WHBN 04-01

Welsh Health Building Note

Supplement 1
Isolation facilities for infectious patients in acute settings

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Overview

This Welsh Health Building Note (WHBN) sets out practical guidance on how to provide safe, effective isolation facilities for infectious patients (source isolation) that are simple to use and meet the needs of most patients on acute general wards.

This guidance describes:

- how a single-bed room with en-suite sanitary facilities can be used to provide effective isolation for patients with non-airborne diseases, (See paragraph 2.2 'Segregation room');
- how a ventilated single-bed room with en-suite facilities can provide an isolation room for patients who have an infection that can be spread by the airborne route, (See paragraph 2.11 'Negative pressure room');
- how a single bed room with a positive pressure ventilated lobby (PPVL) and en-suite sanitary facilities with extract ventilation can provide both source and protective isolation (See paragraph 2.22 'Positive pressure ventilated lobby (PPVL) room').

It can be used for both new-build schemes and the upgrading of existing accommodation.

Room layouts are included as illustrative examples; other room configurations are possible.

This WHBN should be read in conjunction with:

- WHBN 00-09 – 'Infection control in the built environment'. The document provides information about how good design can prevent cross-infection in healthcare premises generally;
- WHBN 04-01 – 'Adult in-patient accommodation', which covers the planning and design of in-patient facilities for adults and includes space standards for bed areas (including isolation rooms and lobbies).
- WHBN 00-03 – 'Clinical and clinical support spaces', which provides detailed design information and layouts for single-bed rooms.

Policy on the location and number of isolation rooms

For policy advice on the location and number of isolation rooms that should be provided, NHS Trusts / Health Boards are advised to contact the Welsh Government's Department for Health and Social Services.

Acknowledgements

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Contents

Chapter 1 Introduction

1.1 The key to effective isolation on acute general wards is the provision of single-bed rooms with en-suite sanitary facilities. Single-bed rooms reduce the risk of cross-infection for non-airborne diseases and help to lower the incidence of healthcare associated infections. Most patients requiring isolation on acute general wards can be isolated in single-bed rooms with en-suite facilities. All single-bed rooms in new-build hospitals must have en-suite facilities so that they can be used to isolate patients, among other reasons.

1.2 The infection and prevention control team should be closely involved with all aspects of planning for, and determining the provision of, isolation facilities. When undertaking a project, a multi-disciplinary approach should involve the:

- infection control team and clinical team;
- architect and designer;
- building contractor and mechanical/electrical maintenance service providers;
- in-house estates team.

1.3 It is recommended that all registered providers put in place systems to manage and monitor the prevention and control of infection. These systems use risk assessments and consider how susceptible patients are and any risks that their environment and other users may pose to them. The 'Health and Social Care Act 2008 Code of Practice on the prevention and control of infections and related guidance' published by the Department of Health in 2010, whilst not applicable in Wales, is a useful reference document for users in Wales.

1.4 There are four main reasons for caring for patients in single rooms:

- patient susceptibility to infection from other sources;
- where a patient presents an infection risk to others;
- non-medical, for example, patient preference;
- clinical but not infection-related.

In terms of infection control, only patients in the first two categories require isolation. Patients in the latter two categories can be cared for in standard single en-suite rooms.

Note

The provision of isolation rooms that are switchable from positive to negative air pressure is not permitted.

1.5 The guidance on positive pressure ventilated lobbies (PPVL) and negative pressure isolation suites in this document is based on a model that was validated by the Building Services Research and Information Association (BSRIA) and the University of Leeds. The complete validation process and results obtained will be available from BSRIA.

Exclusions

1.6 This WHBN does not describe the specialist facilities required in the following:

- high security infectious disease units;
- isolation wards for cohorting groups of infectious patients;
- protective isolation for severely immuno-compromised patients;
- critical care areas; and
- special care baby units.

These specialist facilities will require bespoke solutions.

1.6 This WHBN focuses on single occupancy isolation rooms only.

Chapter 2 Options for provision

2.1 This chapter sets out options for addressing two main types of isolation facilities:

1. Type A: Isolation facilities for patients with non-airborne diseases.
2. Type B: Isolation facilities for patients who have an infection that can be spread by the airborne route and therefore prevent the spread of pathogens that are transmitted by the airborne route.

Isolation facility Type A: Option for patients with non-airborne diseases

Segregation room

2.2 A single-bed room with en-suite sanitary facilities is a simple and cost-effective way to provide isolation and will meet the needs of most patients on general wards. An example layout for a new-build single-bed room with en-suite facilities is shown in Appendix 1 Figure 1.

2.3 Detailed design guidance and space standards are given in WHBN 04-01 – 'Adult inpatient accommodation' and the section on 'Single-bed room' in WHBN 00-03 – 'Clinical and clinical support spaces'. Key considerations are the inclusion of:

- en-suite sanitary facilities;
- optional lobby – if a lobby is not provided, space is needed for personal protective equipment and its disposal;
- clinical wash-hand basin in the room and in the lobby, if provided;
- good patient observation facilities;
- design features that enhance patient comfort (for example, ability to see out of the room).

2.4 Openable exterior windows and suspended tiled ceilings are permitted as these rooms are used to provide effective isolation for patients with non-airborne diseases.

2.5 See also WHBN 00-09 – 'Infection control in the built environment'.

2.6 Some patients with infections need to stay in isolation in hospital for long periods. The number of visitors they receive and the length of time they can spend with them may be restricted. This means that patients who are already vulnerable, but not necessarily physically severely incapacitated, will be confined to the room sometime for several weeks and can experience long periods of boredom.

2.7 Accommodation for these patients should be stimulating and as comfortable as possible. Designers should try to achieve a balance between the need for a clean environment and the comfort of patients. A number of publications describe in detail evidence that supports the concept that a therapeutic environment has a positive effect on a patient's general feeling of well-being; reduces the length of stay for many patients; reduces depression, confusion and aggressive episodes; and significantly increases a patient's level of satisfaction with the overall quality of their care (see WHBN 04-01 – 'Adult in-patient accommodation').

2.8 If patients are to stay in an isolation room, it is important that they are able to see staff from their beds. This reduces the psychological problems of isolation. Staff must also be able to see the patient in case of emergency. Observation windows should have integral privacy blinds or glass that can be obscured electronically, which can be controlled by both staff and patients. The sense of containment can also be reduced by providing outside views using windows with low sills.

Isolation facility Type B: Options for preventing the spread of pathogens that are transmitted by the airborne route

2.9 There are two main ways of providing effective isolation facilities designed to prevent the spread of pathogens that are transmitted by the airbourne route:

- **Negative pressure room option**: it describes how a ventilated single-bed room with en-suite

sanitary facilities and negative pressure ventilation can provide an isolation room for patients who have an infection that can be spread by the airborne route (see paragraph 2.11);

- **Positive pressure ventilated lobby room option**: it describes how a single bed room with a positive pressure ventilated lobby (PPVL) and en-suite sanitary facilities with extract ventilation can provide both source and protective isolation (see paragraph 2.22).

Note

The isolation room must be physically constructed so that undesirable air flow in or out is restricted. This is described as the "permeability" of the room which, in simple terms, is a measure of how leaky it is. If air can leak between an isolation room and an adjacent area in either direction, then this presents a route for the transmission of an airborne infection (see also Appendix 2).

2.10 A ventilated single-bed room with en-suite facilities (negative pressure) can provide an isolation room for patients who have an infection that can be spread by the airborne route. This includes chickenpox, measles and some cases of pulmonary tuberculosis. It is for local clinical risk assessment to decide which patients will need to be nursed in these facilities.

Negative pressure room

2.11 This room is at negative pressure to the corridor and other adjacent areas (except for its en-suite).

2.12 The robust direction of air flow is more important than the numerical value of the pressure differential (see paragraph 2.16).

2.13 The inflow of air into the room (negative pressure) prevents the escape of contaminated air to surrounding areas; the ventilation in the room dilutes airborne pathogens.

Room criteria

2.14 The following criteria are considered essential:

- a sealed, solid, integrated ceiling;
- unopenable and well-sealed windows to the exterior;
- service penetrations should be minimised to support the principle of a well-sealed room;
- one or more pressure stabilisers must be installed above the door between the corridor and the patient's room.
- provision of a transfer grille to en-suite facility.
- provision of a clinical hand-wash basin, with non-touch, fixed temperature mixer tap, adjacent to the exit door;
- provision of wall-mounted soap dispensers, disinfectant hand rub dispensers, and disposable towel holders;
- provision of a bin for disposing of paper towels and other non clinical items;
- provision of a suitable extract to the en-suite bathroom;
- provision of an en-suite WC to be non-touch flush and hand-wash basin to have single tap with flow and temperature control;
- provision of an observation window in corridor wall with integral privacy blinds that can be controlled by both patients and staff;
- doors are a critical part of the design. The door from the corridor to the patient's room must be well hung and open into the patient's room. It must be fitted with a door closer to ensure that the pressure regime is maintained. It must be fitted with a transfer grille in its lower half in order to promote an inflow of air to the en-suite.

2.15 For space requirements, see WHBN 04-01 – 'Adult in-patient accommodation'.

Basic design parameters

2.16 The patient's room must have around 10 air changes per hour and must be compatible with patient comfort. Air flow must be fully mixed to ensure good dilution and removal of airborne pathogens from the room space. The pressure differential to surrounding areas must indicate a definite inward flow of air. A minimum differential pressure of 5 pascals should be sufficient to achieve and maintain this condition. To prevent excessive air change rates in the en-suite, consideration should be given to providing an additional extract grille in the patient room. Supply air for the negative pressure room will be derived from the normal department's ventilation system via the wall mounted pressure stabiliser.

2.17 The en-suite facility should be sized according to the recommendations given in WHBN 04-01 – 'Adult in-patient accommodation'.

2.18 Appropriate standby provision must be provided, for example, connection to the essential power supply, to enable continuity of supply should a mains power failure occur (see WHBN 06-01 – 'Electrical services supply and distribution').

Monitoring and record keeping

2.19 The pressure differential between the patient room and corridor must be monitored continuously, for example, by using a differential pressure sensor. Failure to maintain a negative pressure must activate an alarm at a designated nurse station as well as in the estates department. There must be a delay on the alarm to allow doors to be opened, resulting in a temporary zero pressure differential, to allow the transfer of a bed into and out of the room. This should be set at a maximum of 10 minutes. Note that when the bed is moved into or out of the room, the patient is NOT in isolation.

2.20 A magnehelic pressure gauge must show the pressure differential between the patient room and the corridor. It must be mounted at eye level on the corridor wall adjacent to the entry door. The gauge must be clearly marked to identify the isolation room to which it refers and the safe operating pressure. The pressure must be recorded at the start and end of each shift (see paragraph 2.41)

Maintenance and cleaning

2.21 Guidance on the maintenance and cleaning of materials and finishes is contained in WHBN 00-09 – 'Infection control in the built environment'. Planning teams should also refer to the National standards for cleaning in NHS Wales.

Positive pressure ventilated lobby (PPVL) room

2.22 This is a single-bed room with a PPVL and en-suite sanitary facilities with extract ventilation (see Appendix 1 Figure 2 for an example layout).

2.23 The ventilated lobby ensures that:

- air entering the bedroom is the clean, filtered, ventilation supply from the lobby. Air from the corridor is blocked by the ventilation supply in the lobby. Consequently the patient in the bedroom is protected from air from the corridor;
- potentially contaminated air from the bedroom is prevented from escaping into the corridor by the ventilated lobby, so the patient will not present a risk of infection to others. Because the lobby simultaneously prevents unfiltered air entering the room and potentially contaminated air escaping from it, the room can be used by both infectious patients and those at risk of infection from others.

2.24 The use of personal protective equipment (PPE) will be determined by local infection prevention and control policy. Facilities for putting on and removing PPE, and washing hands, are provided in the lobby. The risk of contaminants being dislodged from used PPE by the ventilation system and blown out into the corridor is considered negligible. However, a hand-wash basin and disposal bin are also provided in the bedroom close to the exit door so that PPE can be removed in the bedroom should local policy require.

2.25 The benefits of the isolation suite are that it is simple in concept, requires no specialist knowledge by the nursing staff to operate it, and can also be used for general nursing. In addition, if the ventilation system fails, the layout of the suite still ensures a degree of protection.

Room criteria

2.26 The following criteria are considered essential:

- one or more pressure stabilisers must be installed above the door between the lobby and the patient's room.
- a suitable extract system to the en-suite facility must be provided (See paragraph 2.42).
- a transfer grille in the lower section of the en-suite door must be installed (See Table 1).
- to support the room being well-sealed, the detail of the construction joints between elements of the building and service penetrations will be critical to achieving the air leakage standard demanded. The joints must be carefully sealed as construction progresses and service penetrations minimised, as they will be inaccessible once the inner finish is applied (see Appendix 2 on air leakage).
- the door between the corridor and the lobby must open into the lobby and be fitted with a door closer. The door between the lobby and patient's room must open back into the lobby and be fitted with a door closer. This is to ensure that the closure of both doors is aided by the lobby pressure, thus maintaining the air flow direction and pressure regime of the suite.

In the lobby:

- a clinical hand-wash basin with non-touch, fixed temperature mixer tap;
- wall-mounted soap dispensers, disinfectant hand rub dispensers, and disposable towel holders;
- wall-mounted plastic apron and glove dispensers and storage for other clean PPE items;

- a clinical waste bin for disposal of used PPE;
- a bin for disposing of paper towels and other non clinical items;
- storage for room cleaning equipment;
- a suitable air supply.

In the bedroom:

- a clinical hand-wash basin, with non-touch, fixed temperature mixer tap, adjacent to the exit door;
- wall-mounted soap dispensers, disinfectant hand rub dispensers, and disposable towel holders;
- a clinical waste bin for disposal of used PPE;
- If bed entry to the suite is through the lobby, one-and-a-half-leaf door sets will need to be fitted. Space constraints may make it necessary to hang the half-leaf from parliament hinges so that it can be opened back against the corridor or the wall of the patient's room (see Appendix 1 Figure 2 and Figure 5). Once the bed has passed through the lobby, the half-leaf must be latched shut. Entry for personnel will be via the single door leaf. An oversized door must not be used in place of the one-and-a-half-leaf door set.

2.27 Heating and cooling of the isolation suite will be provided via the ventilation system.

2.28 The provision of a two-way intercommunication system between the patient's bedroom and the nurses' base must be considered.

2.29 For space requirements see WHBN 04-01 – 'Adult in-patient accommodation'.

Basic design parameters

2.30 The patient's room must have 10 air changes per hour delivered through the mechanical ventilation system. The entry lobby shall have a positive pressure of between 8 and 12 pascals with respect to the corridor. Similarly to the patient's room, the en-suite facility must have at least 10 air changes per hour and be at a negative pressure with respect to the patient's room. Table 1 gives nominal design values calculated for rooms of the size stated.

2.31 Modifying or failing to provide one element of the system will jeopardise the performance of the system as a whole.

2.32 An extract terminal must be fitted at high level in the en-suite facility.

2.33 A transfer grille must be fitted at low level in the door between the patient's room and the en-suite facility.

2.34 A pressure stabiliser of the balanced blade type, set to operate at 10 pascals, must be fitted above the door between the lobby and the patient's room. The stabiliser must be visible so that its correct operation can be seen. It must be of a type that will operate silently, and be correctly sized and positioned so that it does not cause a draught that would be uncomfortable for patients.

Note

It is critical to the correct function of this design concept that the stabiliser be fitted as described and the transfer grille in the en-suite door also be fitted as described. This will set up a cyclonic circulation in the patient's room and provide the desired dilution protection levels.

2.35 The supply air handling unit (AHU) must comply in all respects with the minimum standards set out in WHTM 03-01 'Specialised ventilation for healthcare premises'. Heating and cooling must be provided, but not humidification. The supply AHU and the extract fan must draw its power from the essential electrical system.

2.36 A direct reading gauge showing the pressure in the lobby with respect to the corridor must be mounted at eye level on the corridor wall adjacent to the lobby entry door. The gauge and lobby entry door must be clearly marked to identify the isolation room to which they refer.

2.37 Door undercuts are not permitted.

Supply ventilation for PPVL rooms

2.38 The AHU and distribution ductwork must be clearly marked to identify the isolation suite that they serve. Service, maintenance, cleaning and filter change of the system will be subject to a permit to work.

2.39 A G3 pre-filter and a final filter to at least F7 standard must be fitted in the AHU.

2.40 The supply terminal in the lobby must be supplied with a HEPA filter (H14) that clamps into position.

Monitoring and record keeping

2.41 A record of pressure differentials, observed and recorded at the start and end of each nursing shift, must be made. Ward staff must be made aware of what to do if the readings are out of specification.

Room	Parameter	Nominal design value
Lobby	Room volume: Bed access lobby (5 m^2 x 2.7 m) Personnel access lobby (4 m^2 x 2.7 m)	 13.5 m^3 10.8 m^3
	Pressure differential to corridor	Nominally 10 pascals
	Supply air flow (see Note 3)	Bed access lobby – 238 L/s Personnel access lobby – 208 L/s
	Air change rate	Bed access lobby – 63 per hour Personnel access lobby – 69 per hour
Isolation room	Room volume (19 m^2 x 3 m)	57 m^3
	Pressure differential to corridor	Nominally zero
	Room air flow	158 L/s
	Air change rate	10 per hour
En-suite	Room volume (6 m^2 x 2.7 m)	16.2 m^3
	Pressure differential to isolation room	Negative
	Extract air flow	158 L/s (if extract is fitted in the isolation room this reduces to approximately 100 L/s in the en-suite with approximately 58 L/s extract in the isolation room)
	Air change rate	At least 10 per hour

Notes

1. In this example, the design parameters are based on WHBN 04-01 – 'Adult in-patient accommodation'. The en-suite is sized to comply with BS 8300 accessibility requirements.
2. The air flow rates quoted do not include any allowance for construction leakage. Air tightness specifications are given in Approved Document L of the Building Regulations (2010). See also the Air Tightness Testing & Measurement Association's (ATTMA) 'Technical Standard L2: Measuring air permeability of building envelopes (non-dwellings)' (see Appendix 2).
3. These are typical values based on standard room sizes. The actual volume of air required will be the sum of the air required to provide 10 air changes per hour in the patient's room + the air leakage through the door between the lobby and corridor at a differential pressure of 10 pascals. (See Appendix 4 in WHTM 03-01 Part A for leakage rate for single and double doors at 10 pascals.)

Table 1: EPPVL isolation suite – ventilation parameters

Extract ventilation – negative pressure and PPVL rooms

2.42 The extract fan unit should preferably be located outside the building so that all ductwork within the building is under negative pressure. Access and cleaning hatches must only be fitted where absolutely necessary. If fitted, they must be of the sealed type and marked with a biohazard symbol. If the fan has to be located inside the building, it must be as close as practicable to the outside. The extract fan motor should be mounted out of the air stream and must be capable of being changed without withdrawing the impeller or opening up the ductwork. The extract fan must draw its power from the essential electrical system.

2.43 Extract filters will not be required provided that the fan can discharge in a safe location at least 3000 mm above the building height. In exceptional circumstances safe change filters could be installed, in which case they should be enclosed in a fire rated enclosure. Extract filters, where fitted, must be of HEPA H14 grade. Even if filtered, extract air must not be recirculated.

2.44 Extract ductwork, the fan and discharge stack must be clearly marked to identify the isolation suite that they serve. Service, maintenance,

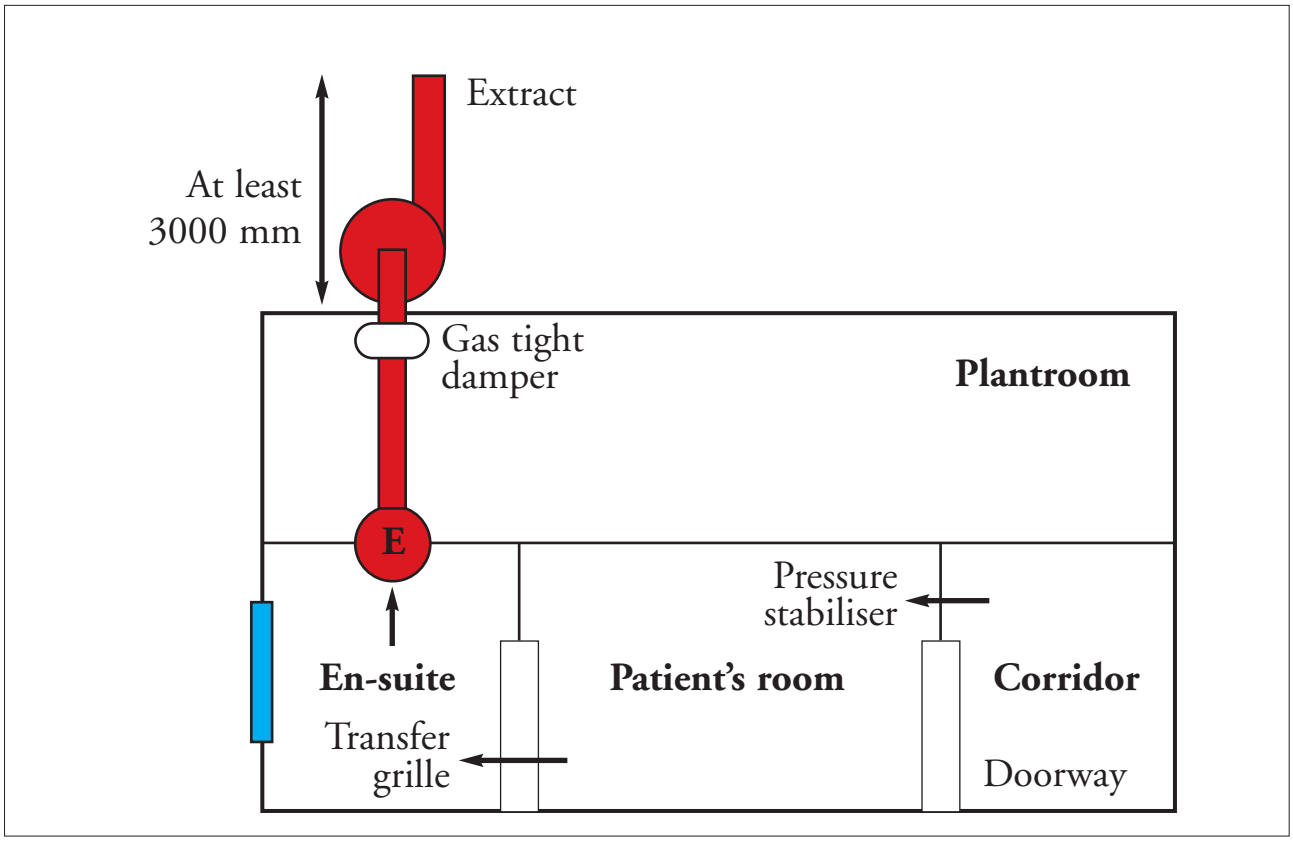

Figure 1: Extract ventilation – Negative pressure rooms

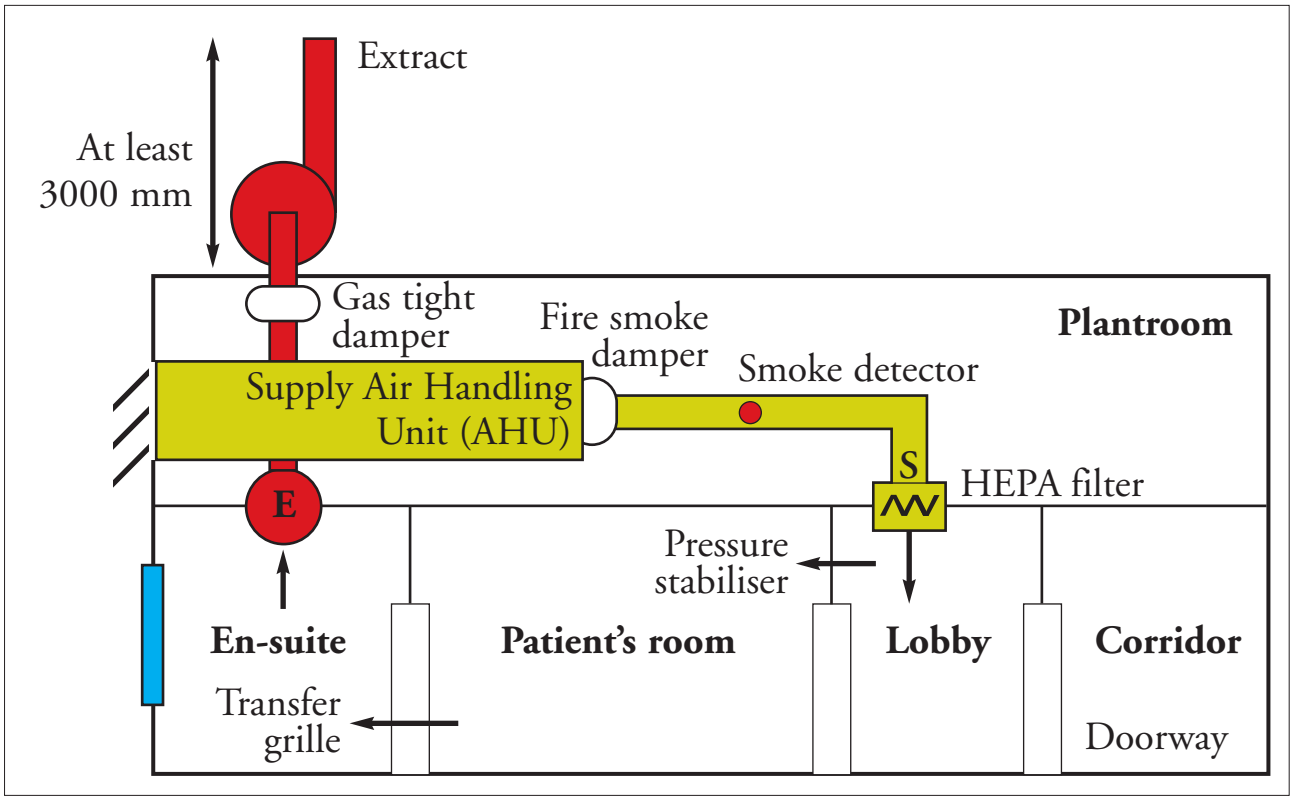

Figure 2: Supply and Extract ventilation – PPVL rooms

cleaning and filter change of the system will be subject to a permit to work.

2.45 The extract duct must be fitted with a gas-tight damper so that the system can be sealed to allow the isolation suite to be disinfected. The damper must be fitted at the inlet of the extract fan. This will also permit isolation of the extract fan for service and maintenance.

2.46 Each PPVL isolation suite must have its own dedicated supply and extract system. If two or more suites share a ventilation system, there will be an inevitable increase in the complexity of the system and a corresponding reduction in reliability and serviceability. Routine maintenance or breakdown of the ventilation system will result in failure of all suites that it serves; therefore, each such isolation suite must have its own dedicated AHU meeting the requirements of WHTM 03-01.

2.47 The object must be to keep the ventilation systems as simple as possible. Standby fans or motors are not required for either supply or extract. This is because the system as designed is robust enough to withstand fan failure without significantly compromising the level of protection. A differential pressure switch must be fitted to each system that will alarm on fan failure at a designated nurse station and the estates department.

2.48 Ductwork must be kept as direct and simple as possible. In order to facilitate duct cleaning, volume control devices and other obstructions in the distribution ducts must be avoided. Supply and extract flow rates must, where possible, be set by terminal and duct size design. In the unlikely event that volume control devices are required, iris dampers are the preferred type.

Documentation

2.49 A logbook retained by the estates department will be required for each isolation room/suite. It should contain the following information:

- a schematic layout of the isolation room/suite and ventilation system serving it;
- information on the ventilation design parameters;
- a record of the actual ventilation performance at initial validation;
- records of the annual validations;
- records of any routine service and maintenance activities;
- records of any repairs or modifications;
- records of the lobby pressure, taken by ward staff;
- a method statement for disinfecting the system.

Other considerations

2.50 As far as practicable, access to domestic hot and cold water services and their associated thermostatic mixing valves must be via access panels in the lobby or corridor. Every effort must be made to avoid service and maintenance staff having to enter or pass through the bedroom when carrying out routine service and maintenance tasks.

Service and maintenance

2.51 Gas-tight dampers must be used to seal the system, should the suite and/or its ventilation system require disinfection. A method statement must be prepared detailing the procedure. For further guidance on disinfection refer to 'Biological agents: Managing the risks in the laboratory and healthcare premises' (Health and Safety Executive: Advisory Committee on Dangerous Pathogens). All works of service and maintenance must be subject to a permit to work.

Chapter 3 Converting existing facilities

Note

Air permeability tests should be carried out during and following all refurbishment work.

3.1 En-suite single-bed rooms and isolation suites can be provided by converting bays and adapting existing single-bed room accommodation. However, the layout of existing facilities may impose constraints on the design and planning teams will sometimes have to resolve the conflict between what is desirable and what is achievable.

3.2 When converting existing accommodation into isolation facilities, the easiest and least expensive option is to adapt existing en-suite single-bed rooms. However, where existing single-bed rooms do not have en-suite facilities, the accommodation will need to be reconfigured (see below).

Converting an en-suite single-bed room to a segregation or negative pressure room

3.3 A typical layout for converting an existing en-suite single-bed room is shown in Appendix 1 Figure 3.

3.4 The additional requirements for an upgrade to an isolation suite are:

- a clinical hand-wash basin, with non-touch, fixed temperature mixer tap, adjacent to the exit door;
- provide suitable extract fan/system (for negative pressure rooms refer to paragraphs 2.42-2.48);
- a transfer grille in the en-suite door;
- en-suite WC to be non-touch flush and wash basin to have single tap with flow and temperature control;
- an observation window in the corridor wall with integral privacy blinds that can be controlled by both patients and staff;
- all windows, including observation windows, must be low enough to provide a view for patients lying in bed.

Converting a single-bed room without en-suite facilities

3.5 In an existing building, it may be possible to modify three adjacent single-bed rooms into two single-bed rooms each with en-suite facilities – see Appendix 1 Figure 4.

3.6 The requirements for disabled access, as set out in Approved Document M of the Building Regulations 2010 and the Equality Act 2010, should be met.

Creating an en-suite single-bed room with ventilated lobby (PPVL)

3.7 An option for reconfiguring two existing single-bed rooms to provide one en-suite single-bed room with ventilated lobby, with bed access through the lobby, is shown in Appendix 1 Figure 5.

3.8 Where space restrictions mean that bed access through the lobby is not possible, an alternative layout gives bed access directly to the patient's room from the corridor – see Appendix 1 Figure 6.

3.9 Access is through a single door via the lobby. The existing door-and-a-half for bed access only should be kept locked and include seals to minimise air transfer.

3.10 When converting any rooms into an en-suite single-bed room with ventilated lobby (PPVL), any suspended ceiling must be replaced with a sealed solid ceiling. If a single-bed room has a suspended ceiling to permit access to overhead services, a sealed ceiling with sealable access hatches could be installed or the services moved.

3.11 The additional requirements for upgrade to an isolation suite are:

In the lobby:

- a clinical hand-wash basin with non-touch, fixed temperature mixer tap;
- wall-mounted soap dispensers, disinfectant hand rub dispensers, and disposable towel holders;

- wall-mounted plastic apron and glove dispensers and storage for other clean PPE items;
- a clinical waste bin for disposal of used PPE;
- a bin for disposing of paper towels and other non clinical items;
- storage for room cleaning equipment;
- a suitable air supply.

In the bedroom:

- a clinical hand-wash basin, with non-touch, fixed temperature mixer tap, adjacent to the exit door;
- a clinical waste bin for disposal of used PPE;
- observation window in corridor wall with integral privacy blinds;
- a pressure stabiliser above the bedroom door.

In the en-suite bathroom:

- suitable extract system to the en-suite bathroom;
- transfer grille in the en-suite door;
- en-suite WC to be non-touch flush and wash basin to have single tap with flow and temperature control.

In the en-suite as a whole:

- sealed, solid ceiling;
- shut and sealed windows to the exterior.

3.12 The provision of a two-way intercommunication system between the patient's bedroom and the nurses' base should be considered.

Converting a multi-bed bay to segregation or negative pressure rooms

3.13 An existing four-bed bay may be converted to provide two en-suite single-bed rooms (see Appendix 1 Figure 7).

3.14 In this configuration it is not possible to provide a normal observation window. As observation is critical, however, one option would be to provide glazed bedroom doors, with integral privacy blinds, to enable observation from the corridor and to provide a view out for the patient.

Chapter 4 Fire safety

4.1 It is recommended that fire safety considerations should be discussed with the healthcare organisation's fire safety adviser, the building control authority and the local fire-and-rescue service.

4.2 The fire precautionary measures and response procedures for isolation facilities should be coordinated with the site's overall fire strategy.

Segregation room

4.3 Where segregation rooms are provided for the purposes of preventing the risk of spreading healthcare-associated infections to other parts of a ward, the normal fire safety precautions for single-bed room accommodation apply.

4.4 As the segregation room will either be naturally ventilated or served by the departments ventilation system (i.e. dedicated supply and extract ventilation is not required for segregation rooms), there will be no additional implications for the zone/department's fire alarm cause and effect.

Negative pressure room

4.5 Fire protection/enclosure of negative pressure rooms is not normally required; however, as a dedicated extract ventilation system is required for negative pressure rooms, as shown in Figure 1, 'Extract ventilation – Negative pressure rooms', the following provisions are necessary.

4.6 The extract ventilation system should be interfaced with the department's fire alarm system, whereby the extract system will shut down on activation of a manual call point or detector within the zone/department. This is to prevent potentially smoke contaminated air being drawn into the negative pressure room from the adjoining areas in the event of a fire within the department.

4.7 Ductwork should be considered an extension of the negative pressure room and respective department therefore must be fire rated throughout its length. Fire dampers, where the ducts penetrate walls and floors, will not be required.

Positive pressure ventilated lobby (PPVL) room

4.8 In the case of an isolation room with a PPVL, the ventilation system must comply with WHTM 03-01 – 'Specialised ventilation for healthcare premises'. The ductwork must be fire-rated and the system will only require a fire damper in the ductwork immediately after the AHU as shown in the diagram in Figure 2, 'Supply and Extract ventilation – PPVL rooms'.

4.9 The PPVL isolation suite (comprising the lobby, bedroom and en-suite) is intended to be built as a single fire compartment. The positive pressure in the lobby will deter smoke originating in the corridor from entering the room. Smoke from a fire in the room will be contained within the suite and extracted via the en-suite extract. Because of this the ventilation system serving the isolation facility should be kept running in the event of a fire.

4.10 Ductwork can be considered an extension of the isolation suite, therefore must be fire rated. Fire dampers, where the ducts penetrate walls and floors, will not be required.

4.11 A motorised smoke/fire damper must be fitted at the supply ductwork immediately after the AHU. The damper should close in the event of an AHU or intake fire under the control of a smoke detector mounted in ductwork immediately downstream of the AHU.

Fire rated ductwork

4.12 Where fire rated duct work breaches compartmentation it should be rated to a minimum of 60 minutes.

4.13 Ductwork must be pressure tested following the methodology set out in *DW143 'A Practical Guide to Ductwork Leakage Testing'*.

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Appendix 1: Example room layouts

Introduction

A1.1 The room layouts in this appendix are examples and are intended as a guide. Other room configurations are possible. Refer to WHBN 04-01 – 'Adult in-patient accommodation' and the section on 'Single-bed room' in WHBN 00-03 – 'Clinical and clinical support spaces', which give definitive design guidance and space standards for multi-bed rooms and single-bed rooms with en-suite facilities.

A1.2 For guidance on the sanitary assemblies used in these layouts, see WHBN 00-10 Part C – 'Sanitary assemblies'.

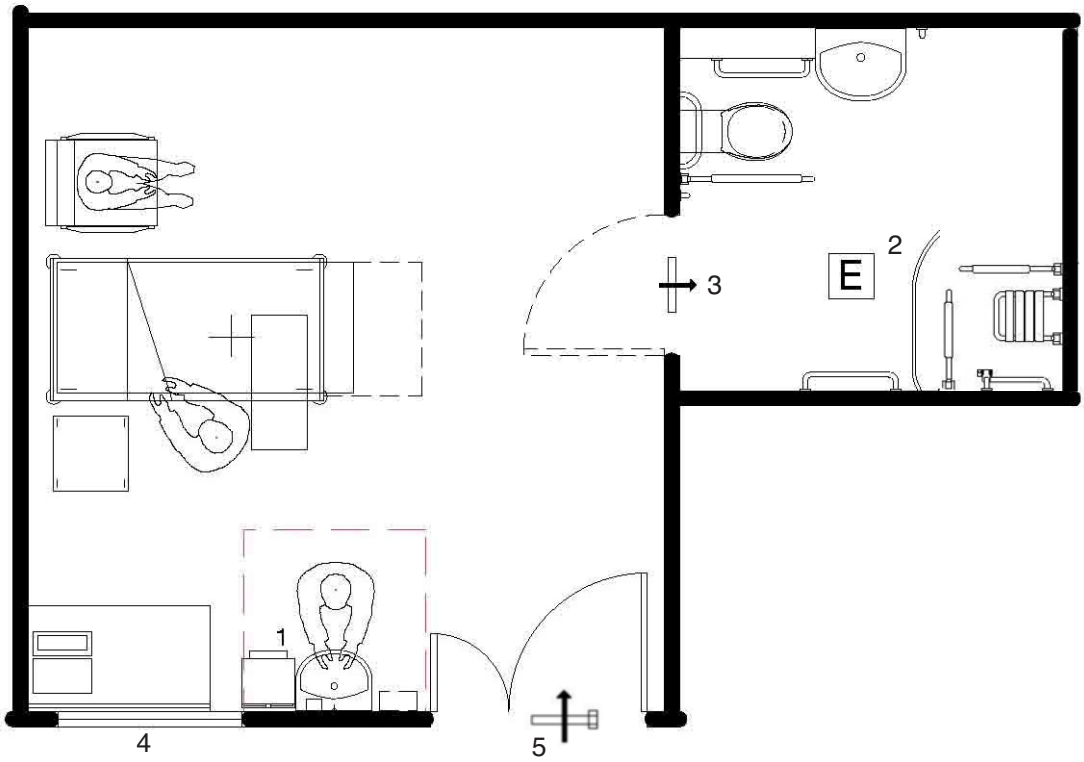

Figure 1: New build single room with en-suite facilities (segregation/negative pressure rooms)

Minimum requirements

1. Clinical wash-hand basin
2. Provide suitable extract fan/system (for negative pressure rooms refer to paragraphs 2.42-2.48)
3. Transfer grille to en-suite door
4. Observation window in corridor wall with integral privacy blinds to allow for staff observation and patient views out
5. For negative pressure rooms, provide pressure stabiliser above bedroom door

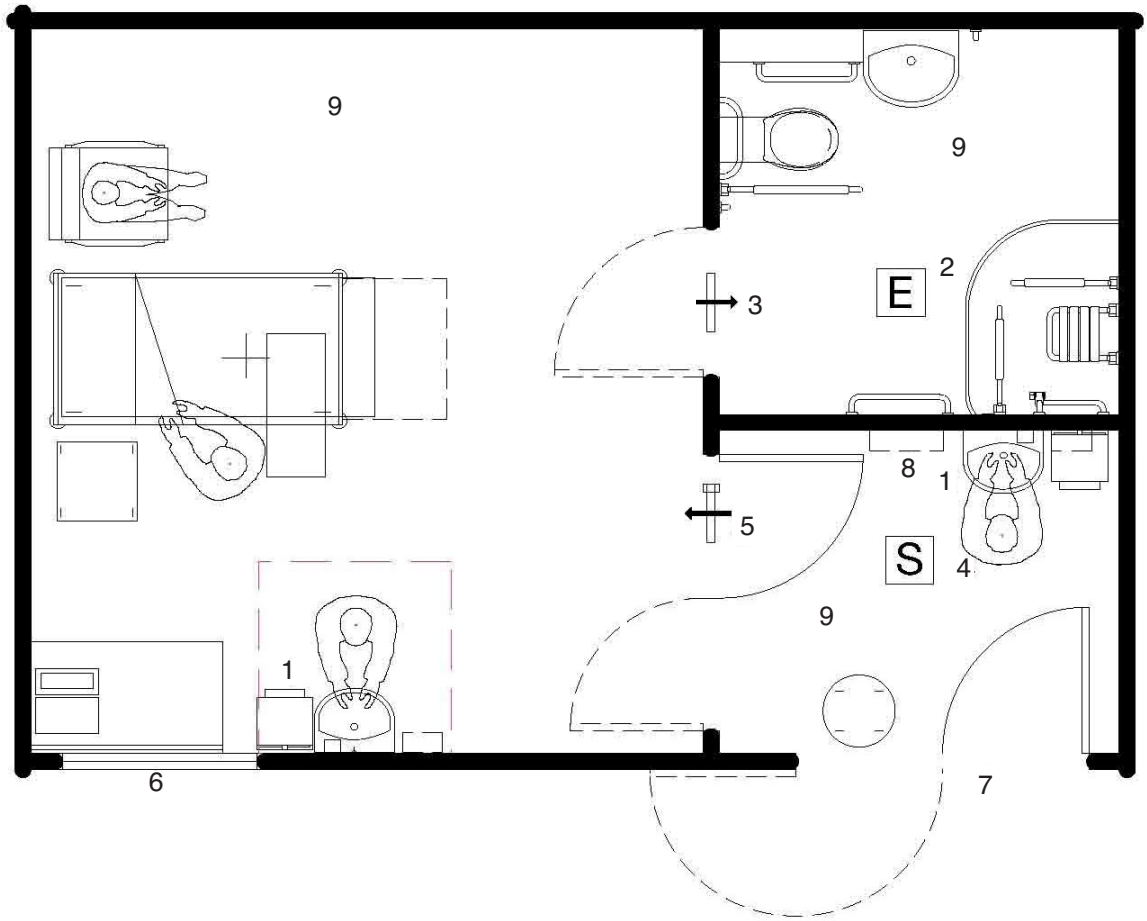

Figure 2: New build single room with en-suite facilities and lobby (PPVL)

Minimum requirements

1. Clinical wash-hand basin
2. Provide suitable extract system
3. Install transfer grille to en-suite door
4. Supply air
5. Pressure stabiliser
6. Observation window in corridor wall with integral privacy blinds to allow for staff observation and patient views out
7. Double door for personnel and bed access
8. Disposable apron dispenser
9. Ceiling to be sealed solid construction, external window to be sealed

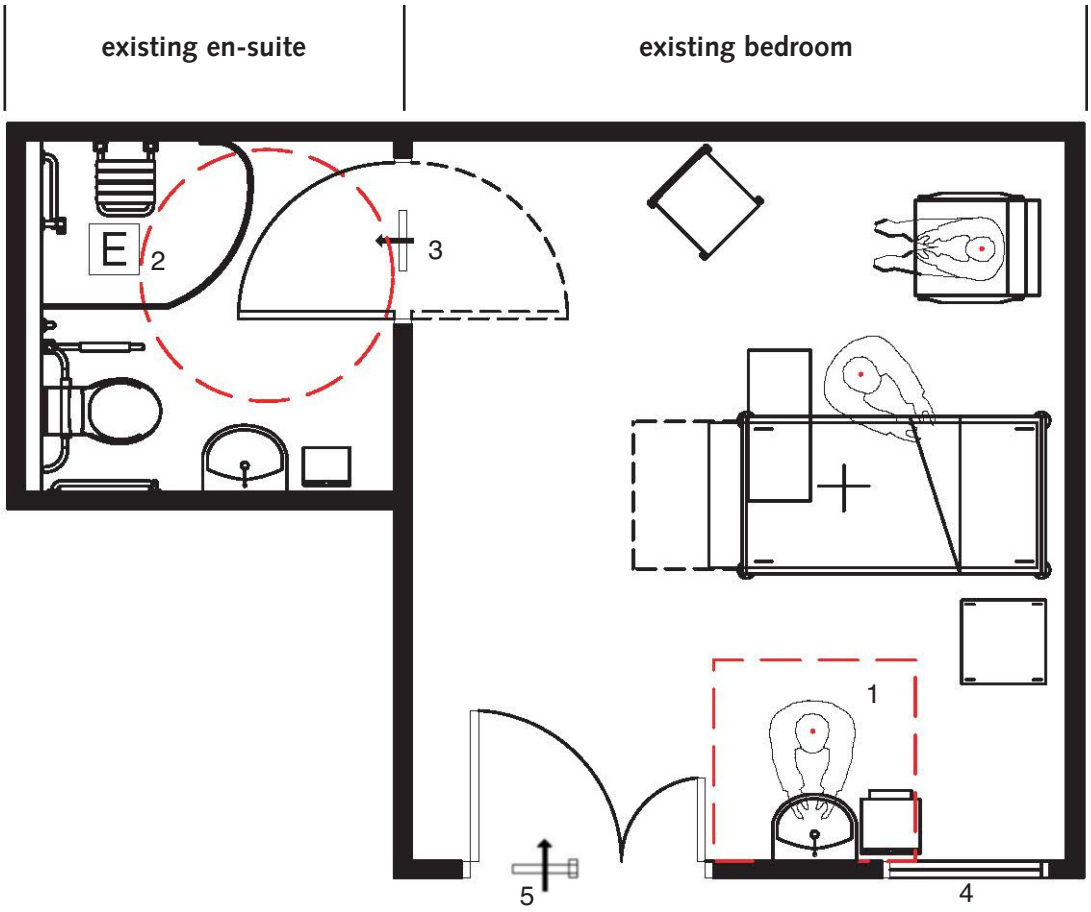

Figure 3: Existing single-bed room with en-suite facilities (segregation/negative pressure rooms)

Minimum requirements to upgrade existing facilities

1. Add clinical wash-hand basin
2. Provide suitable extract fan/system (for negative pressure rooms refer to paragraphs 2.42-2.48)
3. Install transfer grille to en-suite door
4. Observation window in corridor wall with integral privacy blinds to allow for staff observation and? patient views out
5. For negative pressure rooms, provide pressure stabiliser above bedroom door

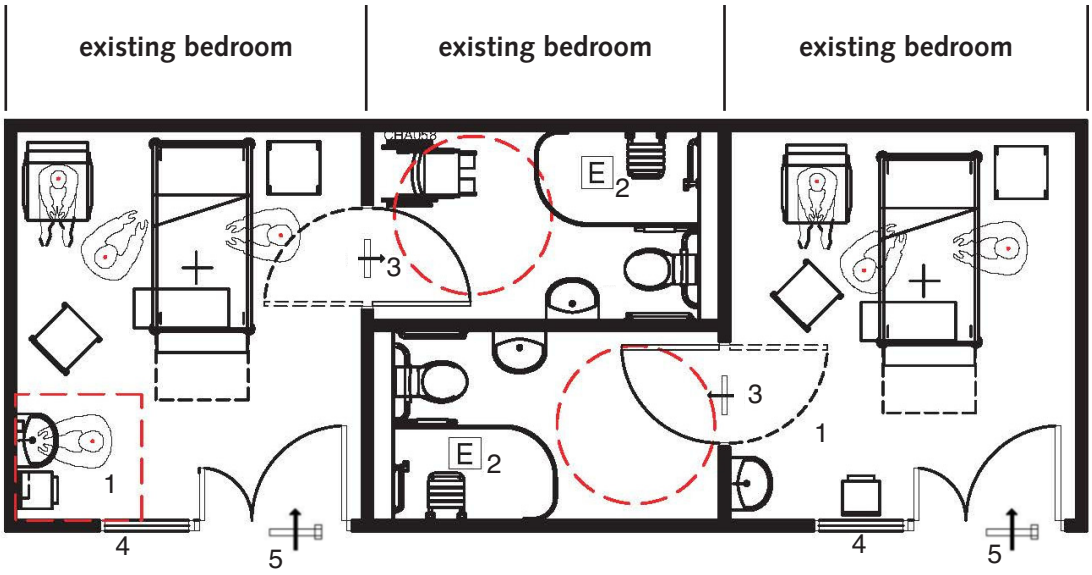

Figure 4: Upgrading three existing single-bed rooms to provide two single-bed rooms with en-suite facilities (segregation/negative pressure rooms)

Minimum requirements to upgrade existing facilities

1. Add clinical wash-hand basin
2. Provide suitable extract fan/system (for negative pressure rooms refer to paragraphs 2.42-2.48)
3. Install transfer grille to en-suite door
4. Observation window in corridor wall with integral privacy blinds to allow for staff observation and patient views out
5. For negative pressure rooms, provide pressure stabiliser above bedroom door

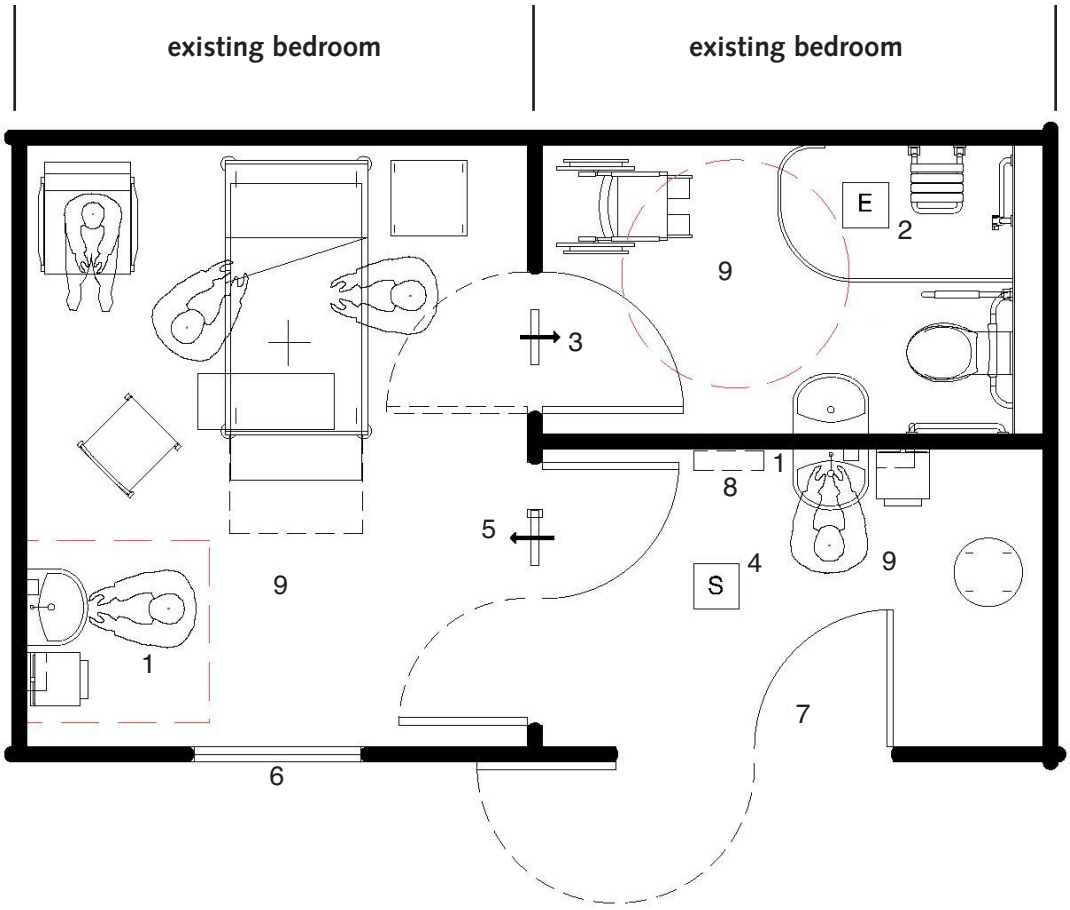

Figure 5: Upgrading two existing single-bed rooms to provide one single-bed room with en-suite facilities and bed access lobby (PPVL)

Minimum requirements to upgrade existing facilities

1. Add clinical wash-hand basin
2. Provide suitable extract system
3. Install transfer grille to en-suite door
4. Supply air
5. Pressure stabiliser
6. Observation window in corridor wall with integral privacy blinds to allow staff observation and patients views out
7. Double door for personnel and bed access
8. Disposable apron dispenser
9. Upgrade ceiling to sealed solid construction, external windows to be sealed

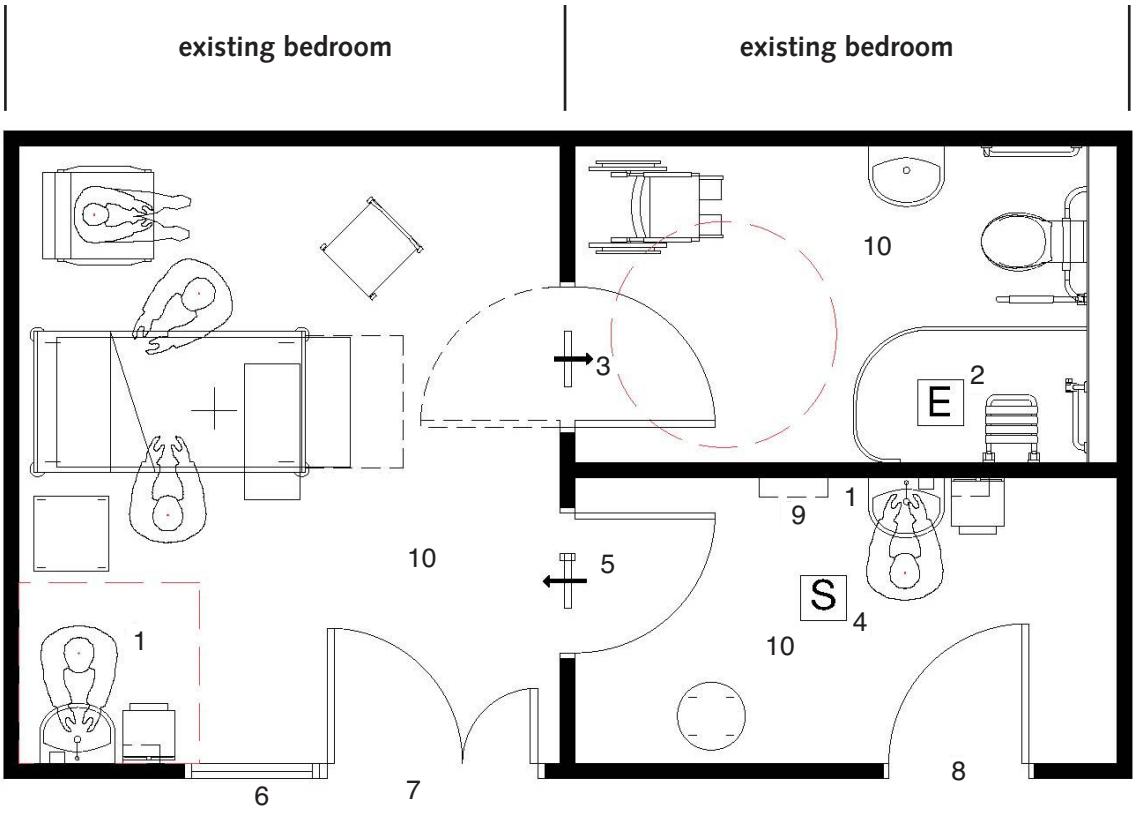

Figure 6: Upgrading two existing single-bed rooms to provide one single-bed room with en-suite facilities and personnel lobby (PPVL)

Minimum requirements to upgrade existing facilities

1. Add clinical wash-hand basin
2. Provide suitable extract system
3. Install transfer grille to en-suite door
4. Supply air
5. Pressure stabiliser
6. Observation window in corridor wall with integral privacy blinds to allow for staff observation and patient views out
7. Existing door and a half for bed access only must be kept locked and have seals to minimise air transfer
8. Single door access via lobby
9. Disposable apron dispenser
10. Upgrade ceiling to sealed solid construction, external windows to be sealed

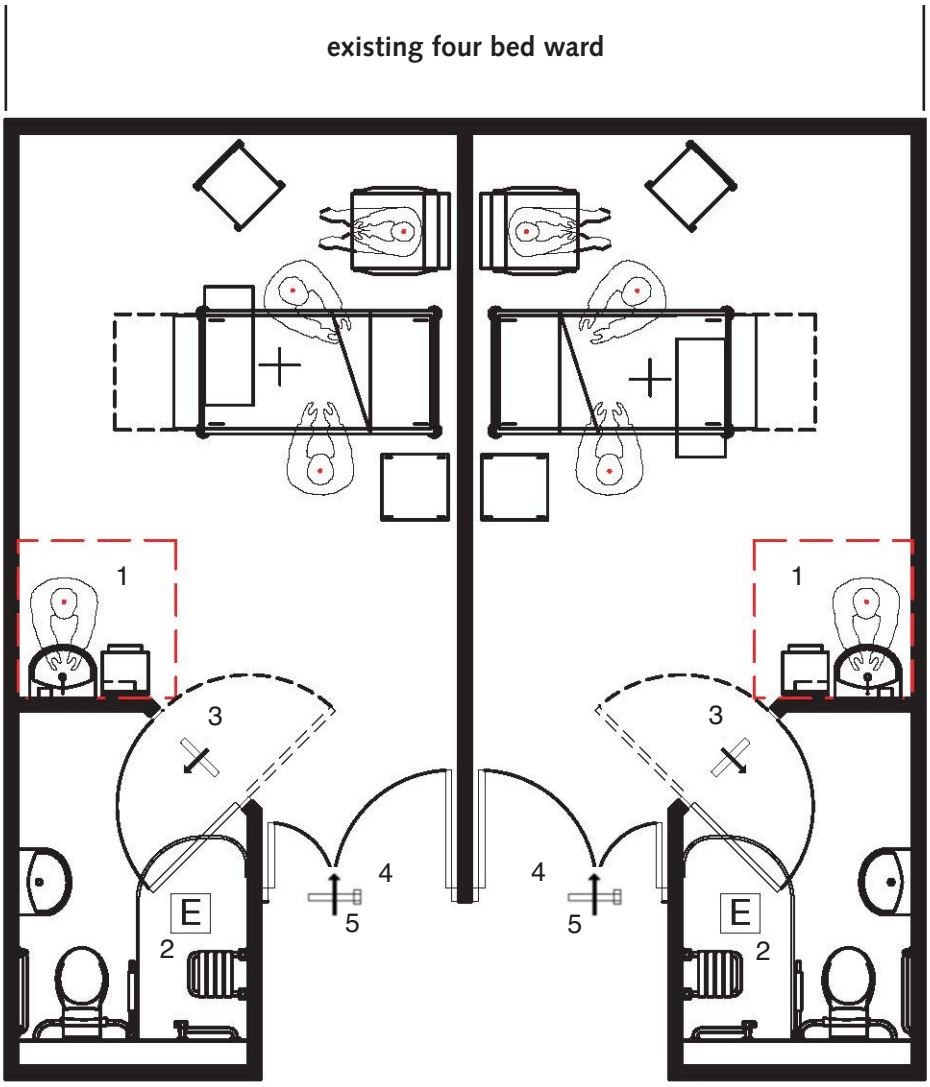

Figure 7: Upgrading existing four-bed ward to provide two single-bed rooms with en-suite facilities (segregation/negative pressure rooms).

Minimum requirements

1. Clinical wash-hand basin
2. Provide suitable extract fan/system (for negative pressure rooms refer to paragraphs 2.42-2.48)
3. Transfer grille to en-suite door
4. Doors to be fully glazed, with integral privacy blinds, to allow staff observation and patients views out
5. For negative pressure rooms, provide pressure stabiliser above bedroom doors

Appendix 2: Acceptance testing of isolation rooms/suites

Definitions

Isolation suite

A2.1 Includes the entry lobby, patient's room, en-suite facility and any storage or other area directly accessible from the patient's room or en-suite facility.

Isolation room envelope

A2.2 The isolation room bounded by a solid floor, solid ceiling and full-height walls that separate it from any other adjoining space or the outside.

Validation – isolation room air permeability

A2.3 Assessment of room envelope air leakage involves establishing a pressure differential across the envelope and measuring the air flow required to achieve that differential.

A2.4 Air permeability specifications are given in Approved Document L2A of the Building Regulations (2010). The standard for measuring air permeability is ATTMA's 'Technical Standard L2: Measuring air permeability of building envelopes (non-dwellings)'.

Rationale

To ensure effective isolation, it is important that air leakage to or from adjacent areas is kept to a minimum. Construction gaps should be minimised and service penetrations sealed before the room is tested. There should be NO temporary seals other than those permitted (i.e. supply and extract ducts). The test pressures are significantly more than would be achieved under a ventilation fault condition within the isolation room. When in operation, the patient's room and en-suite are designed to be at a neutral or slightly negative pressure so the actual leakage between adjoining spaces should be insignificant.

Validation and annual revalidation

Filtration test standards

A2.5 General and fine filter grades to BS EN 779 must be visually inspected to ensure that they are free from tears or other damage at the time of installation. They must be a good fit and clamped into their housing, with no obvious gaps that could allow air bypass. The filter housing must have the same integrity as the filter.

A2.6 High efficiency particulate air (HEPA) filters, where fitted, must be certified by their manufacturer for conformity to BS EN 1822. When installed, their performance should be checked with a particle counter using the method set out in BS EN 1822 or other approved method.

Air permeability tests

A2.7 Air permeability tests should be carried out by an independent testing company that is a member of ATTMA. Air sealers must not test their own work. The report should be as described in ATTMA Technical Standard L2. See also CIBSE's 'Testing buildings for air leakage' (TM23, 2000).

A2.8 These tests must be carried out before initial commissioning and as necessary thereafter following works of refurbishment or when there is any doubt as to the actual performance standard of the room.

A2.9 As a minimum requirement, the air permeability must be no worse than that required by Approved Document L2A of the Building Regulations for the entire building. (This is a variable value with a minimum required air permeability of less than 10 $m^3.h^{-1}.m^{-2}$ at a reference pressure of 50 pascals.)

A2.10 Further clarification, specifications and test procedures can be obtained from BSRIA Test Standard BTS3 'Air permeability testing of isolation facilities' (forthcoming).

A2.11 Other tests may be necessary to check particular aspects of the specific installation. Where this is necessary, reference should be made to Approved Document L2A of the Building Regulations.

System operating standard

A2.12 The room will be considered fit for purpose if, with the ventilation system operating and all doors closed, the following parameters are achieved:

- the patient's room has an air change rate of at least 10 per hour;
- the en-suite facility is at a negative pressure with respect to the patient's room;
- a failure of either the supply or extract fan will be indicated at a designated nurse station and the estates department;
- there is a positive pressure of between 8 and 12 pascals between the entry lobby and the corridor.

A2.13 For a PPVL:

- there is a positive pressure of between 8 and 12 pascals between the entry lobby and the corridor.

A2.14 For a negative pressure room:

- there is a negative pressure cascade from the corridor to the room.

A2.15 The room and associated plant must be tested following initial commissioning and thereafter re-tested at least annually for conformity with this operating standard.

A2.16 These tests must include any pressure stabilisers and air pressure sensors. BSRIA Test Standard BTS2 'Test method for pressure stabilisers' (forthcoming) specifies a test procedure.

Record-keeping

A2.17 In addition to the commissioning and annual validation records, accurate and detailed monitoring records must be kept.

References

Acts and regulations

The acts and regulations shown below can be accessed from the www.legislation.gov.uk/ *website*

The Equality Act 2010

Air Tightness Testing and Measurement Association (ATTMA)

www.attma.org/

Technical Standard L2. Measuring air permeability of building envelopes (non-dwellings)
http://www.attma.org/wp-content/uploads/2013/10/ATTMA-TSL2-Issue-1.pdf

British Standards

http://shop.bsigroup.com/

BS 8300 Design of buildings and their approaches to meet the needs of disabled people. Code of practice

BS EN 779 Particulate air filters for general ventilation. Determination of the filtration performance

BS EN 1822 High efficiency air filters (EPA, HEPA and ULPA)

Building & Engineering Services Association (B&ES)

www.b-espublications.co.uk/Default.aspx

DW143: Guide to Good Practice – Ductwork Air Leakage Testing
http://www.b-espublications.co.uk/Ecommerce/ID/36/Product/APracticalGuidetoDuctworkLeakageTesting/Details.aspx

DW144: Specification for sheet metal ductwork, low, medium & high pressure/velocity air systems
www.b-espublications.co.uk/Ecommerce/ID/38/Product/SpecificationforsheetMetalDuctworkLowMediumHighPressureVelocityAirSystems/Details.aspx

Building Services Research and Information Association (BSRIA)

www.bsria.co.uk/

BTS2 Test method for pressure stabilisers (forthcoming)

BTS3 Air permeability testing of isolation facilities (forthcoming)

Chartered Institution of Building Services Engineers (CIBSE)

https://www.cibseknowledgeportal.co.uk/

Testing buildings for air leakage TM23

Department of Health

www.gov.uk/government/organisations/department-of-health

Health and Social Care Act 2008 - The Code of Practice on the prevention and control of infections and related guidance
www.gov.uk/government/uploads/system/uploads/attachment_data/file/216227/dh_123923.pdf

Health & Safety Executive (HSE)

www.hse.gov.uk/

Biological agents: Managing the risks in the laboratory and healthcare premises. Advisory Committee on Dangerous Pathogens, 2005
http://www.hse.gov.uk/biosafety/biologagents.pdf

NHS Wales Shared Services Partnership - Facilities Services

The publications below are available from the NHS Wales Shared Services Partnership - Facilities Services websites:
Intranet: howis.wales.nhs.uk/whe
Internet: www.wales.nhs.uk/whe

National standards for cleaning in NHS Wales (Intranet only)

Welsh Health Building Notes

WHBN 00-03 – Clinical and clinical support spaces

WHBN 00-09 – Infection control in the built environment

WHBN 00-10 Part C – Sanitary assemblies

WHBN 04-01 – Adult in-patient accommodation

Welsh Health Technical Memorandum

WHTM 03-01 – Specialised ventilation for healthcare premises,

WHTM 06-01 – Electrical services supply and distribution

Welsh Government

http://wales.gov.uk/?lang=en

Building Regulations
http://wales.gov.uk/topics/planning/buildingregs/publications/?lang=en

Approved Document L – Conservation of fuel and power

Approved Document M – Access to and use of buildings