

## Health Building Note 01-01: Cardiac facilities



# Health Building Note 01-01

## Cardiac facilities

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# Preface

## About Health Building Notes

Health Building Notes give “best practice” guidance on the design and planning of new healthcare buildings and on the adaptation/extension of existing facilities.

They provide information to support the briefing and design processes for individual projects in the NHS building programme.

## The Health Building Note suite

Healthcare delivery is constantly changing, and so too are the boundaries between primary, secondary and tertiary care. The focus now is on delivering healthcare closer to people’s homes.

The Health Building Note framework (shown below) is based on the patient’s experience across the spectrum of care from home to healthcare setting and back, using the national service frameworks (NSFs) as a model.

## Health Building Note structure

The Health Building Notes have been organised into a suite of 17 core subjects.

**Care-group-based** Health Building Notes provide information about a specific care group or pathway but cross-refer to Health Building Notes on **generic (clinical) activities** or **support systems** as appropriate.

Core subjects are subdivided into specific topics and classified by a two-digit suffix (-01, -02 etc), and may be further subdivided into Supplements A, B etc.

All Health Building Notes are supported by the overarching Health Building Note 00 in which the key areas of design and building are dealt with.

### Example

The Health Building Note on accommodation for adult in-patients is represented as follows:

“Health Building Note 04-01: Adult in-patient facilities”

The supplement to Health Building Note 04-01 on isolation facilities is represented as follows:

“Health Building Note 04-01: Supplement 1 – Isolation facilities for infectious patients in acute settings”

Health Building Note number and series title	Type of Health Building Note
Health Building Note 00 – Core elements	Support-system-based
Health Building Note 01 – Cardiac care	Care-group-based
Health Building Note 02 – Cancer care	Care-group-based
Health Building Note 03 – Mental health	Care-group-based
Health Building Note 04 – In-patient care	Generic-activity-based
Health Building Note 05 – Older people	Care-group-based
Health Building Note 06 – Diagnostics	Generic-activity-based
Health Building Note 07 – Renal care	Care-group-based
Health Building Note 08 – Long-term conditions/long-stay care	Care-group-based
Health Building Note 09 – Children, young people and maternity services	Care-group-based
Health Building Note 10 – Surgery	Generic-activity-based
Health Building Note 11 – Community care	Generic-activity-based
Health Building Note 12 – Out-patient care	Generic-activity-based
Health Building Note 13 – Decontamination	Support-system-based
Health Building Note 14 – Medicines management	Support-system-based
Health Building Note 15 – Emergency care	Care-group-based
Health Building Note 16 – Pathology	Support-system-based

## Other resources in the DH Estates and Facilities knowledge series

### Health Technical Memoranda

Health Technical Memoranda give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery of healthcare (for example medical gas pipeline systems, and ventilation systems).

They are applicable to new and existing sites, and are for use at various stages during the inception, design, construction, refurbishment and maintenance of a building.

All Health Building Notes should be read in conjunction with the relevant parts of the Health Technical Memorandum series.

### Activity DataBase (ADB)

The Activity DataBase (ADB) data and software assists project teams with the briefing and design of the healthcare environment. Data is based on guidance given in the Health Building Notes, Health Technical Memoranda and Health Technical Memorandum Building Component series.

1. Room data sheets provide an activity-based approach to building design and include data on personnel, planning relationships, environmental considerations, design character, space requirements and graphical layouts.
2. Schedules of equipment/components are included for each room, which may be grouped into ergonomically arranged assemblies.
3. Schedules of equipment can also be obtained at department and project level.
4. Fully loaded drawings may be produced from the database.
5. Reference data is supplied with ADB that may be adapted and modified to suit the users' project-specific needs.

### Note

The sequence of numbering within each subject area does not necessarily indicate the order in which the Health Building Notes were or will be published/printed. However, the overall structure/number format will be maintained as described.

# Executive summary

This Health Building Note provides guidance on minor cardiac procedures and cardiac operating theatre suites for inclusion in acute settings, and also guidance that describes spaces that are unique to a catheter laboratory suite.



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# 1 Policy context

- 1.1 Government policy on coronary heart disease (CHD) has been co-ordinated in recent years through the Coronary Heart Disease National Service Framework (DH, 2000), which introduced a programme to reduce premature deaths from CHD, and promote faster and more equal access to cardiac services.
- 1.2 The NHS Heart Improvement Programme is continuing to facilitate the strategic service developments initiated by the NSF. This is a national programme that works with clinical cardiac networks and NHS organisations to deliver improvements in cardiac services.
- 1.3 Despite significant progress in recent years, CHD remains the most common cause of premature death in the UK, as well as a significant cause of ill health and disability.
- 1.4 Following publication of the final report of the National Infarct Angioplasty Project (NIAP) in October 2008, the Department of Health has estimated that it is feasible for primary percutaneous coronary intervention (primary PCI) services to be rolled out to at least 95% of the population over about three years, but that implementation should be for local determination.
- 1.5 The aim is to provide rapid and safe treatment to all heart attack patients. For primary PCI, in some areas, patients may be taken directly to a major cardiac centre; in other areas, local hospitals will provide daytime emergency angioplasty, with patients presenting at night being taken directly to the nearest major cardiac centre. A successful PCI programme, therefore, will involve co-operation between neighbouring hospital trusts and collaborative working with the local ambulance trust.

## 2 Service context

### Overview

**2.1** Cardiac networks provide localised support and facilitation for the delivery of integrated care across primary, secondary and tertiary service organisations. Networks have increasingly provided support and advice to service commissioners, and can offer access to expert advice on clinical innovations and specialist service provision.

**2.2** Some cardiac services may be provided from a general hospital while others require specialist provision. The range of specialist cardiac facility provision will depend on the particular circumstances of the hospital or unit concerned. Table 1 illustrates some of the possible configurations.

	Secondary unit	Tertiary unit
<b>Out-patient consultation</b>	Sessional use of main out-patient department	Dedicated consulting/examination facilities if justified by activity levels
<b>Cardiac non-invasive investigation facilities</b>	Sessional use of some rooms within out-patients; others will be dedicated	Normally a dedicated suite of rooms within out-patients
<b>Catheter laboratory suite</b>	May be a self-contained suite or part of a day intervention unit	May be a self-contained suite, part of a day intervention unit or co-located with cardiac theatres
<b>Minor cardiac procedures suite</b>	If required, usually co-located with catheter laboratory suite to maximise current and future flexibility	If required, usually co-located with catheter laboratory suite to maximise current and future flexibility
<b>Day case admissions and recovery area</b>	Usually shared access to central day case recovery area	Usually shared access to central day case recovery area
<b>Cardiac operating theatres</b>	N/A	Either a dedicated cardiac theatre suite or specific theatre allocation within a larger general operating theatre suite
<b>Cardiac critical care</b>	N/A	Either a dedicated cardiac critical care unit or a bed allocation within a larger general critical care unit
<b>Coronary care unit</b>	A general acute ward with additional telemetry; usually adjacent to other general medical/cardiology wards	A general acute ward with additional telemetry; may be adjacent to other general medical wards or within a specialist cardiac facility
<b>Cardiology/medical wards</b>	Cardiology beds often provided as part of general medical bed allocation	May be adjacent to other general medical wards or dedicated cardiology ward as part of a specialist cardiac facility
<b>Cardiac surgery wards</b>	N/A	Dedicated cardiac surgery ward
<b>Children's cardiac wards</b>	N/A	Dedicated children's cardiac ward

Table 1

## Out-patient consultations

- 2.3 Out-patient consultations for cardiac patients do not require specialist facilities. The need for dedicated facilities will depend on activity levels. If facilities are dedicated, co-location with non-invasive cardiac investigations is advantageous to enable one-stop clinics to operate.

## Diagnostic services

- 2.4 Most non-invasive cardiac investigations procedures, including ECGs, echocardiographs, and pacemaker monitoring and adjustment, may be carried out in an out-patient environment.
- 2.5 Coronary angiography and electrophysiology studies will usually be undertaken in a catheter laboratory.
- 2.6 Other diagnostic imaging services (including cardiac magnetic resonance imaging (cardiac MRI) and nuclear cardiology) will usually be provided from a central diagnostic imaging facility (see Health Building Note 6 – ‘Facilities for diagnostic imaging and interventional radiology’ for details).
- 2.7 Where congenital cardiac disorders are treated, consideration may be given to locating cardiac MRI facilities alongside other cardiac facilities rather than in the main imaging unit.
- 2.8 Where investigations involve an element of recovery, patients may be admitted to a day case unit.

## Treatment services

- 2.9 Aside from surgery, invasive cardiac treatments will be undertaken either in a catheter laboratory or in a minor cardiac procedures room.
- 2.10 Cardiac surgery is undertaken in designated operating theatres.

## In-patient services

- 2.11 In-patient accommodation for cardiac patients does not differ from in-patient accommodation for other patient groups.
- 2.12 Coronary care units (CCUs) are in-patient areas for the continuous monitoring of patients suffering from cardiac abnormalities or acute cardiac emergencies, such as acute myocardial infarction (AMI).

- 2.13 A CCU may also accommodate patients not stable enough to return to a general ward after an invasive procedure and/or patients requiring an initial assessment.
- 2.14 The functional requirements for a CCU are essentially the same as those of a general acute ward, with the addition of the necessary telemetry equipment. The staff base should be designed to allow central monitoring of all CCU patients, and careful attention should be paid to ensuring clear sight lines to all beds.
- 2.15 Ideally, emergency referrals of patients with confirmed or strongly suspected AMI will be made directly to a CCU and associated catheter laboratories. Direct ambulance access should be provided where feasible. If the CCU is not at ground level, dedicated lift access is recommended.
- 2.16 In hospitals that do not carry out primary PCIs, there may be few, if any, AMI admissions. In such places a distinct CCU may not be required.
- 2.17 Consideration should be given to the provision of a number of designated monitored/telemetry beds in the general cardiology wards to support the monitoring of cardiac patients who do not require admission to a CCU. These may include in-patients who have undergone procedures in the catheter laboratory; monitoring may typically be required for up to four hours post-procedure.
- 2.18 Critical care beds for cardiac surgery patients do not differ from critical care beds for other patient groups. There should be direct access to cardiac operating theatres.

- 2.19 See also Health Building Note 04-01 – ‘Adult in-patient accommodation’ and Health Building Note 04-02 – ‘Critical care units’.

## Rehabilitation services

- 2.20 Cardiac patients may require access to a group room or gymnasium for the purpose of rehabilitation. This will usually be provided from a central rehabilitation facility. Access to an outdoor walking circuit is desirable. See Health Building Note 8 – ‘Facilities for rehabilitation services’.

## 3 Scope of guidance

- 3.1 This Health Building Note describes spaces that are unique to a catheter laboratory suite. It also describes any variations to common hospital spaces and clarifies requirements for these spaces, where necessary.
- 3.2 For a full list of space requirements see the following example schedules of accommodation for a 2-lab and 4-lab suite. The example schedules provide a basis for sizing facilities at initial planning stages but exact requirements should be determined locally based on the number and case mix of patients, hospital policy for the provision of supplies and waste disposal, and the layout of the unit. Links to guidance on common spaces are provided from the schedules.

Example schedules of accommodation for catheter laboratory suite									
Version 1, 20.09.11									
<b>Example 1: Catheter laboratory suite: 4 rooms</b>									
	Room name/function	Unit area allowance	Quantity	Net internal area	Circulation and communication allowance	Engineering allowance	Gross internal area	Notes	
<b>Clinical and clinical support spaces</b>									
<b>Catheter laboratory area</b>									
X1029/X1030	Catheter laboratory	50.0	4	200.0	70.0	38.0	308.0	Example schedule includes one dedicated catheter laboratory for children/patients with congenital heart defects.	
X1031	Control room	12.0	4	48.0	16.8	9.1	73.9	1 per catheter laboratory.	
N0317	Anaesthetic room	19.0	1	19.0	6.7	3.6	29.3	For children/patients with congenital heart defects.	
B2425	Emergency admission and post-anaesthetic recovery bay	14.0	2	28.0	9.8	5.3	43.1	Based on case mix of patients in example schedule.	
J1264	Parking bay: trolley/bed	4.0	4	16.0	5.6	3.0	24.6	1 per catheter laboratory.	
G0180-01	Parking bay: resuscitation trolley	2.0	2	4.0	1.4	0.8	6.2	1 per 2 catheter laboratories; minimum of 2 in case of 2 emergencies simultaneously.	
V0346	Dirty utility room: theatre	12.0	1	12.0	4.2	2.3	18.5	1 per 4 catheter laboratories.	
W1584/1585	Storage, equipment and consumables	4.0	4	16.0	5.6	3.0	24.6	4 m <sup>2</sup> per catheter laboratory.	
<b>Shared clinical support spaces</b>									
M0326-03	Image review/meeting room: 2 workstations	16.0	1	16.0	5.6	5.3	26.9	1 per suite.	
Y0646	Disposal hold: 3000 litres	12.0	1	12.0	4.2	4.0	20.2		
Y1510	Cleaners' room	8.0	1	8.0	2.8	2.6	13.4	1 per suite.	
<b>Staff spaces</b>									
D0434-04	Rest room with mini kitchen (size based on number of seats)	1.9	12	22.8	8.0	7.5	38.3	3 places per catheter laboratory.	
V0564-03/0567-01/ V0725/V1321	Changing area: staff (size based on number of lockers)	1.4	31	43.4	15.2	14.3	72.9	Includes uniform exchange area, showers and a number of individual changing rooms. Based on 7 people per catheter laboratory, 10% spare contingency allowance for male/female split (suggested apportionment 2/3 female to 1/3 male).	
Y0511	Footwear washing utility room	4.0	1	4.0	1.4	1.3	6.7		
V1321	Shower room: ambulant	2.5	1	2.5	0.9	0.8	4.2	Additional shower rooms to allow for male and female segregated.	
V0725	Changing room: semi-ambulant	2.0	1	2.0	0.7	0.7	3.4	Additional individual changing rooms to allow for male and female segregation.	
V1010	WC: ambulant	2.0	4	8.0	2.8	2.6	13.4	Associated with staff changing areas.	
<b>Total allowance</b>				<b>461.7</b>	<b>161.6</b>	<b>104.3</b>	<b>727.6</b>		
<b>Optional clinical and clinical support spaces</b>									
T0531	Preparation room	9.0	4	36.0				1 per catheter laboratory.	
T0522-02	Preparation room	12.0	2	24.0				1 per 2 catheter laboratories.	
N0219	Scrub-up and gowning room: 2 places	7.0	4	28.0				1 per catheter laboratory. In lieu of scrub-up and gowning area within catheter laboratory.	
X1031-01	Control room	20.0	2	40.0				1 per 2 catheter laboratories. In lieu of a dedicated control room for each catheter laboratory.	
X1035	Minor cardiac procedures room	28.0						Project option.	
<b>Optional staff spaces</b>									
M0251	Office: 1-person	8.0	1	8.0				For unit manager.	
M0278-01/M0281/ M0410/M0731	Admin area: shared use (size based on number of workstations)	6.6	4	26.4				National allowance.	
V1010	WC: ambulant	2.0	1	2.0					
V0922	WC: independent wheelchair	4.5	1	4.5					
H1304-02	Seminar room: 20 places	34.0	1	34.0				National allowance.	
				<b>Cost guide allowances:</b>	<b>Circulation</b>	<b>Engineering</b>			
				Clinical	35%	33%			
				Staff	35%	19%			

Cath lab soa\_20.09.11.xls: Cath lab (4 rooms)

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Example schedules of accommodation for catheter laboratory suite									
Version 1, 20.09.11									
Example 2: Catheter laboratory suite: 2 rooms									
	Room name/function	Unit area allowance	Quantity	Net internal area	Circulation and communication allowance	Engineering allowance	Gross internal area	Notes	
Clinical and clinical support spaces									
Catheter laboratory area									
X1029	Catheter laboratory	50.0	2	100.0	35.0	19.0	154.0	1 per catheter laboratory.	
X1031	Control room	12.0	2	24.0	8.4	4.6	37.0	1 per catheter laboratory.	
J1264	Parking bay: bed/trolley	4.0	2	8.0	2.8	1.5	12.3	1 per 2 catheter laboratories; minimum of 2 in case of 2 emergencies simultaneously.	
G0180-01	Parking bay: resuscitation trolley	2.0	2	4.0	1.4	0.8	6.2	1 per 4 catheter laboratories.	
Y0436	Dirty utility room: theatre	12.0	1	12.0	4.2	2.3	18.5	1 per 4 catheter laboratories.	
W1564/1585	Storage: equipment and consumables	4.0	2	8.0	2.8	1.5	12.3	4 m <sup>2</sup> per catheter laboratory.	
Shared clinical support spaces									
Y0642	Disposal hold: 1700 litres	8.0	1	8.0	2.8	2.6	13.4		
Y1510	Cleaners' room	8.0	1	8.0	2.8	2.6	13.4	1 per suite.	
Staff spaces									
D0434-01	Rest room with mini kitchen (size based on number of seats)	1.9	6	11.4	4.0	3.8	19.2	3 places per catheter laboratory.	
W0554-03/V0667-01/V0725/V1321	Changing area: staff (size based on number of lockers)	1.4	16	22.4	7.8	7.4	37.6	Includes uniform exchange area, showers and a number of individual changing rooms. Based on 7 people per catheter laboratory. 10% space contingency allowance for male/female split (suggested apportionment 2/3 female to 1/3 male).	
Y0511	Footwear washing utility room	4.0	1	4.0	1.4	1.3	6.7	Additional shower rooms to allow for male and female segregation.	
V1321	Shower room: ambulant	2.5	1	2.5	0.9	0.8	4.2	Additional individual changing rooms to allow for male and female segregation.	
V0725	Changing room: semi-ambulant	2.0	1	2.0	0.7	0.7	3.4	Associated with staff changing areas.	
V1010	WC: ambulant	2.0	2	4.0	1.4	1.3	6.7		
Total allowance				218.3	76.4	50.2	344.9		
Optional clinical and clinical support spaces									
T0531	Preparation room	9.0	2	18.0				1 per catheter laboratory.	
T0522-02	Preparation room	12.0	1	12.0				1 per 2 catheter laboratories.	
N0219	Scrub-up and gowning room: 2 places	7.0	2	14.0				1 per catheter laboratory. In lieu of scrub-up and gowning area within catheter laboratory.	
X1031-01	Control room	20.0	1	20.0				1 per 2 catheter laboratories. In lieu of a dedicated control room for each catheter laboratory.	
N0317	Anaesthetic room	19.0						Number to be determined by case mix of patients.	
B2425	Emergency admission and post-anaesthetic recovery bay	14.0						Number to be determined by case mix of patients.	
M0326-03	Image review/meeting room: 2 workstations	16.0						1 per suite. In small units, this room may not be located in the catheter laboratory suite itself.	
X1035	Minor cardiac procedures room	28.0						Project option.	
Optional staff spaces									
M0251	Office: 1 person	8.0	1	8.0				For unit manager.	
M0278-01/M0281/ M0410/M0731	Admin area: shared use (size based on number of workstations)	6.6	2	13.2				Notional allowance.	
V1010	WC: ambulant	2.0	1	2.0					
V0922	WC: independent wheelchair	4.5	1	4.5					
H1304-01	Seminar room: 10 places	19.0	1	19.0				Notional allowance.	
Cost guide allowances:									
				Cost guide allowances:	Circulation	Engineering			
				Clinical	35%	33%			
				Staff	35%	19%			

## 4 Whole unit planning and design considerations

### Procedures undertaken in catheter laboratories

4.1 Catheter laboratories can be used for a range of invasive cardiac investigations and treatments including:

- coronary angiography;
- percutaneous coronary interventions (PCIs);
- transoesophageal electrocardiograms (TOEs);
- electrophysiology studies (EPS);
- radiofrequency ablations (RFAs);
- closure of atrial septal defects (ASDs) and ventricular septal defects (VSDs);
- transcatheter aortic valve implantations (TAVIs);
- mitral valvuloplasty;
- implantable cardioverter defibrillators (ICDs);
- insertion of implantable devices (including complex devices).

4.2 They may also be required to undertake non-cardiac procedures such as:

- neurovascular angiography;
- endovascular coiling.

### Departmental relationships

4.3 The catheter laboratory suite should be as close as possible to a day case admissions and recovery area to provide immediate access to stage two recovery facilities. This area will also be used for stage three recovery and pre-procedure paperwork and clinical checks. One option is to include the catheter laboratory suite as part of a day intervention unit, together with other similar facilities such as day surgery, endoscopy and interventional radiology.

4.4 The catheter laboratory suite should also be close to the coronary care unit.

4.5 If primary PCIs are undertaken in the catheter laboratories, the emergency access route should be given priority. This may mean siting the catheter laboratory suite close to the hospital's emergency department or providing direct ambulance access. The emergency access route is also important in non-tertiary units to allow for immediate patient transfer to a tertiary unit, when required.

4.6 In tertiary units, careful consideration should be given to the location of the catheter laboratories in relation to the cardiac operating theatres. It must be possible to transfer a patient to theatre immediately, when required. In rare cases, the theatre team may need to perform emergency surgery in the catheter laboratory.

4.7 There should be good access to and from the cardiology/medical wards and, in tertiary units, cardiothoracic surgical wards.

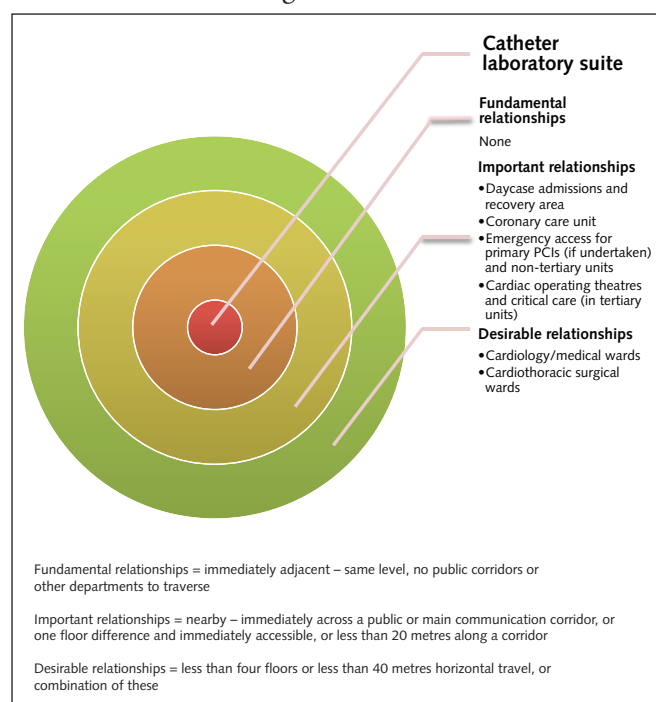


Figure 1 Departmental relationships for a catheter laboratory suite



## Radiation protection

- 4.8 Appropriate radiation shielding is essential in the catheter laboratories. The design of the laboratories and associated facilities must comply with all relevant regulations, notably the Ionising Radiations Regulations 1999 and the Health and Safety at Work etc Act 1974.

## 5 Clinical spaces

### Catheter laboratories

5.1 See [Figure 2](#). Each catheter laboratory should accommodate the following equipment:

- a multi-angular digital angiographic X-ray system (single or biplane) comprising a C-arm (X-ray source and image intensifier, also known simply as an image intensifier), a fully-adjustable patient table and ceiling-mounted flat panel monitors for angiography work, PCIs, EPS and RFAs (up to eight, if EPS and RFAs are undertaken);
- two computer workstations – one for the cardiac physiologist/technician (plus additional equipment if EPS and RFAs are undertaken) and the other for the nurse – or one workstation for the nurse, if the physiologist chooses to be stationed in the control room;
- a scrub trough and associated facilities for scrub-up and gowning (alternatively, a separate scrub-up and gowning room may be provided);
- a worktop for drugs preparation and documentation (alternatively, a separate preparation room may be provided);
- enclosed storage for equipment and consumables, including a rack for catheters;
- a wall-mounted controlled drugs cupboard;
- a heated lotion cabinet for the preparation of contrast media;
- a trolley for power injection facilities for contrast media (alternatively, facilities may be ceiling-mounted or table-mounted);
- where EPS and RFAs are undertaken, stimulators, ablaters and mapping systems – mounted on trolleys or within specially designed shelving units that can be moved to be near the patient.

5.2 A minimum size of 50 m<sup>2</sup> is recommended in order to accommodate the above equipment and

up to eight members of staff (needed if EPS and RFAs are undertaken).

- 5.3 Most angiographic X-ray systems are floor-mounted, although ceiling-mounted options are available. Where ceiling-mounted systems are used, additional reinforcement of supporting structures may be required. Floor-mounted components are normally fixed to the floor by secure heavy-duty fixing devices, capable of retaining a moving mass weighing up to 3 metric tons with high residual torque.
- 5.4 Biplane equipment is needed to support treatments of congenital cardiac disorders, for EPS, TAVIs and, if undertaken, neurovascular angiography and endovascular coiling. Where biplane equipment is to be installed, consideration should be given to making the room longer along the table axis to allow for the movement of the second C-arm.
- 5.5 The patient table should be capable of multi-directional movement and operating in conjunction with an isocentre positioned at or near the patient's heart. The position of the table should allow for movement of the C-arm and provide operator access to both sides. Tilting tables are available that allow tilting along both axes; the use of such tables may put an additional strain on floor structures, and expert advice should be sought. In choosing a table, consideration should also be given to the treatment of overweight patients.
- 5.6 Monitors display real-time, digitally recorded angiographic images and basic physiological data (or advanced data in the case of monitors for EPS and RFAs).
- 5.7 The monitors should be positioned so they can be easily and comfortably viewed by the operator (the cardiologist). The physiologist will require good access to the fluoroscopy reference monitor. The monitors should be located above the opposite side of the couch to the side on which the patient will approach the couch. During procedures they may be positioned on either side of the patient.

5.8 A leaded apron rack is required, located at the entrance to the catheter laboratory, outside the control area. Wall-mounted racks may require reinforcements to wall structures due to the weight of the aprons. Alternatively, floor-mounted racks may be installed.

5.9 Key engineering considerations include:

- Each laboratory should be equipped with a ceiling-mounted minor operating light selected to meet the clinical function of the particular catheter laboratory.
- The general lighting should be coordinated with the patient table and tube stand to ensure that fluoroscopic imaging perception is not adversely affected. Locally controlled variable lighting levels should be provided to avoid reflection on monitoring screens.
- Medical oxygen, medical compressed air and medical vacuum, together with nitrous oxide and active anaesthetic gas scavenging, should be provided from wall-mounted outlets or a ceiling-mounted pendant.
- “X-ray on” signs (illuminated safety sign and warning lamp) are required outside the main doors into each catheter laboratory, and also at the entrance to each laboratory from the respective control area. The warning lamps must give a clear indication in red when they are energised, and the illuminated signs should incorporate the legend “do not enter”, visible only when illuminated. All warning lamps should have incandescent filaments energised from a suitable power source within the room and switched via appropriate devices interlocked with the operation of the diagnostic or therapeutic equipment. All such signs should be connected to essential supplies where necessary.
- All alarms should be visual as well as audible, as the room’s lead-lining may make it difficult to hear them.
- To determine ventilation requirements, it is essential to establish the range of procedures to be undertaken. Many simple procedures of short duration, such as inserting temporary pacemakers and simple implantable devices, require ventilation only to treatment room standards; lengthy procedures including PCIs, RFAs, closure of ASDs and VSDs will require air-conditioning to operating theatre standards.

- It is recommended that removal of a catheter under X-ray control is possible in the event of mains power failure; this requirement should be discussed with the hospital’s and system manufacturer’s engineers.

## Control rooms

5.10 See [Figures 3 and 4](#). Each laboratory should be served by a dedicated X-ray system control room. Alternatively, one control room may serve two laboratories. If shared between laboratories, the control room should be large enough to enable two teams with their monitoring equipment to operate independently and maintain unimpeded access to the appropriate laboratory.

5.11 Each control room should provide a viewing window into each laboratory served. This should provide a clear view of the patient table in the laboratory. The preferred position for the control room in relation to the laboratory is at the foot end of the patient table. From this foot position, the person in the control room has a view that is unrestricted by staff working at the table or overhead hanging monitors.

5.12 The control room requires radiation protection and good voice contact with the laboratory.

5.13 It should be possible to access the control room direct, without entering the laboratory. There is usually direct access between the laboratory and control room.

5.14 Key equipment considerations:

- Two computer workstations are required; one for viewing, capturing and annotating pressure and ECG data; the other for entering data about the procedure. There also needs to be a replay facility for acquired images, linked to the display in the catheter laboratory opposite the operator, to allow anyone supervising or reviewing a case from the control room access to the same data as the operator.
- The number of monitors required will depend on the range of procedures undertaken. Typical requirements are 2 haemodynamics, 2 radiography, and possibly 1 intravascular ultrasound, 2 electrophysiology, and 1 or more mapping workstations. One of the patient monitors must be powered independently of the X-ray equipment to allow continuous monitoring of the patient should a malfunction of the X-ray kit occur.

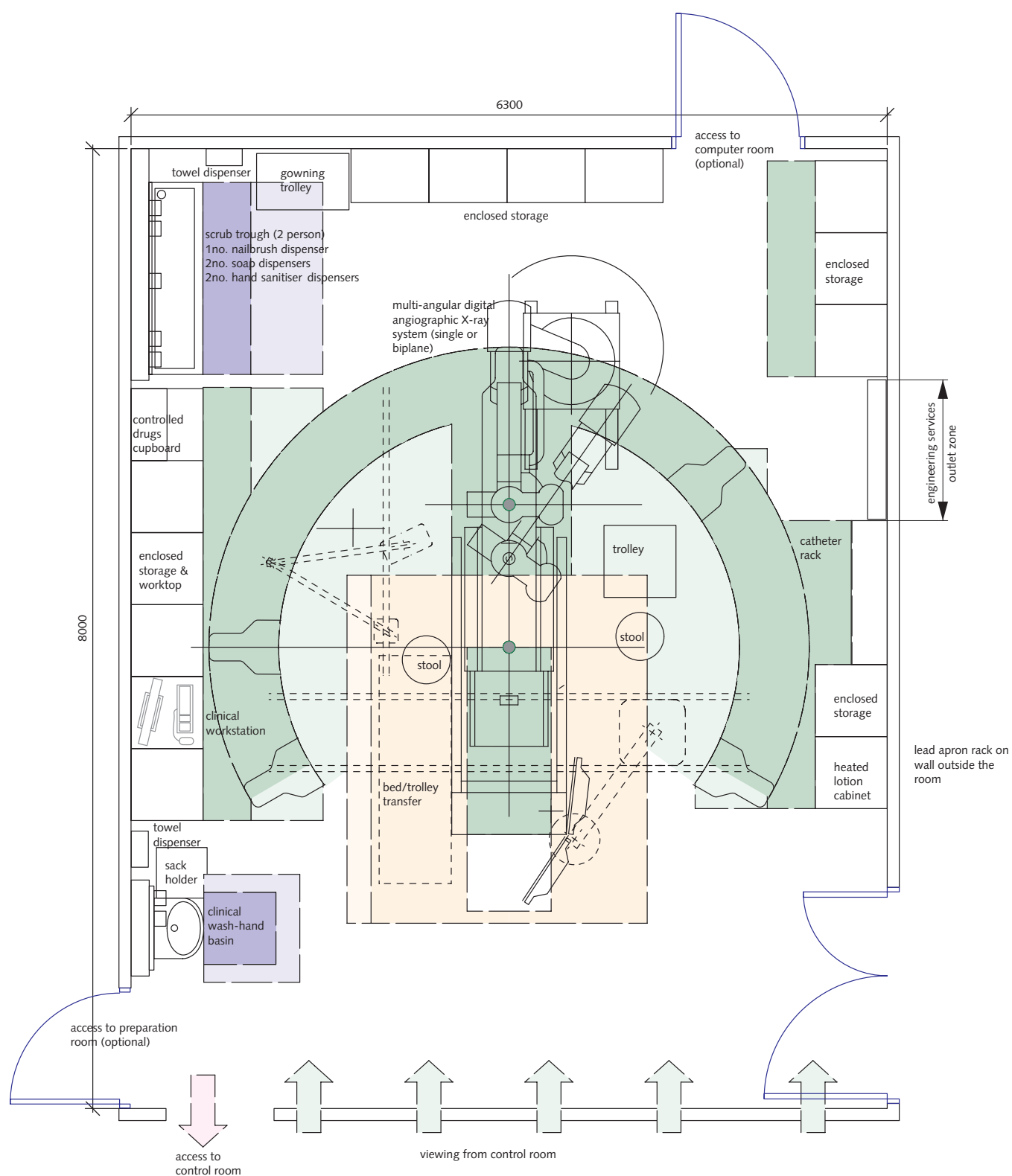


Figure 2 Catheter laboratory

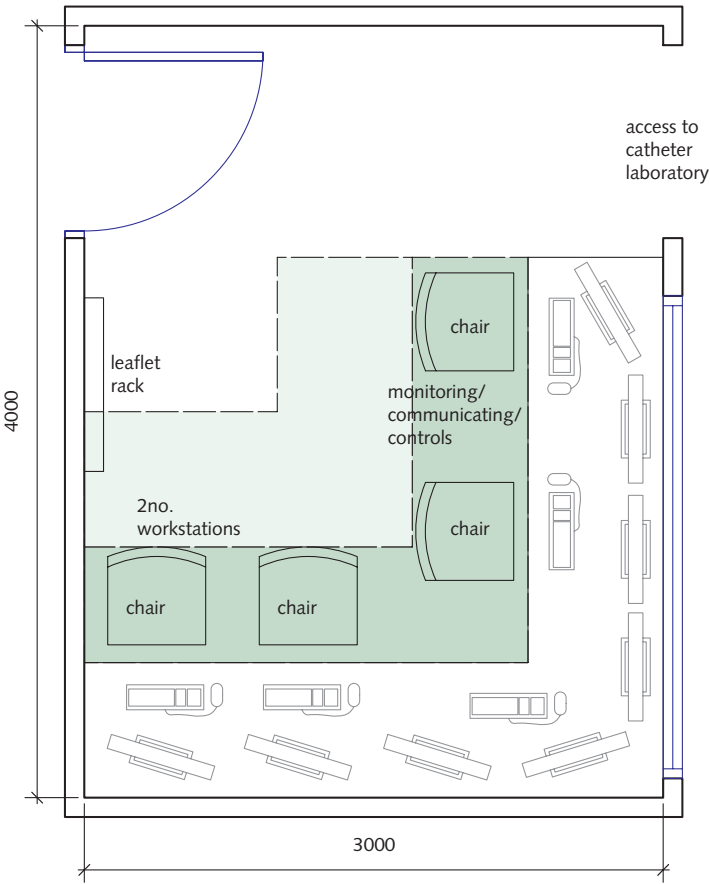


Figure 3 Control room serving single catheter laboratory

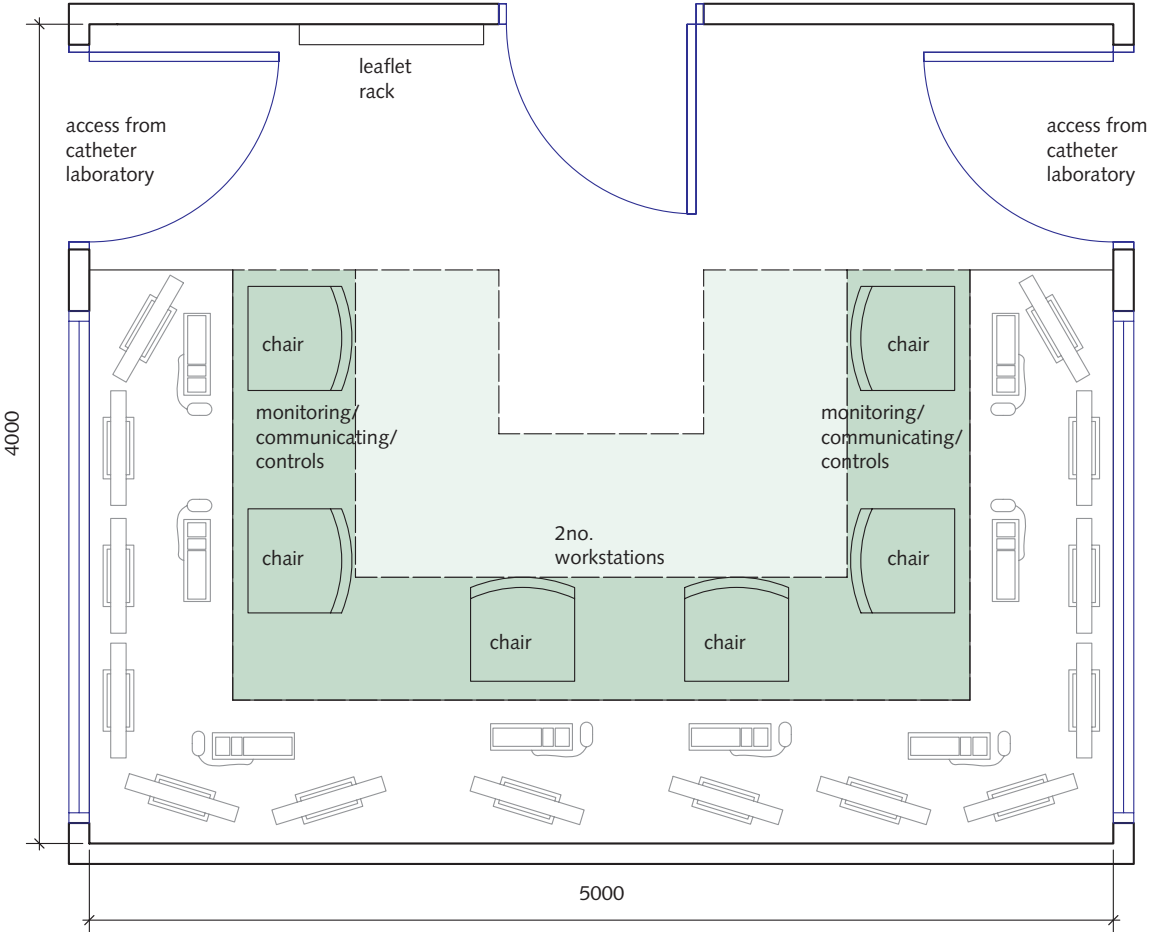


Figure 4 Control room serving two catheter laboratories

## Anaesthetic rooms

5.15 Generally only children and adults with congenital heart defects require a general anaesthetic prior to a procedure in a catheter laboratory. However, patients with epilepsy and physical disabilities may require a general anaesthetic. Ideally the anaesthetic should be delivered in a separate anaesthetic room en-suite to the catheter laboratory.

## Emergency admission and post anaesthetic recovery bays

5.16 One or more bays may be needed:

- for the direct admission of primary PCI patients on beds or trolleys;
- for post-anaesthetic recovery and/or to stabilise patients before moving them.

5.17 This bay is identical to a standard post-anaesthetic recovery bay.

## Preparation rooms (optional)

5.18 See Figures 5 and 6. Where preparation rooms are provided separately, these may serve a single catheter laboratory or a pair of catheter laboratories.

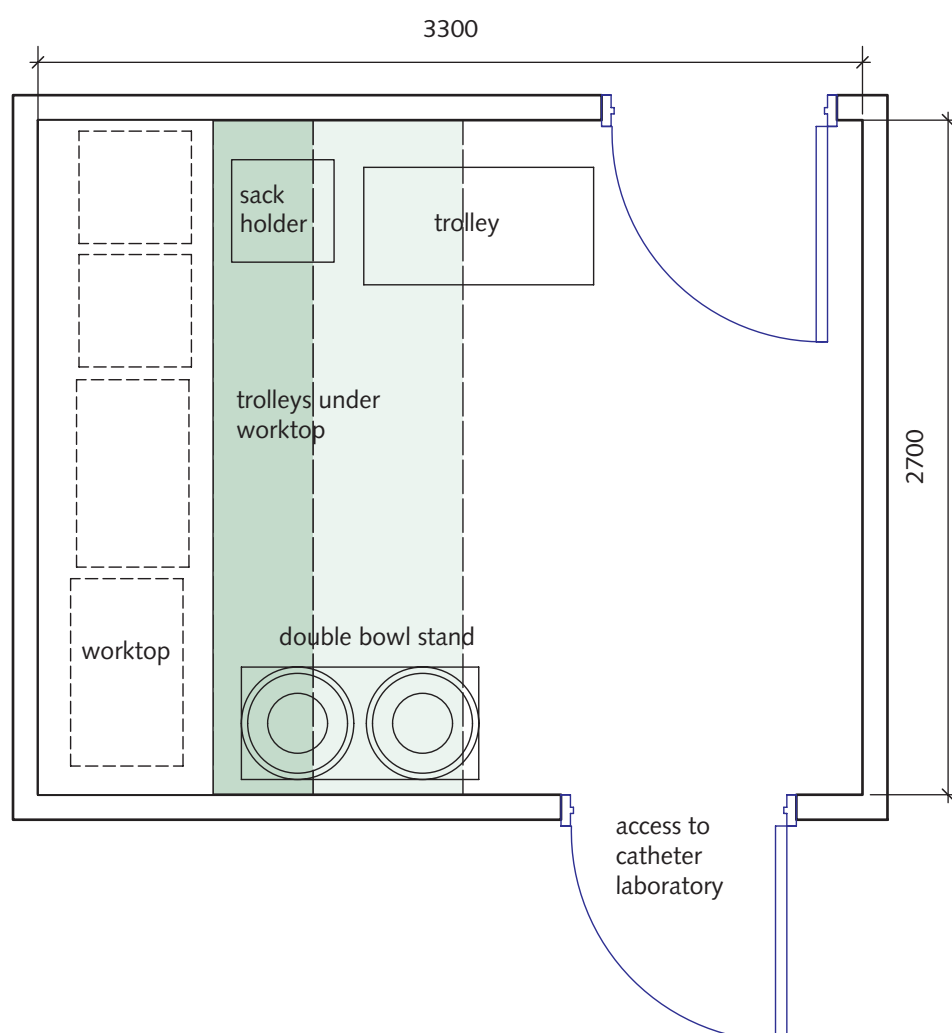


Figure 5 Preparation room serving single catheter laboratory

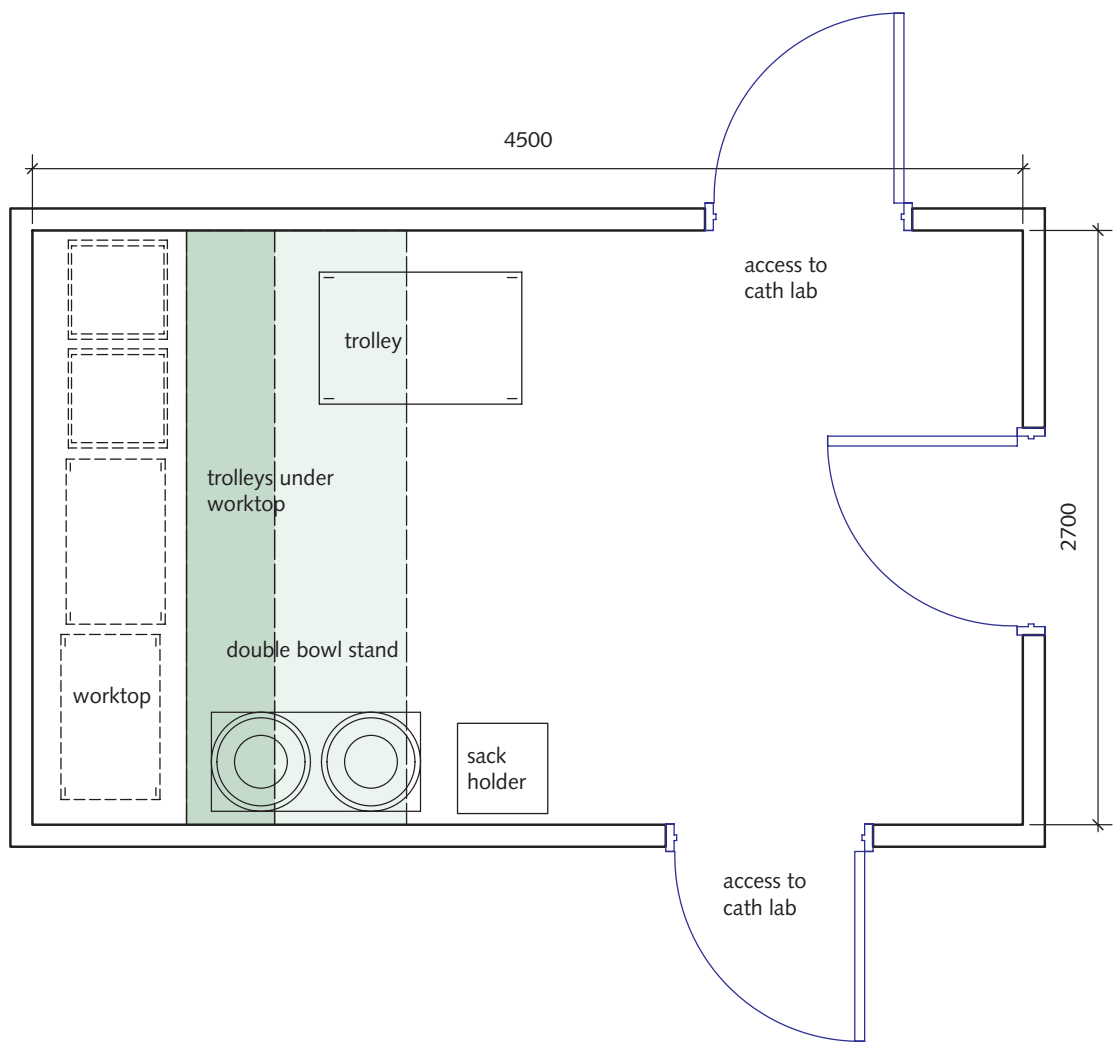


Figure 6 Preparation room serving two catheter laboratories

## 6 Clinical support spaces

### Trolley/bed parking bays

- 6.1 These bays are not intended to provide for immediate post-procedure stage two recovery, which should take place in a day case recovery area. They are intended for bed or trolley storage while the patients are in the catheter laboratories.

### Dirty utility room

- 6.2 Most procedures use fully disposable supplies. For this reason the dirty utility room should be equipped with a macerator.

### Storage for equipment and consumables

- 6.3 The example layout of the catheter laboratory is based on the assumption that a core supply of consumables and equipment, including catheters, is held within the room.
- 6.4 The example schedules include an additional space allowance for a central stock of consumables and less frequently used bulky equipment, such as intravascular ultrasound (IVUS) machines, rotablation, robotic equipment, pressure wire workstations, balloon pumps and implantable devices. Facilities for charging syringes and IV pumps should be provided.

### Image review/meeting room

- 6.5 An image review/meeting room is required. The room should support multidisciplinary case

reviews. It should accommodate approximately eight staff and include two workstations providing links to the hospital intranet, patient administration system, PACS and any other systems necessary to access radiological images including CT, MRI, echo and angiography imaging.

- 6.6 In small units, the room may not need to be located in the catheter laboratory suite itself.
- 6.7 Variable lighting level control and avoidance of reflection on monitors through selection and positioning of luminaires is essential.

### Computer/imaging equipment room

- 6.8 Space is needed to house the X-ray imaging generators and computers that run the imaging systems. It should not be possible to enter this space while any of the catheter laboratories are operational.
- 6.9 The presence of high-tension electricity, and the need for radiation protection for persons working here, should be noted. Careful consideration should also be given to effective environmental control to prevent overheating of imaging equipment.



## 7 Cardiac operating theatre suite

- 7.1 This chapter describes spaces that are unique to cardiac operating theatre suites. It also describes any variations to the provision of common theatre spaces as used in general operating theatre suites.
- 7.2 It is based on the assumption that patients will normally be admitted to an in-patient ward immediately prior to surgery. However, consideration should be given to providing facilities to enable final pre-procedure paperwork and clinical checks to be undertaken in the theatre suite without the need for direct admission to an in-patient ward. This will only be appropriate for certain patients.
- 7.3 For a full list of space requirements see the example schedule of accommodation for a 4-cardiac theatre suite. The example schedule provides a basis for sizing facilities at initial planning stages but exact requirements should be determined locally based on the number and case mix of patients, hospital policy for the provision of supplies and waste disposal, and the layout of the unit. Exit space from each theatre is covered by the circulation allowance. Links to guidance on common spaces are provided from the schedules.

### Whole unit planning and design considerations

#### Procedures undertaken in cardiac theatres

- 7.4 Cardiac operating theatres should provide a safe environment for patients to undergo cardiac procedures including closed and open-heart cardiac and thoracic surgery, and heart and heart/lung transplants.

#### Departmental relationships

- 7.5 The cardiac operating theatre suite should:
- be immediately adjacent to cardiac critical care (fundamental relationship);
  - be close to the catheter laboratories, allowing for transfers for emergency surgery;

- provide close, simple access to and from the cardiothoracic wards, ideally located on the same floor, if not with an immediately-accessible lift connection;
- have good access from the emergency department;
- have good access to and from the coronary care unit (CCU) and the cardiology/medical wards;
- provide good connections with sterile services.

- 7.6 See also [Figure 1](#).

### Clinical spaces

#### Cardiac operating theatres

- 7.7 Cardiac theatres should be at least 55 m<sup>2</sup>, broadly rectangular and with a minimum dimension in any single direction of 7 metres.
- 7.8 When coronary bypass operations are being undertaken, it is necessary to accommodate two surgical teams with their support apparatus working on the patient simultaneously, and it is this requirement that has the greatest significance for the design and layout of the room, including the need for one main operating light and two smaller (satellite) lights.
- 7.9 Occupancy of the theatre during an operation will normally comprise:
- a lead and one or two support surgeons with a scrubbed practitioner and non-scrubbed “runner”;
  - an anaesthetist and anaesthetist’s assistant;
  - a monitoring technician.
- 7.10 When a coronary bypass operation is being undertaken, that occupancy will be increased by:
- a second surgeon; and
  - a perfusionist to operate the heart bypass machine.

7.11 Each cardiac theatre requires two ceiling-mounted twin-armed pendants to accommodate a range of equipment and for the provision of medical gases and electrical and data connectivity. For further details see the description of a general operating theatre.

7.12 Cardiac theatres also require a single ceiling-mounted vertical pendant for the perfusionist. The following equipment will need to be connected to the vertical pendant:

- perfusion machine (heart/lung machine);
- balloon pump;
- cell savers;
- echocardiography machine;
- mobile C-arm X-ray unit and monitors.

7.13 Most theatres will not require a fixed C-arm; where provided, it should be ceiling-mounted to minimise the obstruction it may cause to surgical teams.

7.14 The pendants should be positioned so that during bypass operations all teams have access to their pendant without impeding the surgical fields.

7.15 Modern techniques may require minimally invasive “stacks” and numerous sterile trolleys.

7.16 An ultra-clean ventilation canopy is not an essential requirement in most cardiac theatres, although it should be seriously considered in theatres in which transplant work will be undertaken.

7.17 The theatre will need to accommodate a sterile trolley for examining specimens.

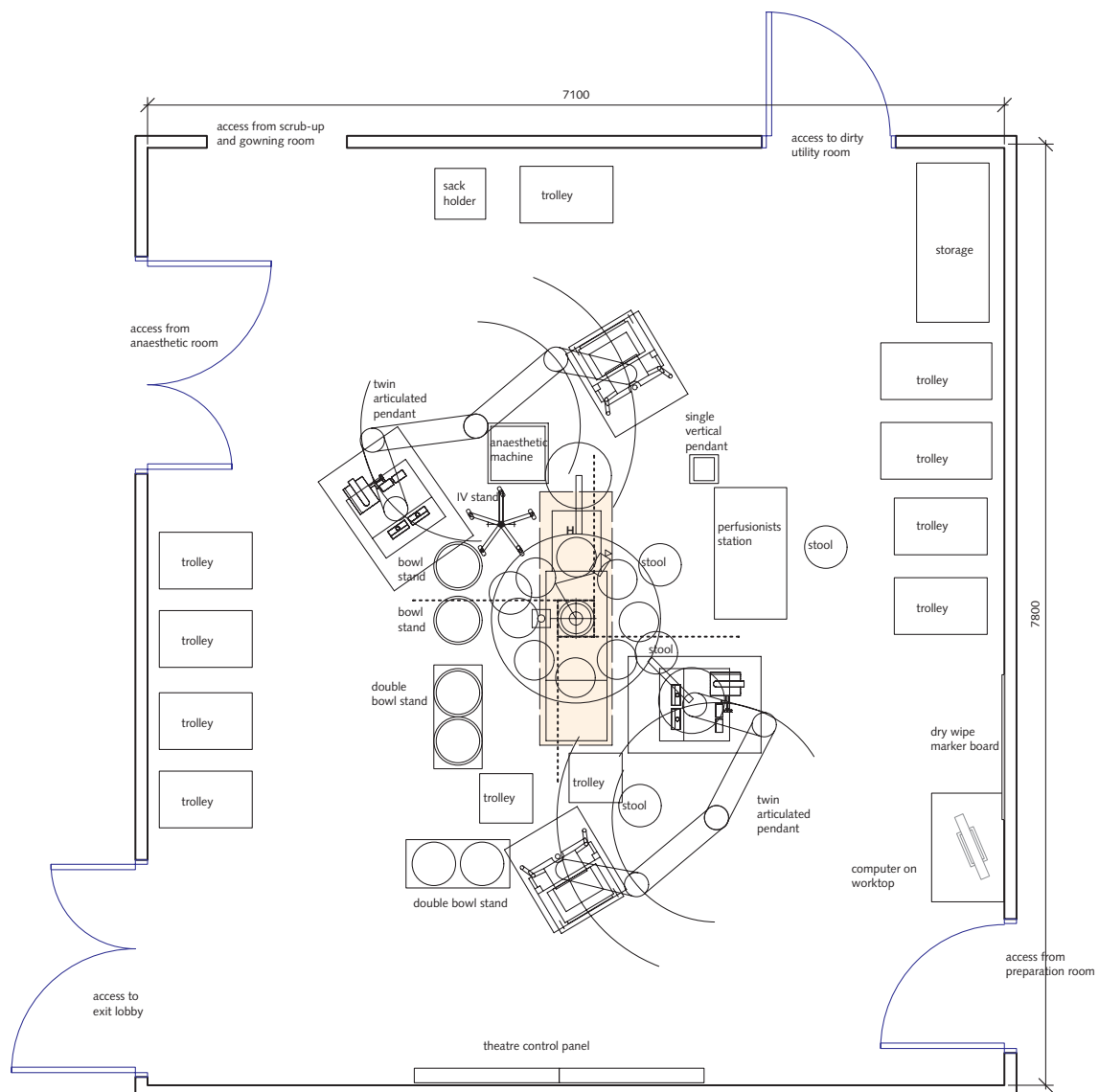


Figure 7 Cardiac operating theatre

## Recovery bays

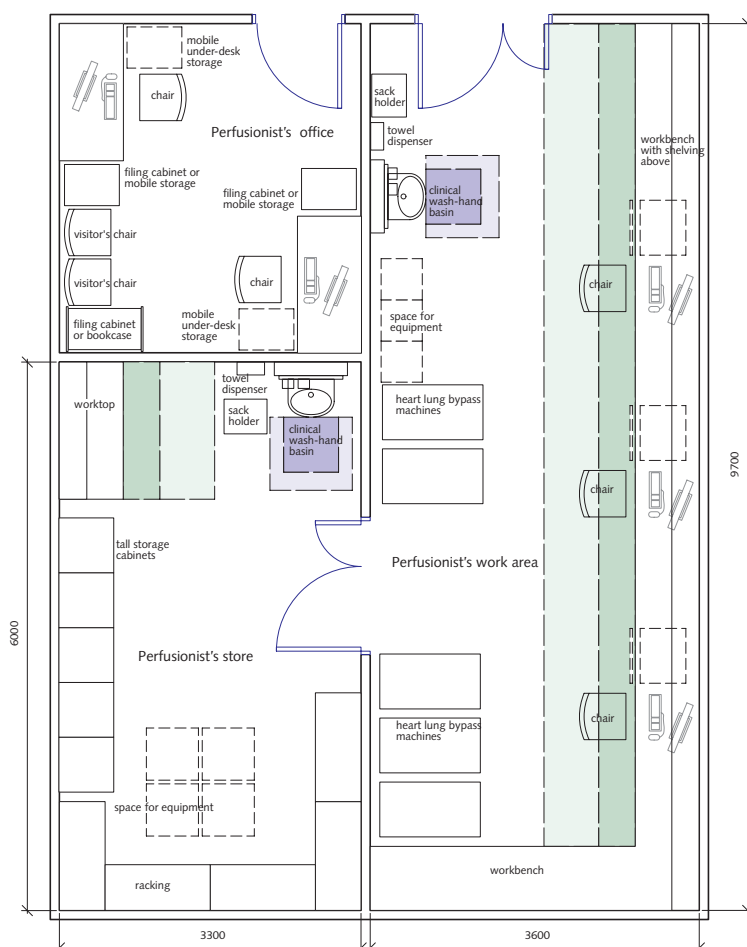
- 7.18 One post-anaesthetic recovery bay is recommended for every two cardiac theatres. This is based on the assumption that a large proportion of cardiac surgical patients will go directly to critical care rather than remaining in theatre recovery. It is less than the two recovery places per theatre recommended for general operating theatre suites.
- 7.19 Most thoracic cases require post-anaesthetic recovery. If a high proportion of thoracic patients are being seen, the ratio of recovery bays will need to be increased. Equally, if cardiac patient are not transferred immediately to critical care, the ratio of recovery bays will need to increase.

## Clinical support spaces

### Perfusion suite

- 7.20 A perfusion workroom is required for the cleaning and setting up of perfusion machines.
- 7.21 There should be at least one perfusion machine for each theatre, plus one spare.
- 7.22 The room should contain computer workstations for accessing patient records, work surfaces of sufficient height to store trolleys underneath, and should be fitted with cupboards and shelving.
- 7.23 An adjacent area should be provided for the storage of perfusion machines, balloon pumps and cell savers when not in use. Storage for large quantities of disposable packs and volumes of fluids should be provided. This will require heavy-duty shelving.
- 7.24 An office may be provided according to local project requirements, for use by the perfusionists and other theatre staff.

Figure 8 Perfusion suite



## 8 Minor cardiac procedures suite

- 8.1 This chapter describes a minor cardiac procedures suite.
- 8.2 A minor cardiac procedures room will need access to the following facilities:
- dirty utility room;
  - stores for equipment and consumables
  - disposal hold.
- 8.3 Where a catheter laboratory suite is provided on-site, the minor cardiac procedures room may be included as part of this suite. If this is the case, it may be sized so that it can be converted into a catheter laboratory in the future, and consideration given to the possible future requirement for a control area and access to a computer/ imaging equipment room.

### Whole unit planning and design considerations

#### Procedures undertaken in a minor cardiac procedures room

- 8.4 A minor cardiac procedures room can be used for a range of minor cardiac investigations and treatments, where the risk of infection is low, a general anaesthetic is not required and immediate recovery period is short, including:
- transoesophageal echocardiograms (TOEs);
  - cardioversion;
  - insertion and adjustment of simple implantable devices;
  - implantable cardioverter defibrillators (ICDs);
  - cardiac resynchronisation therapy (CRT)/ biventricular pacing (BVP).
- 8.5 They can also be used for non-cardiac procedures such as bronchoscopies and biopsies.

#### Departmental relationships

- 8.6 The minor cardiac procedures suite should be located as close as possible to a day case admission and recovery area to provide immediate access to stage two recovery facilities if required. This area will also be used for stage three recovery and pre-procedure paperwork and clinical checks.
- 8.7 The suite should be easily accessible from the coronary care unit (CCU) and cardiology/medical wards.

### Clinical spaces

#### Minor cardiac procedures room

- 8.8 The minor cardiac procedures room should be able to accommodate a mobile or fixed C-arm (comprising an X-ray source and image intensifier, also known simply as an image intensifier), a moveable, fully-adjustable and long-axis tilting couch (offering all-round access to the patient), ceiling-mounted minor operating light, and a small surgical procedures trolley.
- 8.9 The sketch layout shows a mobile image intensifier. However, mobile image intensifiers have a narrower field of view than fixed image intensifiers, possibly necessitating longer exposure times, and are of restricted value for undertaking device implants. If simple device implants are regularly undertaken, a fixed image intensifier is recommended. This will also enable non-cardiac procedures such as endoscopic retrograde cholangiopancreatographs (ERCPs) to be undertaken.
- 8.10 An early decision regarding the choice of imaging equipment and its features is essential as this will influence the room's design; the specifications are also needed to determine power supply needs as well as air cooling considerations.
- 8.11 Consultation with the RPA will be necessary to determine whether and to what extent radiation protection is required. Leaded screening of doors may be necessary, and the room itself may need

lead-lining, both of which may have structural implications.

- 8.12 Medical oxygen, medical compressed air and medical vacuum, together with nitrous oxide and active anaesthetic gas scavenging should be provided from wall-mounted outlets or a ceiling-mounted pendant.
- 8.13 Ventilation requirements will depend on the range and nature of the procedures to be undertaken.

Many simple procedures of short duration, such as inserting temporary pacemakers and simple implantable devices, require ventilation only to treatment room standards.

- 8.14 The sketch layout of the room includes a preparation area. Alternatively, a separate preparation room may be provided. Additional storage is required for rooms undertaking device implants.

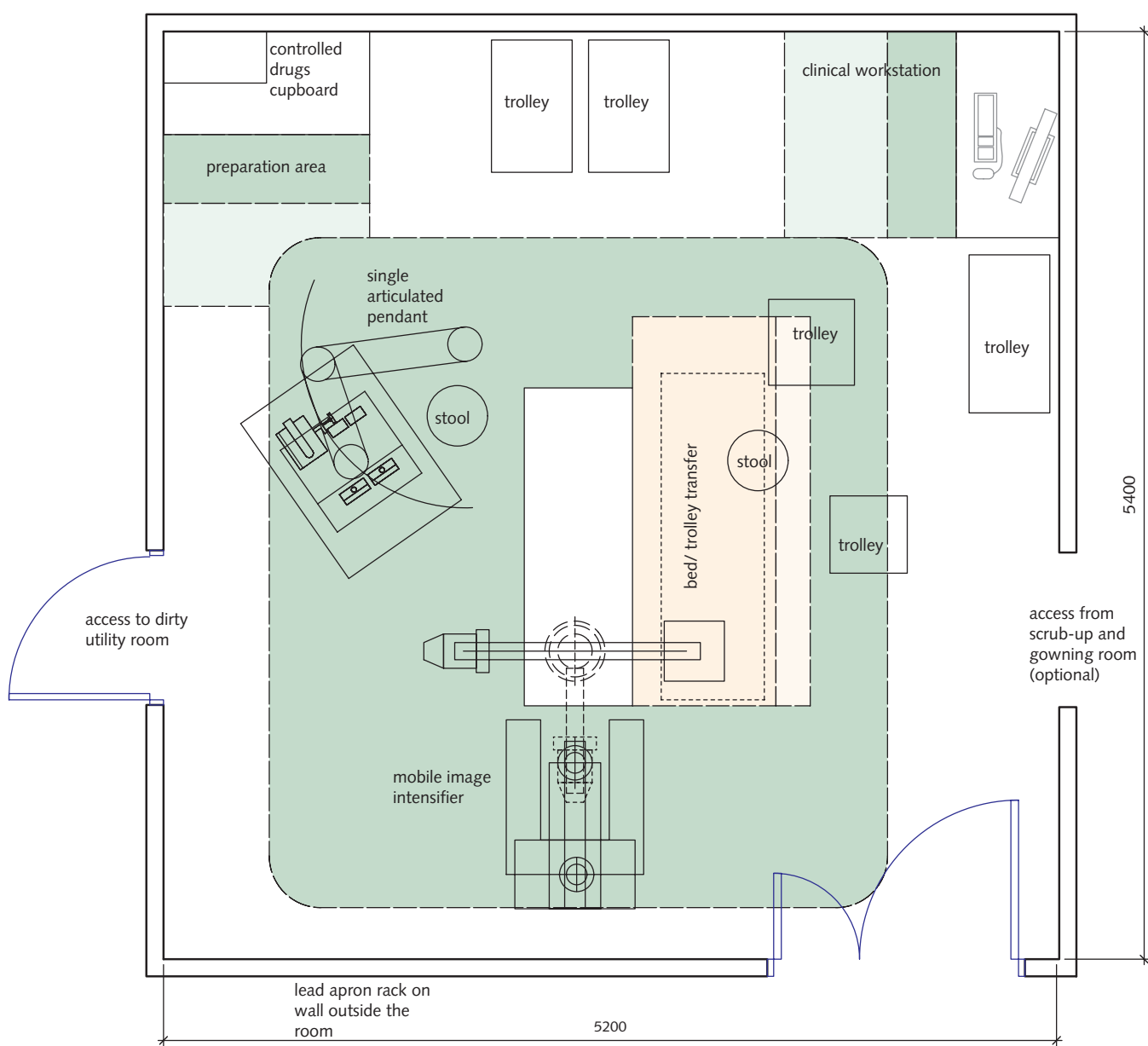


Figure 9 Minor cardiac procedures room

### Scrub-up and gowning room

- 8.15 The need for a scrub-up and gowning room will depend on the range of procedures to be

undertaken in the minor cardiac procedures room. This facility will be required where devices are implanted and/or pacing work is undertaken.

## 9 References

Health Building Note 6 – Facilities for diagnostic imaging and interventional radiology.

Health Building Note 04-01 – Adult in-patient accommodation.

Health Building Note 04-02 – Critical care units.

Health Building Note 8 – Facilities for rehabilitation services.

Coronary Heart Disease National Service Framework.

NHS Heart Improvement Programme.

Ionising Radiations Regulations 1999.

Health and Safety at Work etc Act 1974.