Australasian Health Facility Guidelines

Part D - Infection Prevention and Control

Uncontrolled when printed

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Australasian Health Facility Guidelines

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01 INTRODUCTION

01.01 Scope

Part D of the Australasian Health Facility Guidelines (AusHFG), Infection Prevention and Control, (Part D) Has been written to assist project teams in the planning, design and construction or refurbishing of healthcare facilities. It was drafted from a comprehensive review of infection prevention and control literature and with input from experts in the field of infection prevention and control.

Infection prevention and control is influenced by environmental factors, building services and human activity. Part D addresses environmental and building services factors relating to infection prevention and control.

Part D is intentionally general in scope and does not address infection prevention and control policy or specific service requirements. Further details may be found in:

- the infection prevention and control policies of individual jurisdictions; and
- service-specific Health Planning Units (HPU) provided in Part B of the Australasian Health Facility Guidelines (e.g. HPU 190 - Sterile Supply Unit).

This document should be read in conjunction with relevant policies and Australian Standards relating to infection prevention and control, occupational health and safety and environmental health. Many of these are listed in the References and Further Reading section of this Guideline.

Also refer to the Glossary of Terms for explanation of many key terms as well as:

- NHMRC, 2010, Australian Guidelines for the Prevention and Control of Infection in Healthcare (2010) http://www.nhmrc.gov.au/guidelines/publications/cd33 ; and
- Standards Australia, 2003, Handbook 260: Hospital acquired infections - Engineering down the risk http://healthfacilityguidelines.com.au/AusHFG_Documents/Guidelines/Handbook%20260,%20Hospital%20acquired%20infections%20-%20Engineering%20down%20the%20risk.pdf

01.02 Contributing Factors

Healthcare associated infection (HAI) is the most common complication affecting patients in Australian hospitals. The Australian Commission on Safety and Quality in Health Care estimates that at least half of all HAIs are preventable (Factsheet: Preventing and Controlling Healthcare Associated Infections, Standard 3).

The design of healthcare facilities can influence the transmission of HAIs. Key design features that minimise transmission include:
surface finishes that are easy to clean and maintain;

- ventilation, air conditioning, cooling towers and water systems that meet prescribed standards; and
- the ability to isolate patients who are infectious or immunocompromised; andworkplace design.

Workplace design features include:

- separation of clean and dirty work flows;r
- ready access to hand hygiene facilities and personal protective equipment (PPE);
- adequate storage; and
- adequate systems and procedures for waste management, cleaning and linen handling (Australian Guidelines for the Prevention and Control of Infection in Healthcare (2010), page 231).

For more information refer to:

- Australian Commission on Safety and Quality in Health Care, 2012, Controlling Healthcare Associated Infections (Factsheet on Standard 3) http://www.safetyandquality.gov.au/wp-content/uploads/2012/01/NSQHS-Standards-Fact-Sheet-Standard-3.pdf; and
- NHMRC, 2010, Australian Guidelines for the Prevention and Control of Infection in Healthcare (2010) http://www.nhmrc.gov.au/guidelines/publications/cd33.

01.03 Consultation Process

The documentation and implementation of infection prevention and control principles is critical to the planning, design and construction or refurbishment process of healthcare facilities. Building services should comply with the relevant national standards, legislative and regulatory requirements and relevant guidelines issued by each jurisdiction.

Infection prevention and control staff have a fundamental role at each stage of a redevelopment project. Their involvement will ensure implementation of infection prevention and control guidelines and standards and that changes to design are cognisant of infection prevention and control implications.

01.04 Risk Management

Risk identification and management strategies throughout the life of the project are critical and are addressed in Section 900 (Construction and Renovation) of Part D.

Occupational health and safety (OHS) legislation requires the design team to consult with stakeholders and identify, assess and control risks in order to provide an optimal design outcome.

By adopting a risk management approach, many safety and security related hazards can be eliminated or minimised at the planning stage, reducing the likelihood of adverse incidents occurring.

For further information refer to:

- ACSQHC, 2012, Preventing and Controlling Healthcare Associated Infections: Safety and Quality Improvement Guide for Standard 3 http://www.safetyandquality.gov.au/wp-content/uploads/2012/10/Standard3_Oct_2012_WEB.pdf
- AHIA, 2010, AusHFG Part C: Section 790, Safety and Security Precautions http://healthfacilityguidelines.com.au/AusHFG_Documents/Guidelines/%5bC-0790%5d%20Safety%20and%20Security%20Precautions.pdf
- NHMRC, 2010, Australian Guidelines for the Prevention and Control of Infection in Healthcare (2010) http://www.nhmrc.gov.au/guidelines/publications/cd33 and
- Standards Australia, 2009, AS/NZS ISO 31000:2009 Risk management - Principles and guidelines (SAI Global) http://infostore.saiglobal.com/store/Details.aspx?ProductID=1378670&gclid=CKHz55W11LoCFQYepAod3nsAmA

01.05 Pandemic Preparedness

When considering infection prevention and control requirements, contingency plans should be identified for the bio-preparedness of each facility/service from initial planning and design phase through to completion. These may include fever clinic locations, isolation rooms, access, flow and logistics of an infectious disease outbreak, air conditioning supply and controls, water and waste management.

01.06 References

- ACSQHC, 2012, Preventing and Controlling Healthcare Associated Infections: Safety and Quality Improvement Guide for Standard 3, Australian Commission on Safety and Quality in Health Care, Sydney, Australia http://www.safetyandquality.gov.au/wp-content/uploads/2012/10/Standard3_Oct_2012_WEB.pdf

- AHIA, 2010, AusHFG Part C: Section 790, Safety and Security Precautions, AHIA, AHIA, Sydney, NSW http://healthfacilityguidelines.com.au/AusHFG_Documents/Guidelines/%5bC-0790%5d%20Safety%20and%20Security%20Precautions.pdf
- Australian Commission on Safety and Quality in Health Care, 2012, Controlling Healthcare Associated Infections (Factsheet on Standard 3), Australian Commission on Safety and Quality in Health Care, Sydney, Australia http://www.safetyandquality.gov.au/wp-content/uploads/2012/01/NSQHS-Standards-Fact-Sheet-Standard-3.pdf
- NHMRC, 2010, Australian Guidelines for the Prevention and Control of Infection in Healthcare (2010), Australian Government, Canberra, Australia http://www.nhmrc.gov.au/guidelines/publications/cd33
- Standards Australia, 2009, AS/NZS ISO 31000:2009 Risk management - Principles and guidelines (SAI Global), Standards Australia, Sydney, NSW http://infostore.saiglobal.com/store/Details.aspx?ProductID=1378670&gclid=CKHz55W11LoCFQYepAod3nsAmA
- Standards Australia, 2003, Handbook 260: Hospital acquired infections - Engineering down the risk, Standards Australia, Sydney http://healthfacilityguidelines.com.au/AusHFG_Documents/Guidelines/Handbook%20260,%20Hospital%20acquired%20infections%20-%20Engineering%20down%20the%20risk.pdf

02 BUILDING ELEMENTS

02.01 Introduction

It is recommended that project staff refer to jurisdictional policies relating to infection prevention and control and hand hygiene, to fully inform requirements relating to the following building elements. Many of these policies and guidelines are listed in AHIA, 2015, AusHFG Part D, Section 1000 - References and Further Reading.

02.02 Hand Hygiene

GENERAL
Effective hand hygiene is one of the most important strategies in preventing HAIs. Healthcare organisations are required to develop effective governance and management systems to prevent and control HAIs, as described in Australian Commission on Safety and Quality in Health Care, 2012, Controlling Healthcare Associated Infections (Factsheet on Standard 3).

Hand hygiene is defined as a process that reduces the number of microorganisms on hands. It is a general term applied to the use of soap/solution (non-antimicrobial or antimicrobial) and water or a waterless antimicrobial agent, to the surface of the hands (e.g. alcohol-based hand rub). When performed correctly, hand hygiene results in a reduction of microorganisms on hands. For resources on hand hygiene refer to the Hand Hygiene Australia Website.

Hand hygiene may be classified as:

- routine/social, including patient care situations;
- aseptic procedures; or
- surgical procedures.

HAND WASHING
Hand washing in hand basins is generally reserved for situations when hands are visibly soiled, or as defined by jurisdictional hand hygiene policies. Descriptions of the various types of hand basins and their location are provided in the next section.

SOAP
All basins should be provided with near neutral pH soap. Clinical basins and scrub troughs should, in addition, be provided with antimicrobial liquid soap. Soap dispensers are to be the closed-cartridge type and are to be mounted on or above the splashback.

HAND DRYING
Single use cloth or paper towels will be provided at all hand basins. Locate towel dispensers adjacent to the splashback to prevent splash contamination. Dispensers should be smooth-surfaced and easy to clean to prevent dust or soil contamination.

Paper towel may be used in public amenities and beverage bays.

Hot air hand dryers are not recommended for installation in clinical areas of healthcare facilities. High speed hand dryers may be considered in non-clinical areas, such as public toilets.

ALCOHOL-BASED HAND RUBS
Alcohol based hand rub (ABHR) improves compliance with hand hygiene and is the hand hygiene product of choice for all standard aseptic non-touch technique procedures.

Hand Hygiene Australia recommends making ABHR available:

- at the foot of every patient bed or adjacent wall;
- affixed to mobile work trolleys (e.g. intravenous, drug and dressing trolleys);
- in high staff traffic areas (e.g. staff station, utility rooms and at the entrance to patient rooms);
- other multi-use patient care areas such as consultation rooms;
- at the entrance of each inpatient unit, outpatient clinic and other departments; and
- in public areas such as waiting rooms, receptions areas, hospital foyers, and near elevator doors in high traffic areas.

Dispenser systems should minimise the possibility of 'dripping' to avoid potential damage to wall and floor coverings.

GLOVES
A disposable glove dispenser, sufficient to hold all glove sizes (usually three sizes), should be located near areas where staff are likely to come into contact with blood and body fluids. The dispenser should allow re-stocking without the need to touch new gloves, and be located away from the splashback to prevent splash contamination.

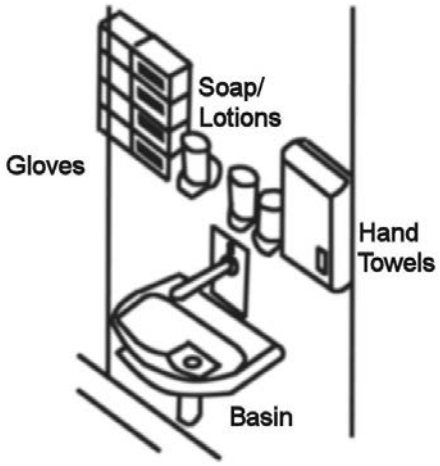
Glove dispensers will be located in areas such as inpatient bed rooms, emergency treatment bays and dialysis bays where staff are identified as being at risk of exposure to blood and body fluids at the point of care.

HAND CREAM / LOTION
Locate a moisturising cream/lotion dispenser at or near each hand basin. Dispensers should be non-refillable. Hand cream/lotion should be compatible with all hand hygiene products.

ARRANGEMENT OF DISPENSERS AT CLINICAL BASINS
Dispensers should be arranged in a consistent manner across healthcare facilities, as shown in the concept drawing in Figure 1. Glove dispensers should be located to the staff members' left and hand towels to the right. Soap and hand cream/lotions dispensers should be mounted over the basin to 'catch' drips.

Refer to room layout sheets (RLS) (Bay – Hand Washing) for detailed information.

Figure 1: Arrangement of Dispensers at Basins



SIGNAGE
Clear visible signs reminding all staff and visitors to attend to hand hygiene should be provided.

WASTE RECEPTACLES
Locate waste receptacles at each hand basin for disposal of single use towels. The bins should be of adequate size, non-touch design and easy to clean.

MIRRORS

Mirrors should not be installed above hand basins in food preparation areas, nurseries, clean and sterile supply areas and other areas where infection prevention and control would be compromised by staff touching their hair.

Mirrors may be installed in anterooms, near PPE bays and near the entry to surgical scrub rooms, to assist staff to correctly don caps, masks and to check their hair is appropriately covered.

PPE BAYS

Transmission-based precautions should be implemented when standard precautions may be insufficient to prevent transmission of infection.

Transmission-based precautions are recommended for specific patients known (or suspected) to be infected or colonised with disease agents that cause infections in health care settings that cannot be contained by standard precautions alone.

Rooms identified to care for patients requiring transmission-based precautions should have personal protective equipment (PPE). PPE should be located outside:

- each single bedroom or pair of single rooms; or
- each two or four-bedded room (where cohorting is common).

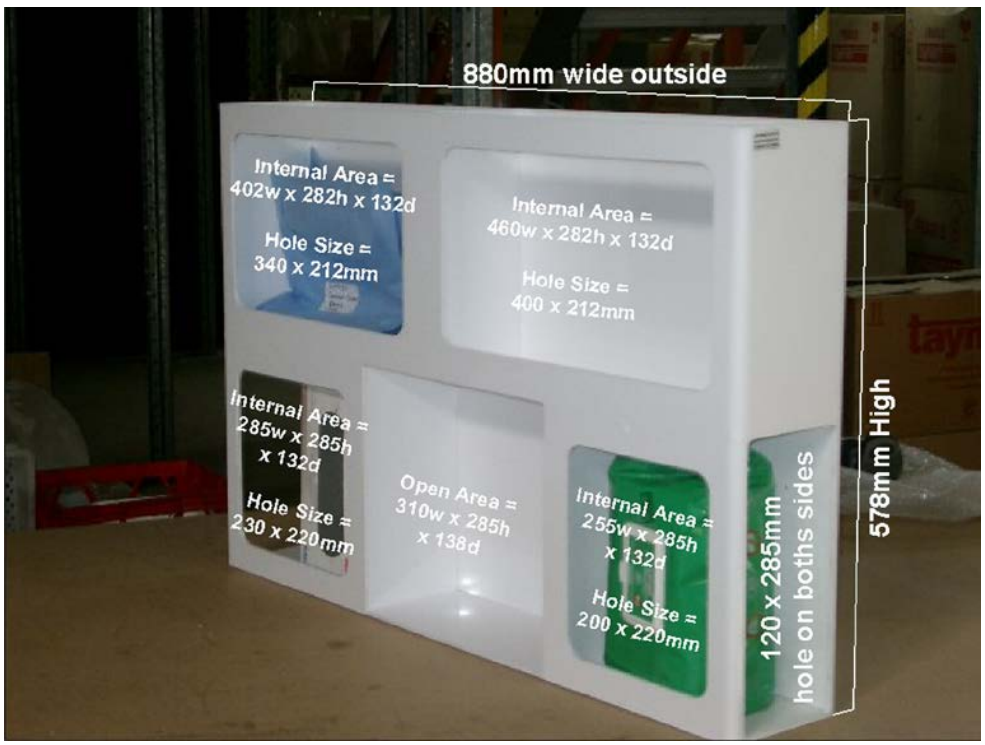
A dedicated hand wash basin is not needed as basins are available in clinical corridors. PPE and associated products will routinely include:

- a bracket for ABHR;
- gowns; and
- a disposable gloves dispenser.

In negative pressure isolation rooms, PPE is stored in the anteroom.

Some health services have developed custom solutions to accommodate PPE, as shown in the photo in Figure 2. This type of system can be stocked when required and is easily mounted on a wall reducing the need for trolleys or recessed bays.

Figure 2: Example of a customized PPE container (source: Queen Elizabeth Hospital, South Australia)



02.03 Hand Basin Types and Uses

GENERAL
The following descriptions are based on Room Data and Room Layout Sheets (Bay – Hand Washing) for Standard Components provided in Part B.

HAND BASINS
Hand hygiene compliance is significantly improved when hand basins are visible and accessible.

Clinical hand basins must be reserved for hand washing.

Depending on their use, hand basins may be defined as:

- clinical - large 'scrub' (Type A);
- clinical - medium (Type B);
- non-clinical - small or medium (including vanities) (Type C); and
- surgical scrub troughs.

Hand basins are required in all patient care areas and in all areas where careful attention to hygiene is essential such as kitchens, laundries, pharmacies, laboratories and amenities for patients, visitors or staff. Reticulated, free-flowing warm and cold water will be provided. Plugs should not be provided other than to hand basins in patient ensuites (e.g. vanity basins).

Splashbacks will be required behind all basins. The splashback should be large enough to contain splashes and prevent moisture seepage. The surface should be water resistant and easy to clean.

For advice regarding weight tolerance for basin attachment also refer to the Handwash Facilities section (Clause 710.086.00) of AHIA, 2010, AusHFG Part C: Section 710, Space Standards and Dimensions.

HAND BASIN DESIGN
Design should ensure that hand basins:

- have no overflow;
- have curved sides, to minimise splashing;
- are large enough to enable good hand hygiene techniques;
- are either sealed to the wall or far enough away from the wall to allow effective cleaning;
- have a waterproof splashback;
- have suitable taps;
- do not include integrated plugs; and
- have water delivered at a suitable temperature to allow hand washing under running water.

Hand basins should be made of a hard, non-scratch material (usually porcelain) and be easy to clean. Polycarbonate or other moulded plastic materials are not suitable.

Drainage design should be easy to access internally and externally for regular cleaning of 'S' bends to remove biofilm build-up.

TYPE A - CLINICAL BASIN - LARGE (SCRUB BASIN)
The Type A clinical scrub basin is required in selected areas requiring clinical hand washing prior to undertaking selected procedures that may occur in non-operating room settings (e.g. delivery room).

The basin is a large wall-mounted type, with hands-free taps that may be wall mounted elbow taps, foot/knee operated or electronic sensor taps, with warm and cold water delivered by a common spout. Tap placement should allow washing up to the elbow.

Refer Standard Components: Room Data and Room Layout Sheet - Bay Hand washing Type A.

TYPE B - CLINICAL BASIN - MEDIUM

This hand basin is used in areas requiring hand hygiene by staff and visitors for patient care situations and aseptic procedures. The basin is a medium wall-mounted type. The taps may be either wall-mounted or basin-mounted with elbow or wrist hands-free operation, and warm/cold free-running water.

Refer to Standard Components: Room Data and Room Layout Sheet - Bay Hand washing Type B.

TYPE C - NON-CLINICAL BASIN - SMALL / MEDIUM

The Type C basin is required in public, patient and staff amenities.

Type C is a small wall-mounted basin, which may be part of a vanity unit. The taps may be wall-mounted or basin-mounted. Supply warm and cold water. Cold water-only may be provided to Type C facilities in areas such as public amenities.

For ease of cleaning and use taps should be lever operated as commercially available.

Refer to Standard Components: Room Data and Room Layout Sheet - Bay Hand washing Type C.

Basins in accessible toilets must comply with Standards Australia, 2010, AS 1428 (Set) 2010 Design for access and mobility Set (SAI Global).

SCRUB SINK/TROUGH
This is a long sink that can accommodate one or more staff scrubbing for a surgical procedure (see Standard Components: Room Data and Room Layout Sheets - Scrub Up / Gowning).

TAPS AND WATERSPOUTS
The use of spray taps and hoses is not supported in clinical environments as they create aerosols.

A domestic style single lever operation is considered an appropriate substitute for a wrist operated tap.

Clinical basins and scrub sinks or troughs should have waterspouts fitted with anti-splash devices. Clinical basins and scrub sinks/troughs should have sufficient space between the waterspout and the basin, sink or trough to enable adequate washing up to the elbow.

Alignment of the waterspout should ensure the water flow does not run directly into the drain aperture, thus avoiding aerosol splashback to the hands and face of the user. The waterspout will be positioned to ensure the water flow hits at the front of the basin, sink or trough. For this reason, the selection of basins and tap ware should be coordinated and approved by clinical staff as a single unit.

For further details relating to taps and waterspouts, refer to the Standard Components of hand basins and scrub sinks.

Healthcare facilities should comply with Standards Australia, 2005, AS/NZS 3718:2005 Water Supply—Tap Ware.

02.04 Hand Hygiene - Schedule and Placement

The following table indicates recommended basin and alcohol based hand rub dispensers for particular rooms/spaces. For rooms not listed refer to a similar area.

Room/Space	Basin Type	Placement Details
Acute Inpatient Bedrooms (single & multi-bed)	B	A hand basin to be provided within each single, double or four bed room. Each bedspace will have access to alcohol based hand rub. Alcohol based hand rub will be available at the entry to each pair of single rooms

		with PPE where indicated. In the case of rooms with anterooms, this PPE will be stored within this room.
Birthing rooms	A	Access to a hand basin is required in each room in addition to alcohol based hand rub.
Critical care - adult, paediatric & neonatal:- enclosed rooms/ open bays	A	A hand basin be provided in each single room or shared between a pair of open patient bays. In NICU – SCN, one hand wash bay per four bed spaces is adequate. Each bedspace will have access to alcohol based hand rub.
Day medical bed bays (oncology, dialysis etc)	B	A hand basin to be provided for every four patient bays. Each patient bay will have access to alcohol based hand rub.
Day Procedure rooms (endoscopy etc)	A	A hand basin to be provided for each Procedure Room unless a scrub trough is provided
Imaging Rooms - angiography - other	 A B	A hand basin be provided for each angiography room, unless a scrub trough is provided. A hand wash basin should be provided in all other imaging rooms (e.g. general x-ray). Each imaging room will have access to alcohol based hand rub
Patient Bay - Recovery - Stage 1 - Stage 2/3	 A B	A hand basin to be provided for every four patient bays. Each patient bay will have access to alcohol based hand rub.
Patient Bay - Resuscitation	A	A hand basin to be provided for every patient bay. Each patient bay will have access to alcohol based hand rub.
Emergency Department	B	A hand basin to be provided for every four patient treatment bays. Each bedspace will have access to alcohol based hand rub
Treatment/ Procedure Room	A	A hand basin to be provided in each room. Each room will have access to alcohol based hand rub.
Dental Surgery	B	A hand bay to be provided for each closed dental surgery or shared between two open surgeries. Each dental surgery will have access to alcohol based hand rub.
Consult Room	B	A hand basin to be provided for each Consult Room. Each room will have access to alcohol based hand rub.
Clean Utility Room	B	A hand basin to be provided for each room.

		Access to alcohol based hand rub will also be provided.
Clean-up room / Dirty utility room	B	A hand basin to be provided for each room. Access to alcohol based hand rub will also be provided.
Mortuary	B	
Post mortem (autopsy)	A	A hand basin to be located in each autopsy room.
Pathology Laboratory	B	Allocation will be dependent on layout of laboratory areas.
Isolation anteroom / airlock / inpatient unit corridors	B	While staff may need access to a hand wash basin in the corridor, it is likely that in most circumstances, access to alcohol based hand rub will be adequate given access to hand wash basins in patient care and other support areas is provided. It is recommended that Type A hand wash basins are located in airlocks that support Q Class rooms.
Entry to or from a clinical unit (e.g. inpatient unit)		Alcohol based hand rub is recommended.
Beverage Bay / Food servery (if provided)	C	Unless one is located in close proximity.
Formula Rooms	B	
Sterile Supply Unit	B	
Cleaners Room	C	
Maintenance Areas	C	
Disposal Room	-	Ideally, a basin should be provided in close proximity to this room to provide access. Alcohol based hand rub is recommended.
Staff /Public /Visitor Toilets	C	
Parent room / Baby change room	C	
Patient ensuite	C (or vanity)	Basin and taps to comply with AS 1428.1
Operating Room	Scrub trough	Provided for each Operating Room or shared between two rooms.

02.05 Baths and Showers

Bath surfaces should be non-porous and easy to clean. Spa baths are generally not favoured owing to the potential for water backflow and bacterial contamination.

Ensure the shower hose is short enough so that the shower head does not reach the floor when it is removed from its bracket.

In specialty areas such as an ICU, where patients may be showered on shower trolleys, a longer hose may be necessary. Alternatively two shower outlets may be preferred.

Hoses should not be installed as part of a delivery bath/pool as the hose may fall into pool water and become contaminated with pathogens.

02.06 Isolation Rooms

INTRODUCTION
This Guideline describes and identifies requirements for patients requiring transmission-based precautions, or for patients who require protection from external sources.

TYPES OF ISOLATION ROOMS
There are four types of isolation room. The isolation room types and uses are detailed in Table 2.

Table 2: Isolation Room Types

AusHFG	As detailed in HB260 (Standards Australia 2003c)
Class S - Standard	Standard isolation - Type 4
Class P - Positive pressure	Patient protection - Type 3
Class N - Negative pressure	Respiratory isolation - Type 5
Class Q - Quarantine	Quarantine isolation - Type 5 plus airlock

The isolation room used in Table 2 refer to definitions used in Standards Australia, 2003, HB 260:2003 Hospital Acquired Infections - Engineering Down the Risk.

Isolation rooms Class S and Class N, when not required for the care of infectious patients, can accommodate other patients once the room is vacated and cleaned as per the infection prevention and control policy of the facility.

The risk of utilising these Class N rooms for patients other than those with infectious conditions is that doors can be left open, compromising the door seals. In addition, negative air pressure may be turned off, which may further compromise the integrity of the mandatory mechanics required for infection prevention and control.

Patients with airborne transmitted infections, such as varicella, measles, and tuberculosis will not be accommodated in Class P isolation.

Controls for pressurised isolation rooms should be located to minimise the risk of tampering. Staff should be able to easily view pressure gauges.

CLASS S - STANDARD ISOLATION ROOM

A Class S/ Type 4 isolation room is a single room with an ensuite that is not shared. The room is used for patients who require isolation to minimise the potential for infections being transmitted by contact or droplets to other patients and staff.

A Type B hand basin is required within the room. Self-closing doors to help control room temperature are recommended. A PPE bay may be provided outside the door and may be shared with an adjoining room.

There are no specific requirements for air conditioning.

CLASS P - POSITIVE PRESSURE ISOLATION ROOM
A Class P isolation room is a single room with an ensuite that is not shared. This room is used to reduce the risk of airborne transmission of infection to susceptible patients with prolonged granulocytopenia, such as allogeneic bone marrow recipients.

A Type B hand basin is required within the room and self-closing doors to control room pressures.

The positive pressure air handling system within the room operates at a higher pressure, with respect to adjacent rooms/spaces, and air supply is high efficiency particulate air (HEPA) filtered. Air exhausted from these rooms is not infectious and therefore does not require filtration. For details of air changes etc., refer to Section 6.6 of AS 1668.2 (Protective Isolation Rooms).

An enclosed anteroom is not required, but sufficient and appropriate storage space should be provided outside the room for PPE. Waste disposal should be provided inside the room.

For further information refer to Standards Australia, 2002, AS 1668.2:2002 The Use of Ventilation and Airconditioning in Buildings, Part 2.

CLASS N - NEGATIVE PRESSURE ISOLATION ROOM
A Class N isolation room is a single room with an ensuite that is not shared. It is used for patients who require isolation to reduce airborne transmission of disease (e.g. varicella, measles, pulmonary or laryngeal tuberculosis).

A Type B hand basin within the room and a self-closing door are required, with sufficient and appropriate storage for clinical waste.

The design of the room must provide separate entry doors to allow for movement of the patient in and out of the room. The anteroom is only for use by staff and visitors.

The air handling system in Class N isolation rooms operates at a lower pressure with respect to adjacent areas such as the anteroom and corridor. Air in negative pressure rooms will be exhausted to the outside in accordance with AS 1668.2 to prevent air recirculation. Ideally, supply air into the room should be located on the ceiling above the foot of the bed. The exhaust air to be located at the head of the bed.

The discharge points should be located as far as possible from air intakes and from where people congregate or work. If external exhaust is not possible, air should be recirculated through HEPA filters. Provision of a dedicated exhaust system to each room, separate to the common exhaust air system, will reduce the risk of contamination.

HPUs that require one or more Class N rooms include:

- emergency unit;
- intensive care units (adult, paediatric, neonatal);
- respiratory units;
- paediatric inpatient units; and
- infectious diseases units.

Procedural areas such as bronchoscopy rooms and sputum induction rooms may require similar negative pressure air handling systems.

The air handling systems designed for airborne infection isolation should be connected to the emergency backup power in case of power failure. These rooms have additional seals to prevent inadvertent escape of pathogens, therefore with no ventilation in the event of sustained power failure; isolation of airborne patients with infectious conditions becomes a patient safety risk.

For more information also see Standards Australia, 2002, AS 1668.2:2002 The Use of Ventilation and Airconditioning in Buildings, Part 2.

CLASS Q - QUARANTINE ISOLATION ROOM
A Class Q isolation room is a single room with a dedicated ensuite that is not shared and includes all design requirements as described for a negative pressure room. In addition, the quarantine isolation room will require an anteroom designed to function as an absolute airlock (refer to clause 820.006.075 below).

Inclusion of an electronic communication system (intercom) between the isolation room and the airlock will assist in eliminating or reducing unnecessary traffic into the room.

One hospital in each Australian capital city will have designated Class Q rooms providing facilities for patients with highly infectious pathogens such as haemorrhagic fevers and pneumonic plague. These patients require a further level of containment over and above the standard negative pressure isolation room.

COMBINED ALTERNATING PRESSURE ISOLATION ROOMS
Combined alternating pressure rooms (enabling the room to have either negative or positive pressure) are NOT recommended due to concerns such as:

- the difficulty in the configuration of appropriate airflow for two fundamentally different purposes;
- the risk of operator error;
- the need for complex engineering; and
- the absence of failsafe mechanisms.

CALCULATION OF NUMBERS OF SINGLE ROOMS - GENERAL
When redeveloping healthcare facilities, project planning teams should use available service planning and incidence data to determine the number and type of single rooms required, and the mix of isolation rooms. Assessment of actual demand for patient isolation should include:

- number of patient admissions with infections known or suspected to require isolation;
- the type and duration of isolation required;
- clustering of cases that may be influenced by seasonal and other trends; and
- type of units where patient isolation may be necessary.

Estimates of numbers and types of isolation rooms should consider:

- trends in disease in the general population and the particular population served (e.g. settlement of refugees in rural areas);
- demographic trends in the population served;
- specialties of the healthcare facility; and
- projected changes in future clinical activities.

Data collected over one year or longer will provide more reliable estimates and assist in determining peak needs for diseases with marked seasonal variations.

Retrospective data (based on discharge) should be used with caution as the data may not include suspected, but unconfirmed, cases of certain infections requiring isolation, thereby causing an underestimation of requirements. For planned new facilities, data from comparable facilities serving comparable populations may be available in place of retrospective data.

When calculating requirements for persons known or suspected of having infections that require airborne precautions, it is important to collect data on patients suspected of having tuberculosis or other transmissible diseases, and/or contacts that require isolation because they are in the potentially infectious period. Patients

will require isolation until confirmed as uninfected by clinicians, or until the treatment or the clinical course of the infection renders the patient no longer infectious.

Consider the need for one negative pressure room per 100 acute beds as a minimum. Actual requirements will be dependent on an assessment of the health services baseline infection rate and recent trends. Also see Standards Australia, 2003, HB 260:2003 Hospital Acquired Infections - Engineering Down the Risk.

The requirement for Class P isolation rooms should be determined by collecting data on local threats from pathogens such as Aspergillus, as well as evidence (from within and beyond the facility) on the ability to protect vulnerable patients. This will depend on the clinical specialties within the facility or catchment area.

DESIGN PRINCIPLES FOR ISOLATION ROOMS

The aim of environmental control in an isolation room is to control the airflow, thereby reducing the number of airborne infectious particles that may infect others within the environment. This is achieved by:

- controlling the quality and quantity of intake and exhaust air;
- diluting infectious particles in large volumes of air;
- maintaining differential air pressures between adjacent areas; and
- designing patterns of airflow for particular clinical purposes.

The location and design of isolation rooms within a particular HPU (department or inpatient unit) should ideally enable their isolation from the rest of the unit. Multiple isolation rooms should be clustered and located away from the main entrance of the unit.

An exception is an emergency department where it is recommended that designated isolation rooms be located near the entry to prevent spread of possible airborne infection throughout the unit.
Consideration may be given to one whole floor level, or a defined section of inpatient accommodation, being designed with separate air-conditioning and exhaust systems to enable healthcare facilities to accommodate an infectious outbreak.

When planning isolation rooms consider:

- sufficient and appropriate storage space for waste receptacles inside the room;
- sufficient and appropriate storage space for PPE outside the room;
- provision of an observation window with a privacy blind between double glazing (to allow staff to observe patients without entering the isolation room);
- provision of a communication system such as a phone or intercom to allow communication between staff, patients, interpreters, visitors etc. without leaving the room; and
- suitable surface finishes (ceiling, walls, floor coverings etc.).

ENGINEERING REQUIREMENTS

Details of engineering requirements and services for isolation rooms are available from a number of sources including:

- CDC, 2003, Guidelines for Environmental Infection Control in Health-Care Facilities;
- NHS Estates, 2013, Infection Control in the Built Environment (HBN 00-09);
- Standards Australia, 2003, HB 260:2003 Hospital Acquired Infections - Engineering Down the Risk;
- Standards Australia, 2002, AS 1668.2:2002 The Use of Ventilation and Airconditioning in Buildings, Part 2; and
- Victorian Advisory Committee on Infection Control, 2007, Guidelines for the Classification and Design of Isolation Rooms in Health Care Facilities.

ANTEROOMS

Anterooms allow staff and visitors to change into, and dispose of, personal protective equipment used on entering and leaving rooms when caring for infectious patients. Clean and dirty workflows within this space should be considered so that separation is possible.

Anterooms increase the effectiveness of isolation rooms by minimising the potential escape of airborne nuclei into a corridor area when the door is opened.

For Class N isolation rooms the pressure in the anteroom is lower than the adjacent ambient (corridor) pressure, and positive with respect to the isolation room. The pressure differential between rooms should be not less than 15 Pascal.

Anterooms are provided for Class N isolation rooms in intensive care units, emergency departments, birthing units, infectious diseases units, and for an agreed number of patient bedrooms within inpatient units accommodating patients with respiratory conditions. The need for anterooms for Class N/ Type 5 rooms in other HPUs should be considered on a case-by-case basis.

An anteroom should not be shared between rooms.

An anteroom will not be used to move the patient in and out of the room. The patient entry doors will instead be used.

AIRLOCKS FOR Q CLASS ROOMS

Anterooms in Class Q rooms act as full airlocks with two interlocking doors that cannot be opened simultaneously. The airlock will need to be large enough to incorporate additional disposal facilities as well as allowing bed movement with doors interlocked.

Ensuring that the pressure in the airlock is lower than the adjacent ambient (corridor) pressure, and positive with respect to the isolation room. The pressure differential between rooms should be no less than 15 Pascals. The door to the airlock from the corridor is to be well sealed with good quality seals on each side. The airlock should have supply air (no exhaust) with a door grille between the airlock and the isolation room.

FUNCTIONAL CLASSIFICATION OF ISOLATION ROOMS

The functional classification of isolation rooms is provided in Table 3.

Table 3: Functional Classification of Isolation Rooms

	Class P	Class S	Class N	Class Q
Key ventilation criteria	Greater air pressure in the room than in the corridor.	No air pressure difference between room and the adjacent corridor.	Lower air pressure in the room than in the adjacent corridor or anteroom.	Lower air pressure in the room than in the adjacent airlock.
Transmission based rationale	To prevent transmission of pathogens from the outside environment to profoundly immuno-compromised patients.	To prevent contact or droplet transmission.	To prevent airborne transmission.	Quarantine of patients with highly transmissible pathogens to prevent airborne transmission.
Examples for use (noting this is not a complete list)	To prevent infections such as aspergillus (fungal infection) in allogeneic bone-marrow transplant recipients.	VRE / MRSA Gastroenteritis Cutaneous anthrax Hepatitis A	Measles and Varicella, suspected or proven. Pulmonary or laryngeal tuberculosis.	Highly infectious pathogens such as haemorrhagic fevers, pneumonic plague.

			Suspected contact of measles, Varicella, and SARS if symptomatic	

For further information refer to section B5.2 of NHMRC, 2010, Australian Guidelines for the Prevention and Control of Infection in Healthcare (2010).

02.07 Non-Patient Areas

Waiting areas in non-inpatient units, including ambulatory care units and community health centres, should be designed and arranged so it is possible to separate patients who have been diagnosed with, or are suspected of having, a communicable disease.

03 PHYSICAL ENVIRONMENT

03.01 Air Conditioning, Ventilation and Water Systems

GENERAL
The control of infection is influenced by the design and effectiveness of the air conditioning and ventilation systems. Specialised areas of a healthcare facility (e.g. operating rooms, birthing rooms, negatively and positively pressured isolation rooms, burns unit, intensive care units, emergency departments and special treatment or procedural areas) should provide high quality air at all times.

The management of airflows and the creation of a turbulence-free environment are essential to the control of the spread of infection.

The provision of natural ventilation to patient care areas should be approached with caution. Non air conditioned spaces rely on natural airflows to achieve comfortable conditions. The natural airflows required to achieve comfortable conditions and the airflows generated by supplementary ventilation (e.g. fans that generate turbulence and unpredictable airflows) have the potential to spread infection from person to person. Sweep ceiling fans, portable fans (with the exception of blade-free fans) and evaporative cooling systems should not be installed or used. Ventilation equipment should maintain the temperature, humidity and purity of the air, plus the inflow of fresh air, all within prescribed limits.

Return air paths in clinical areas will be provided via dedicated return air ducting.

All supply air and return air registers and grills should be removable for regular scheduled cleaning. They should not be installed directly above a patient bed.

Resources that deal with air conditioning topics can be found at the following links:

- AHIA, 2010, AusHFG Part E: Building Services and Environmental Design;
- AHIA, 2015, AusHFG Part D: Section 830 Building Elements;
- CDC, 2003, Guidelines for Environmental Infection Control in Health-Care Facilities; and
- Standards Australia, 2002, AS 1668.2:2002 The Use of Ventilation and Airconditioning in Buildings, Part 2.

LEGIONELLA
Legionnaires' disease is a serious and potentially life threatening lung infection caused by the bacteria Legionella.

Transmission of Legionella pneumophilia is through air by inhaling fine droplets of water contaminated with the organism, and are associated with warm water environments such as cooling towers, evaporative air conditioners, showers, warm water systems, spa pools, misting or droplet sprays and fountains. Legionella bacteria thrive at the optimum temperature of 37 o C and die at about 46 o C.

Plant and equipment, including air handlers, water cooled cooling towers, pipe work systems in warm water and domestic hot water systems should be designed, installed and maintained in accordance with all Federal, state/ territory regulations, standards and guidelines on cooling towers and hot and cold water services.

For more information see:

- AHIA, 2015, AusHFG Part D, Section 1000 - References and Further Reading;
- Heymann, D.L., 2014, Control of Communicable Diseases Manual, 20th Edition; and
- Standards Australia, 2011, AS/NZS 3666 Air-handling and Water Systems of Buildings Set.

WATER PIPES

'Dead legs' should not be designed or built into a new system. Pipe work should be designed to be as direct as possible, avoiding stretches that do not recirculate.

Consideration should be given to the removal of dead legs at every available opportunity when sites are undergoing renovations.

SPLIT SYSTEMS
The use of split system air conditioners is a common way of resolving local cooling problems in new developments or retrofitted facilities. Their use should be avoided in patient care areas due to infection prevention issues. The following need to be considered:

- routing of condensate drains;
- air flow and turbulence effects; and
- maintenance and adequacy of filters.

The use of split system air conditioners should be confined to process cooling for equipment such as computer rooms and MRI equipment rooms, staff only and non-patient care areas.

RETICULATED WATER SYSTEMS
For further information refer to the following documentation:

- ABCB, 2014, Plumbing Code of Australia (PCA); and
- Standards Australia, 2011, AS/NZS 3666.1:2011 Air-handling and Water Systems of Buildings - Microbial Control - Design, Installation and Commissioning.

THERMOSTATIC MIXING VALVES
Where thermostatic mixing valves are fitted, water temperature should be routinely checked to ensure warm water is maintained within the prescribed range. The valves should also be easily removed for maintenance purposes.

ICE-MAKING MACHINES
Ice intended for human consumption should be obtained from self-dispensing ‘on-demand’ ice machines rather than from a trough reservoir.

Ice intended for receptacles for therapeutic use or donor organs can be obtained from an ice-making machine located in a clean area. A clean utility room will not be suitable for storage of such a machine. Routine cleaning and maintenance should be incorporated into the equipment surveillance program.

See also:

- Standards Australia, 2014, AS/NZS 4187:2014 Reprocessing of Reusable Medical Devices in Health Service Organizations; and
- Standards Australia, 2003, HB 260:2003 Hospital Acquired Infections - Engineering Down the Risk.

03.02 Separation of Clean and Dirty Work Flows

Workflows are to be separated in rooms where both clean and dirty functions occur (e.g. dirty utility and clean-up rooms).

The cleaning area should be divided into a contaminated section and a clean section.

Work should flow from clean to contaminated areas, with care taken to avoid contaminated equipment re-entering clean work areas.

The contaminated section should include:

- adequate bench space for dismantling and working on equipment;

- at least one deep, stainless steel sink or trough for manual cleaning of instruments and other equipment;
- cleaning and disinfecting material and equipment including brushes; and
- mechanical disinfector/ washer.

Cleaning sinks must be provided in addition and separate to clinical hand washing basins, and used only for disposal of fluids and equipment cleaning. Where filters are fitted to taps in place of anti-splash devices, they will be regularly cleaned.

The processing area should be carefully defined and protected from all vapours, splashing or aerosols produced during operating, hand-washing, equipment washing, disinfection and ultrasonic cleaning. The area should have adequate storage space and be used only for the storage of effectively covered or packaged, cleaned, disinfected and/or sterilized instruments and equipment.

Staff rooms and recreation areas must be separate from work areas and patient treatment areas.

Ideally, there should be separate loading docks or at least separate entries for food supplies, general clean supplies and linen, and for removal of waste and soiled linen.

For detailed requirements regarding separation of clean and dirty workflows refer to:

- Standards Australia, 2014, AS/NZS 4187:2014 Reprocessing of Reusable Medical Devices in Health Service Organizations; and
- Standards Australia, 2003, HB 260:2003 Hospital Acquired Infections - Engineering Down the Risk.

03.03 Storage

Sufficient storage space should be provided for:

- medical equipment;
- medical and administrative supplies;
- clean and dirty linen;
- medications;
- general and clinical waste; and
- spare beds.

All storage conditions should comply with any relevant Standards. Shelving materials used in storage areas are to be waterproof, impervious and easy to clean. See Standards Australia, 2003, HB 260:2003 Hospital Acquired Infections - Engineering Down the Risk.

STERILE SUPPLIES
Sterile supplies should be handled with care and stored in a manner that maintains the integrity of packs and prevents contamination from any source (dust, vermin, sunlight, water, condensation etc.).

Ensure temperature and light control to storage areas, and ensure that they are easily cleaned. Store supplies off the floor, with the lowest shelf at least 300 millimetres above floor level so as to avoid mechanical damage during cleaning. Refer to:

- AHIA, AusHFG Part B: HPU 190 Sterile Supply Unit; and
- Standards Australia, 2014, AS/NZS 4187:2014 Reprocessing of Reusable Medical Devices in Health Service Organizations.

03.04 Linen Handling

The following refers to linen handling in inpatient accommodation units and other patient care areas. Clean linen should be stored:

- in a dedicated space/bay with a ABHR dispenser located nearby;
- in a clean dry location that prevents contamination by aerosols, dust, moisture and/or vermin;
- on clean shelves and, if necessary, wrapped in a protective dust cover;
- separately from used/soiled linen; and
- in a manner that allows stock rotation.

The risk of disease transmission from soiled linen is negligible. However used/soiled linen should be handled as little as possible and with minimal agitation to prevent gross contamination of the air and the linen handlers, and should be placed into bags at the point of generation.

Refer to Standards Australia, 2000, AS/NZS 4146:2000 Laundry Practice.

03.05 Waste Management

Waste can generally be categorised as follows:

- clinical waste;
- chemical waste;
- radioactive waste;
- cytotoxic wastes
- recyclables;
- organic waste;
- liquid waste; and
- general waste.

Each requires its own disposal method and, very often, colour-coded receptacles.

Waste requirements should be assessed early in the project. In clinical areas waste holding needs should be carefully identified and appropriate space allocated for waste bins and other containers. Additional space may be required in dirty utility rooms for temporary holding of in-use waste bins (usually mobile) and in disposal rooms for holding full containers (including sharps bins) awaiting collection by environmental services staff. Central waste holding and loading docks are not addressed in this document. Specifications for these may be found in jurisdictional policies and guidelines.

All sharps bins should be positioned out of the reach of children at a height that enables safe disposal by all members of staff. Relevant Australian and New Zealand Standards include:

- Standards Australia, 1998, AS/NZS 3816:1998 Management of Clinical and Related Wastes;
- Standards Australia, 1992, AS/NZS 4031:1992 Reusable Containers for the Collection of Sharp Items used in Human and Animal Medical Applications; and
- Standards Australia, 1994, AS/NZS 4261:1994 Reusable Containers for the Collection of Sharp Items used in Human and Animal Medical Applications.

03.06 References

- ABCB, 2014, Plumbing Code of Australia (PCA), Australian Building Codes Board, Canberra, Australia.
- AHIA, 2010, AusHFG Part E: Building Services and Environmental Design, Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney, NSW.
- AHIA, 0001, AusHFG Part B: HPU 190 Sterile Supply Unit, Australasian Health Facility Guidelines, Australasian Health Infrastructure Alliance (AHIA), Sydney NSW.
- AHIA, 2015, AusHFG Part D, Section 1000 - References and Further Reading, Australasian Health Facility Guidelines, Sydney, Australia.
- AHIA, 2015, AusHFG Part D: Section 830 Building Elements, Australasian Health Facility Guidelines, Sydney, Australia.
- CDC, 2003, Guidelines for Environmental Infection Control in Health-Care Facilities, U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (CDC), Atlanta, GA.

- Heymann, D.L., 2014, Control of Communicable Diseases Manual, 20th Edition, APHA Press, Washington, DC.
- Standards Australia, 2014, AS/NZS 4187:2014 Reprocessing of Reusable Medical Devices in Health Service Organizations, Standards Australia, Sydney, Australia.
- Standards Australia, 2011, AS/NZS 3666 Air-handling and Water Systems of Buildings Set, Standards Australia, Sydney, Australia.
- Standards Australia, 2011, AS/NZS 3666.1:2011 Air-handling and Water Systems of Buildings - Microbial Control - Design, Installation and Commissioning, Standards Australia, Sydney, Australia.
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- Standards Australia, 1994, AS/NZS 4261:1994 Reusable Containers for the Collection of Sharp Items used in Human and Animal Medical Applications, Standards Australia, Sydney, Australia.
- Standards Australia, 2003, HB 260:2003 Hospital Acquired Infections - Engineering Down the Risk, Standards Australia, Sydney, Australia.
- Standards Australia, 2002, AS 1668.2:2002 The Use of Ventilation and Airconditioning in Buildings, Part 2, Standards Australia, Sydney, Australia.

04 SURFACES AND FINISHES

04.01 General

The nature and type of surfaces and finishes used in healthcare facilities are integral to the management of infection prevention and control risks.

This topic is also covered in more detail in AHIA, 2010, AusHFG Part C: Section 710, Space Standards and Dimensions.

All surfaces in patient care areas should be smooth and impervious, and easily cleanable.

Unnecessary horizontal, textured, moisture-retaining surfaces or inaccessible areas where moisture or soil can accumulate should be avoided.

Fixtures and fittings should be designed to allow easy cleaning and to discourage the accumulation of dust. Blinds contained in double glazing, curtains and roller-type blinds made of fabric that can be removed and laundered are preferable to louvered and vertical blinds that are extremely difficult to clean.

The bed curtain acts as a signal to staff to identify the patient space. Bed curtains should:

- be washable or disposable;
- be easy to remove and hang;
- provide enough room for staff to carry out procedures without brushing against the screen when pulled around the bed; and
- be secured when not in use.

Where there is likely to be direct contact with patients, or with blood or body fluids, floors and walls should be surfaced with smooth, impermeable seamless materials such as vinyl. In equipment processing areas work surfaces should be non-porous, smooth and easily cleaned.

The use of wall, door and corner guard protection will reduce damage. This in turn will make cleaning of these surfaces easier.

04.02 Ceilings

All exposed ceilings and ceiling structures in areas occupied by patients or staff, and in food preparation or food storage areas, should be finished to ensure they can be readily cleaned with equipment used routinely in daily housekeeping activities.

In food preparation and other areas where dust fallout would present a potential problem, a finished set plasterboard ceiling should be provided that covers all conduits, piping, duct work and open construction systems.

Ceilings in operating and delivery rooms, isolation rooms, nurseries and sterile processing rooms should be monolithic from wall to wall without fissures, open joints or crevices that may retain or permit the passage of dirt particles.

Light fittings should be recessed, flush fitting and designed to prevent dust build up on the surfaces of the fitting, and to prevent ingress of dust.

Acoustic and/or lay-in ceilings should not be used where particulate matter may interfere with hygienic environmental control.

04.03 Floors

Floor coverings should be easy to clean and repair. Clinical areas where patient care and treatments are undertaken should not be carpeted.

Carpet may be provided in selected areas within clinical zones such as interview rooms and office areas. In areas subject to frequent wet cleaning, floor materials must be able to tolerate use of disinfectants.

In areas used for food preparation or assembly, floors should be non-slip, water resistant and greaseproof to comply with relevant standards.

Floors in sterilizing services areas should be non-slip and have smooth surfaces for cleaning. Refer to the following standards:

- Standards Australia, 2014, AS/NZS 4187:2014 Reprocessing of Reusable Medical Devices in Health Service Organizations; and
- Standards Australia, 2004, AS/NZS 4674:2004 Construction and fit out of Food Premises.

04.04 Gaps

A joint is any point where two planes or surfaces meet (wall and ceiling; wall and floor; or two sections of a bench top). A gap is defined as a space where two surfaces do not meet resulting in a space or opening that can harbour dust, germs, mould or vermin.

Good design and detailing of joints are important to infection prevention and control. Gaps between surfaces should be avoided or properly sealed. In particular gaps in the following areas should be prevented between:

- skirting and floor;
- benches and walls;
- cupboards and floor or wall; and
- fixtures attached to floors and walls.

Floor and wall construction, finishes and trims in dietary and food preparation areas; sterile stock areas; and pharmacies, should be free of gaps/spaces that can harbour rodents and insects. Compliance with relevant public health regulations is required.

Floor and wall penetrations by pipes, ducts and conduits, should be tightly sealed to minimise entry by rodents and insects. Joints of structural elements should also be sealed.

04.05 Skirtings

Skirtings, floor and wall joins should be made integral with the floor, tightly sealed against the wall, and constructed without voids (coved) in:

- all patient care areas;
- kitchens;
- clean and dirty utility rooms;
- sterilizing areas; and
- other areas subject to frequent wet cleaning.

04.06 Walls

Other than special treatments included as feature face work in public or staff recreation areas, wall finishes should be smooth and easily cleaned, and where in the immediate vicinity of plumbing fixtures, water-resistant.

04.07 References

- AHIA, 2010, AusHFG Part C: Section 710, Space Standards and Dimensions, Australasian Health Infrastructure Alliance (AHIA), Sydney, NSW.
- Standards Australia, 2014, AS/NZS 4187:2014 Reprocessing of Reusable Medical Devices in Health Service Organizations, Standards Australia, Sydney, Australia.
- Standards Australia, 2004, AS/NZS 4674:2004 Construction and fit out of Food Premises, Standards Australia, Sydney, Australia.

05 CONSTRUCTION AND RENOVATION

05.01 Risk Management

RISK MANAGEMENT STRATEGY
A formal approach to risk management should be part of all building construction and renovation activities. A process for assessing risk and adopting appropriate precautions is provided below. A more detailed review of risk is beyond the scope of this document, but reference to the following documents will provide the framework for a relevant risk management strategy:

- Department of Health, Victoria, 2014, Infection Control Principles for the Management of Construction Renovation Repairs and Maintenance within Health Care Facilities;
- NDSC, 2002, National Guidelines for the Prevention of Nosocomial Invasive Aspergillosis during Construction/Renovation Activities;
- Standards Australia, 2004, AS/NZS 4360:2004 Risk Management (SAI Global);
- Standards Australia, 2001, HB 228: Guidelines for Managing Risk in Healthcare; and
- Standards Australia, 2003, HB 260:2003 Hospital Acquired Infections - Engineering Down the Risk.

RISK IDENTIFICATION
Building, renovation and maintenance activities within a healthcare facility impose risks. Certain construction activities can increase the risk of invasive Aspergillosis among immunosuppressed patients. Mortality rates from this infection are high.

In occupied facilities, a range of systems and precautions will need to be put in place to support construction and renovation activities. The broad tasks include:

- development of organisational governance arrangements and policies;
- identification of the population at risk; and
- an understanding of the preventative measures needed to control risk.

The risk identification strategy should address as a minimum:

- the extent of construction work;
- the identification of the patient population at risk;
- the location of the patient population in relation to the site and construction;
- ventilation system types and potential impact;
- traffic and supply routes;
- determination of air monitoring requirements, methodology and frequency;
- air quality samples taken to establish a baseline; and
- the identification of possible contaminants and their locations.

Possible contaminants and/or locations include:

- ceiling dust;
- service shafts especially in the presence of damp;
- sprayed-on fire retardants; and
- bird droppings.

Infection prevention and control measures to be considered during construction and renovation include:

- at the time of site induction for building workers, infection prevention and control should be presented as a major component of the OHS induction. This induction process should be documented and signed off by each participating worker;

- monitoring worker compliance with procedures. The results of this monitoring should be communicated to the workers routinely through the builder. A systematic approach should be in place to ensure the management of major breaches;
- installation of barriers to contain the impact of construction;
- inspections by the nominated representatives during the construction of the barriers. These inspections should be monitored and reported; and
- documenting all inspections, including a non-conformance system for defaults, complete with a corrective and preventative action loop.

05.02 Hand-over

Prior to handover it is the responsibility of the commissioning team to ensure the area complies with standards for occupation. Health services should ensure:

- all surfaces including walls, ceilings, windows, ventilation systems, service cavities and ceiling spaces have been thoroughly cleaned;
- all surfaces and joints are free from gaps. In clinical areas, surfaces should be smooth and impervious;
- the placement of hand basins, storage facilities complies with layout plans;
- isolation rooms are operating as designed (e.g. supply air, air changes, exhaust, seals etc);
- air sampling and particle counts have been conducted. A program of regular air sampling should be implemented in high-risk areas, allowing time for culturing, results and repeat cleaning and testing prior to occupation, for example in operating theatre/s. Dot testing may take a period of a week to complete and receive microbiology air testing results in order to support commencement of theatre procedures; and
- recertification of HEPA filters and laminar/clean flow systems where installed.

MICROBIAL TESTING

Air and water sampling should be part of the risk management program and be implemented during commissioning. Cumulative data should be used to establish indoor and outdoor background levels of filamentous fungi for a particular site. This will enable establishment of risk profiles for particular locations in and around the healthcare facility.

It is important to consult with a microbiologist experienced in environmental sampling to identify what outcomes are required of the sampling. Equally important is to have an approximate idea of the expected number of fungi that will be obtained: this will determine the appropriate sampling system. For further details, refer to:

- Department of Health, Victoria, 2014, Infection Control Principles for the Management of Construction Renovation Repairs and Maintenance within Health Care Facilities; and
- Queensland Health, 2013, Guidelines for Managing Microbial Water Quality in Health Facilities.

05.03 Verification

All infection prevention and control measures described in this section are required to be verified by inspection.

A multidisciplinary team should be established comprising, but not limited to:

- infection control experts (medical and nursing);
- hospital engineers;
- OHS staff;
- environmental health staff;
- client representatives; and
- project staff (architect, facility planner, consulting engineers, project manager etc.).

These staff should be involved and consulted throughout the stages of planning, design, construction and commissioning.

05.04 Construction Risk Assessment and Action Plan

The construction risk assessment and action plan comprises four key steps including:

- identification of the construction activity type;
- selecting the appropriate infection prevention and control group;
- determining the construction classification class; and
- implementation of the infection prevention and control construction guidelines.

STEP 1 - IDENTIFY THE CONSTRUCTION ACTIVITY TYPE
The identification of the construction activity type (Table 1) is defined by:

- the amount of dust generated; and
- the duration of the involvement of the heating ventilation and air conditioning systems (HVAC).

Table 1: Definitions of the Construction Activity Types

Type A Inspections and general upkeep activities	Type B Small scale, short duration activities, which create minimal dust	Type C Any work that generates a moderate to high level of dust	Type D Major demolition and construction projects
Includes but not limited to : removal of ceiling tiles for visual inspection (limited to 1 tile per 5 m2); painting (but not sanding); installation of wall covering; electrical trim work; minor plumbing; any activities that do not generate dust or require cutting into walls or access to ceiling other than for visual inspection.	Includes, but is not limited to, installation of telephone and computer cabling, access to chase spaces, cutting into walls or ceiling where dust migration can be controlled.	Includes, but is not limited to, demolition or removal of built-in building components or assemblies, sanding of wall for painting or wall covering, removal of floor covering/wallpaper, ceiling tiles and casework, new wall construction, minor ductwork or electrical work above ceiling, major cabling activities.	Includes, but is not limited to heavy demolition, removal of a complete ceiling system, and new construction.

STEP 2 - SELECT THE INFECTION CONTROL RISK GROUPS
The infection control risk groups as defined in the table below are indicative only. Where possible, work should be conducted after patient care hours where services are not provided on a 24 hour, seven day basis, such as outpatient clinics and day therapy services.

Table 2: Infection Control Risk Groups

Group 1 - Low	Group 2 - Medium	Group 3 - Medium/High	Group 4 - Highest
Office areas	Patient care and other areas not listed under Groups 3 or 4	Emergency department	Oncology units

Non-patient/low risk areas not listed elsewhere	Laundry	Medical Imaging – general	Radiation therapy
	Cafeteria	Recovery rooms	Oncology clinical areas
	Dietary	Delivery rooms	Chemotherapy
	Materials management	High dependency unit	Transplant
	Allied health	Newborn nurseries	Pharmacy admixture/ clean rooms
	Admissions/discharge	Paediatrics (except paediatric ICU)	Operating rooms
	MRI	Microbiology labs	Sterile supply units
	Nuclear medicine	Virology labs	Cardiac catheterisation
	Echocardiography	Long stay-sub-acute units	Angiography rooms
	Laboratories not specified under Group 3	Pharmacy	Outpatient invasive procedure rooms
	Public corridors used by patients and to transport linen & supplies	Endoscopy	Anaesthetic and pump rooms
		Bronchoscopy	All intensive care units – adult, paediatric, neonatal
		Dialysis	

STEP 3 - DETERMINE THE CONSTRUCTION CLASSIFICATION CLASS
Using the construction activity type and the infection control risk group selected, apply the matrix below to determine the construction classification class.

The construction classification class matrix (Table 3) determines the procedures to be followed during construction and renovation projects.

Table 3: The Construction Classification Matrix

Construction Activity Risk Level	Type A	Type B	Type C	Type D
Group 1	Class I	Class II	Class II	Class III/IV
Group 2	Class I	Class II	Class III	Class IV

Group 3	Class I	Class III	Class III/IV	Class IV
Group 4	Class III	Class III/IV	Class III/IV	Class IV

STEP 4 - IMPLEMENT THE INFECTION CONTROL CONSTRUCTION GUIDELINES
Infection control construction guidelines (Table 4) outline procedures to control the release of airborne contaminants resulting from construction, demolition or renovation activities.

Implement the appropriate infection control construction guideline based on the construction activity type as identified using the construction classification matrix (Table 3).

An infection control checklist can be found in the Infection Control Checklist.

Table 4: The Infection Control Construction Guidelines

Class	Guideline
Class I	Execute work by methods to minimise raising dust from construction operations. Replace any ceiling tile displaced for visual inspection as soon as possible.
Class II	Provide active means to prevent air-borne dust from dispersing into atmosphere. Seal unused doors with duct tape. Contain construction waste before transport in tightly covered containers. Wet mop and/or vacuum with HEPA filtered vacuum. Place dust-mat at entrance and exit of work area and replace or clean when no longer effective. Isolate HVAC system in areas where work is being performed. Wipe casework and horizontal surfaces at completion of project.
Class III	Isolate HVAC system in area where work is being done to prevent contamination of the duct system. Complete all construction barriers before construction begins. Maintain negative air pressure within work site utilising HEPA filtered ventilation units or other methods of maintaining negative pressure. In each jurisdiction, the relevant public safety officers will monitor air pressure. Do not remove barriers from work area until complete project is thoroughly cleaned. Wet mop or vacuum twice per eight hour period of construction activity or as required in order to minimise tracking. Remove barrier materials carefully to minimise spreading of dirt and debris associated with construction. Barrier material should be wet wiped, HEPA vacuumed or water misted prior to removal. Contain construction waste before transport in tightly covered containers. Place dust-mat at entrance and exit of work area and replace or clean when no longer effective. Wipe casework and horizontal surfaces at completion of project.
Class IV	Isolate HVAC system in area where work is being done to prevent contamination of duct system.

	Complete all construction barriers before construction begins. Maintain negative air pressure within work site utilising HEPA filtered ventilation units or other methods of maintaining negative pressure. In each jurisdiction, the relevant public safety officers will monitor air pressure. Seal holes, pipes, conduits, and punctures to prevent dust migration. Construct Anteroom and require all personnel to pass through the room. Wet mop or HEPA vacuum the Anteroom daily. During demolition, dust producing work, or work in the ceiling, disposable shoes and coveralls are to be worn and removed in the Anteroom when leaving work area. Do not remove barriers from work area until completed project is thoroughly cleaned. Remove barrier materials carefully to minimise spreading of dirt and debris associated with construction. Barrier material should be wet wiped, HEPA vacuumed or water misted prior to removal. Contain construction waste before transport in tightly covered containers. Place dust-mat at entrance and exit of work area and replace or clean when no longer effective. Keep work brooms clean and remove debris daily Wet mop hard surface areas at completion of project, HEPA vacuum carpeted surfaces at completion of project. Wipe casework and horizontal surfaces at completion of project.

05.05 References

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06 GLOSSARY OF TERMS

06.01 Definitions

For the benefit of the project team, the following commonly used terms are described below:

- healthcare associated infection (HAI): any infections that occur during or after a health care encounter that was not present, or incubating, on admission or related to a previous heath care encounter (Krieger et al. 2002);
- MRSA: Methicillin resistant Staphylococcus aureus;
- cohorting: accommodation of patients with the same infectious condition together in the same area; and
- immunosuppressed / compromised: suppression of the normal immune system response potentially resulting in a person becoming more susceptible to infection.

See also Krieger, J.K. et al., 2002, The Seattle-King County healthy homes project: implementation of a comprehensive approach to improving indoor environmental quality for low-income children with asthma.

06.02 Immunocompromised Patients

Highly immunocompromised patients, such as those receiving allogeneic bone marrow transplants have the greatest risk of infection from airborne or waterborne microorganisms such as Aspergillus. Specific engineering parameters may be required. Refer to:

- CDC, 2003, Guidelines for Environmental Infection Control in Health-Care Facilities; and
- Standards Australia, 2003, HB 260:2003 Hospital Acquired Infections - Engineering Down the Risk.

06.03 Standard and Additional Precautions

The use of standard precautions is the primary strategy for minimising the transmission of healthcare-associated infections. Standard precautions include:

- personal hygiene;
- effective hand hygiene before and after patient contact;
- the use of PPE and barriers that may include gloves, gowns, plastic aprons, masks, eye shields or goggles, and waterproof dressings if required; appropriate handling and disposal of sharps and other contaminated or infectious waste; and
- aseptic technique.

Additional standard precautions are designed for patients known or suspected to be infected with pathogens for which transmission based precautions beyond standard precautions are needed to interrupt transmission in healthcare settings. Transmission based precautions are also designed to protect immuno-compromised patients from contracting HAIs while in protective isolation.

06.04 Personal Protective Equipment (PPE)

In the context of infection control PPE refers to a variety of infection control barriers and respirators used alone, or in combination, to protect mucous membranes, skin, and clothing from contact with recognised and unrecognised sources of infectious agents in healthcare settings. The type of personal protective equipment used will vary based on the level of precautions required.

PPE includes:

- gowns;

- plastic aprons;
- masks and respirators;
- gloves;
- eye protection;
- head coverings; and
- over-shoes.

PPE bays should be provided outside all isolation rooms - including Class S. A PPE bay may be shared between two or more rooms.

For more details see Standard Components: Room Data Sheets and Room Layout Sheets.

06.05 References

- CDC, 2003, Guidelines for Environmental Infection Control in Health-Care Facilities, U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (CDC), Atlanta, GA.
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07.08 Legionella and Legionnaires' Disease

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