunications installations - Telecommunications pathways and spaces for commercial buildings
AS/NZS 3500	National plumbing and drainage code
AS 3666.1-3	Air-handling and water systems of buildings-Microbial control
AS 3811	Hard wired patient alarm systems
AS 3892	Pressure equipment - Installation
AS 4254	Ductwork for air-handling systems in buildings
AS 4426	Thermal insulation of pipework, ductwork and equipment - Selection, installation and finish
AS 4428	Fire detection, warning, control and intercom systems - control and indicating equipment
AS 5601	(AGA 601) Gas installations

COMPLIANCE CHECKLIST

	Item	Yes	No
1	**Mechanical**		
	Have all mandatory elements of Enclosure E1 been met? Have all mandatory elements of Part E been met?	☐ ☐	☐ ☐
	Checked and certified by: _____ Date:_____ Company: _____ Position _____ Signature:_____		
2	**Electrical**	Yes	No
	Have all mandatory elements of Part E been met?	☐	☐
	Checked and certified by:_____ Date_____ Company: _____ Position _____ Signature:_____		
3	**Structural**	Yes	No
	Have all mandatory elements of Part E been met?	☐	☐
	Checked and certified by:_____ Date_____ Company: _____ Position _____ Signature: _____		
4	**Hydraulics**	Yes	No
	Have all mandatory elements of Part E been met?	☐	☐
	Checked and certified by:_____ Date_____ Company: _____ Position _____ Signature: _____		
5	**Fire**	Yes	No
	Have all mandatory elements of Part E been met?	☐	☐
	Checked and certified by:_____ Date_____ Company: _____ Position _____ Signature: _____		
6	**Vertical Transport**	Yes	No
	Have all mandatory elements of Part E been met?	☐	☐
	Checked and certified by:_____ Date_____ Company: _____ Position _____ Signature: _____		
7	**Communications**	Yes	No
	Have all mandatory elements of Part E been met?	☐	☐
	Checked and certified by:_____ Date_____ Company: _____ Position _____ Signature: _____		